Herd Immunity Training Module Transcript

Slide 1: Welcome to Herd Immunity: Protect Yourself and Others, an educational video presented by The Immunization Partnership. This video will be narrated by myself, Ashley Beale, Program Coordinator and my colleague Rachel Walker, Program Coordinator.

Slide 2: The Immunization Partnership is a Texas-based non-profit dedicated to helping individuals, physicians, and others with an interest in immunizations to protect their communities from vaccine-preventable diseases. All across Texas, The Immunization Partnership conducts educational community forums and researches immunization best practices.

Slide 3: This presentation is made possible through partnerships and funding from our listed supporters.

Slide 4: Vaccine Myths & Misinformation is eligible for Nursing Continuing Education credits, through approval with the Cizik School of Nursing at UTHealth.

Slide 5: Viewers planning to receive Continuing Education credits must complete all three listed steps. 1) listen to the entire presentation, 2) submit the online pre-test, and 3) submit the online evaluation. Your certificate of completion will be sent via email. Please contact The Immunization Partnership's Education Manager, Katy Gore at kgore@immunizeUSA.org with any questions.

Slide 6: Before we get started, please note: all speakers and individuals on the planning committee have no disclosed conflicts of interest. Additionally, this presentation is for educational use only and does not constitute legal advice.

Slide 7: Here is the agenda for today's presentation: What is herd immunity?, How to achieve herd immunity, When herd immunity doesn't work…, Explanation and examples of vaccine-preventable outbreaks, Tips for reaching herd immunity, and Helpful Resources.

Slide 8: In this section we'll define herd immunity and what it means to the community.

Slide 9: Herd immunity, also known as community immunity, occurs when a high percentage of a community or "herd" becomes immune to a disease as a result of vaccinations and/or prior illness. Once herd immunity is reached, the spread of disease from one individual to another is unlikely. [1,2] The community essentially becomes protected from the disease. Even those who cannot be vaccinated, are also protected. In simpler terms, you can think of achieving herd immunity like an invisible shield of immune people who protect vulnerable people in their community. For example, in this illustration... those holding the shield are vaccinated – protecting those highlighted in yellow. They represent the vulnerable people who are immune deficient or immunocompromised who cannot get vaccinated.

Slide 10: Now we'll discuss how to achieve herd immunity. We'll make sure you understand the concept of natural immunity and its relation to herd immunity. Then we'll cover herd immunity threshold and how to calculate it.

Slide 11: First and foremost, when talking about immunity, you must remember that immunity to a disease happens through the presence of antibodies.[3] Antibodies are proteins produced by the body's immune system when it detects harmful substances such as bacteria, fungi, parasites, viruses, or chemicals.[4] Antibodies are disease-specific. For example, flu antibody will protect someone who is exposed to flu virus but will not be effective if the person is exposed to measles.

There are two types of immunity: active and passive.

Active immunity is when antibodies in the immune system are produced from exposure to a microorganism or chemical (pathogen). Basically, the body is responsible for protecting itself. This can occur as a result of an infection with the actual disease or virus, known as natural immunity. We'll discuss natural immunity in more detail in the next section of this presentation. Active immunity may also occur from a weakened or killed form of the virus, known as vaccine-induced immunity. This type of immunity is usually long-lasting.[3,5]

Passive immunity is when antibodies for a disease are PROVIDED by someone else, rather than produced. Unborn and newborn babies can acquire passive immunity from its mother in two ways: the placenta and breast milk.[3,5] The blood in a pregnant woman's body (which contains antibodies and immune system cells) circulates through the placenta to deliver nourishment and protection to the fetus. A newborn's types and levels of antibodies reflect those of the mother.[5] In the first few days after giving birth, a mother produces a protein-rich version of breast milk called colostrum. Colostrum contains high levels of antibodies and lower levels of nutritional ingredients compared to milk produced in weeks after giving birth.[5]

Passive immunity can also be obtained from immunoglobulin treatments, which provide antibodies that the body isn't making on its own. [3,5]

A major difference between these two types of immunity is that passive immunity only lasts for a few weeks or months, but provides immediate protection. Active immunity can take up to several weeks to develop.[3]

Slide 12: We briefly mentioned natural immunity in the previous slide. In order to fully understand the concept of herd immunity, it is important to grasp the concept of natural immunity first. Again, natural immunity occurs as a result of an infection with an actual disease or virus. For example, if someone becomes infected with chickenpox, after the initial infection the body builds immunity against the disease. Active natural immunity is why people who get the chickenpox tend to be immune against it for decades.[6]

Slide 13: Now that you have a better idea of natural immunity, we'll compare how herd immunity is achieved through natural immunity versus immunizations. We'll also explore the ways in which the community as a whole is affected by each.

Although long-lasting herd immunity can be reached from both natural infection and immunizations, there are some major differences and risks to note associated with relying on natural infection alone.

Herd immunity is achieved when "enough people in a population have recovered from a disease and developed antibodies against future infection." Unlike natural infections, vaccines can create immunity without causing severe illness or complications.[1]

Full immunity usually develops after several doses when vaccinated, while immunity occurs after a single dose with natural infection. However, natural infection usually involves a large dose of exposure along with an unknown time of exposure. Unless you get a vaccine…you do not know for certain where and when you were exposed to a particular virus or bacteria.[7] Immunizations involve small doses of exposure in a controlled environment. "More isn't necessarily better."[7]

Considering the large dose and unknown time of exposure, natural infection symptoms are potentially severe. For example, for immunity after natural infection you can develop pneumonia from pneumococcus, birth defects from rubella, liver cancer from hepatitis B virus, or even death from measles.[7] Immunizations, on the other hand, usually involve very mild symptoms if any at all. These may include headaches, soreness at the injection site, nausea, and chills.

Slide 14: Just to expand on the information explained in the previous slide, this is a list of some vaccines that actually induce a better immune response than natural infection[7]:

HPV vaccine: The high purity of the specific protein leads to better immune response

Tetanus vaccine: The toxin made by tetanus is so potent that the amount that causes disease is lower than the amount that induces a long-lasting immune response. It's the reason why people with tetanus disease are still recommended to get the vaccine.

Hib vaccine: Children less than 2 yrs. old do not have a good response to the polysaccharide (sugar coating) on the surface of Hib that causes disease. The vaccine links this polysaccharide to a helper protein. Children under 2 yrs. old with Hib disease are still recommended to get the vaccine.

Pneumococcal vaccine: This vaccine works the same way as the Hib vaccine, which creates a better immune response than natural infection.

Slide 15: Here is the basic concept on HOW to achieve herd immunity. Simply put, if only SOME people get vaccinated, the virus will continue to spread. If MOST people get vaccinated, spreading is contained. When most people are vaccinated, herd immunity can be achieved.[8]

The spread of disease becomes very limited when a large percentage of the population is vaccinated. Simultaneously, those who are immunocompromised or simply cannot get vaccinations are indirectly protected. This is the basic foundation of herd immunity. As the number of people vaccinated increases, so does the protective effect.[9] Depending on the contagiousness of a disease, herd immunity will usually induce when 50% to 90% of the population is vaccinated.[10] This percentage is known as the herd immunity threshold.

Slide 16: In this slide, we'll discuss how to calculate the herd immunity threshold.

The formula for herd immunity threshold is $1 - 1/R_0$

This threshold is partially dependent on a virus' basic reproduction number, R_0 (pronounced "Rnaught" or reproduction number), which is a measure of contagiousness.[11] R_0 is basically the average number of

new people that a single infected person can expose and infect .[12] So let's say a disease has an R_0 of 15, a person who has the disease will transmit it to an average of 15 other people. Here's a real life example: The chickenpox has an R_0 of 10 - 12 on average, therefore each infected person will transmit the chickenpox to an average of 10 - 12 other people.[13,14]

Here is the significance of R_0 values:[12]

1. If the R_0 is less than 1, each existing infection causes less than one new infection. This means the disease will decline and eventually die out.
2. If the R_0 equals 1, each existing infection causes 1 new infection. There won't be an outbreak or epidemic, but the disease will stay alive and stable.
3. If the R_0 is more than 1, each existing infection causes more than one new infection. The disease will be transmitted between people and there is a high possibility of an outbreak or epidemic.

Now, let's plug the chickenpox R_0 in the threshold formula. So, $1 – 1/R_0$ (10) = 90%. Therefore, we can say that the herd immunity threshold for chickenpox is 90%. We probably need at least 90% or more of the population needs to be vaccinated in order to halt transmission.

Slide 17: Sometimes it's very challenging to achieve herd immunity. Next, we'll talk about some reasons why…

Slide 18: One of the main challenges of not achieving herd immunity is the groupthink phenomenon.

Those who share the same beliefs tend to live, work, and thrive in similar environments. Meaning there are probably clusters of unvaccinated people living, working, thriving in similar environments…leaving room for exposure. Once the percent of vaccinated people in a population drops below the herd immunity threshold, exposure to the disease increases and can spread rapidly throughout the community.[2]

Slide 19: On top of groupthink, there are more deep-rooted factors that can affect herd immunity overall. This image shows the different factors and more detailed reasons as to why a community may not reach herd immunity goals.[15]

1. Pathogen stability
2. Public Policy and Health Care
3. Population Immune Competence

For Pathogen Stability:

- Multiple serotypes (serotypes are groups within a single species of microorganisms, like bacteria or viruses, which share distinctive surface structures)[16]
- New variants
- Immune imprinting (means a bias in immune memory of, and protection against, the initial strain exposure) [17]
- Zoonotic reservoirs of new variants (where new variants may live, grow, and multiply on animals that can transmit to humans) [18]

For Public Policy & Health Care:

- Reliable access to care
- Infrastructure for distribution of care
- Political stability
- Research funding and education
- Population risk/benefit analysis

And for Population Immune Competence:

- Underdeveloped immunity in youth
- Maternal antibody dampening (when the mother's antibodies may dampen the affect of the infant's initial antibody response to infection or immunization)
- Immune deficiency genetic or illness (cancer, HIV, transplantation)

Slide 20: At this point, you know all about herd immunity, the different types of immunity, how to calculate herd immunity thresholds, and factors that affect herd immunity in a population. In this section of the module, we'll explain how vaccine-preventable outbreaks work and provide real-world examples of vaccine-preventable outbreaks.

Slide 21: Vaccine-preventable diseases are still prevalent worldwide. In fact, 1 in 10,000 people die from vaccine-preventable diseases. Smallpox is the only vaccine-preventable disease that is completely eradicated from the world (which we'll discuss soon). Polio still exists in some countries, but is the next closest to being eradicated.[19] We live in a very mobile and transient world, so diseases can spread at an alarmingly fast rate through international travel and trade. Vaccines are vital in protecting the population from any outbreaks.[19] An outbreak is defined as "the occurrence of a disease in a population at levels above the expected baseline." [20]

There are three types of outbreaks: [20]

A regular outbreak: is fairly a localized cluster of disease cases

An epidemic: which is a larger outbreak that may include several states, a country or countries

A pandemic: when an epidemic becomes an outbreak of global proportions

As we have all witnessed with the COVID-19 pandemic, outbreaks can happen ANYWHERE. They often have consequences that we may not initially think about including social, health, and economic repercussions.[20] In recent years, a large portion of disease outbreaks have been vaccine-preventable. Factors like low vaccination coverage, crowding, malnutrition, poor sanitation, and human mobility can undoubtedly increase the severity of an outbreak. It is extremely important that outbreak prevention and preparedness systems are integrated into health systems. Ensuring preparedness means that immunized healthcare workers, streamlined health communications, and surveillance systems are ready to act immediately.[20]

In order for you to get a better understanding of the how the outbreaks work, we'll run through some examples.

Slide 22: The first vaccine-preventable disease that we'll review is smallpox. Smallpox is a serious illness caused by the variola virus and throughout history has been a devasting disease, killing millions and

decimating communities. Evidence from Egyptian mummies and written communication from China and India all led experts to believe that smallpox has affected humanity for at least 3,000 years.[21]

Smallpox is a contagious disease and spread from person to person through prolonged face-to-face contact. Individuals who contracted smallpox were most contagious once the first sores began to appear in their mouth and throat, referred to as the early rash stage.[22] They spread the virus when droplets from their nose and mouth spread through coughs or sneezes. Additionally, as smallpox progresses individuals may develop sores on their skin, and fluids from these sores may also spread the virus, through the contamination of materials the individual touches, such as bedding or clothing. Individuals were contagious until the scab from the last smallpox sore fell off.[22]

Smallpox was a terrible disease with serious negative health outcomes. An average of 3 of every 10 people who contracted smallpox died. The most distinctive symptoms of a smallpox infection were a fever and a progressive skin rash, that often afflicted the face as well as other portions of the body. Many smallpox survivors were left with scars, which were sometimes quite large and severe.[21]

Throughout history there were many severe outbreaks of smallpox, which were often spurred by the movement of people due to trade and exploration from colonization. An example that most Americans are probably familiar with occurred in the 17th century when Europeans brought smallpox to North America, which wreaked havoc on the Indigenous populations of the continent, who lacked prior exposure.[21]

Early attempts to control the spread of smallpox involved a process called variolation, which was named for the virus that causes smallpox, variola virus. Variolation exposed previously uninfected individuals to smallpox through material from smallpox sores, or pustules, by scratching the material into the arm or inhaling it through the air. After variolation, people would generally experience the symptoms associated with a smallpox infection, fever and a rash, however, less people died from variolation, compared to if they acquired smallpox through a natural infection.[21]

In 1796, the basis for vaccination against smallpox (and all other diseases) occurred in England. Edward Jenner, a local doctor, tested his theory that exposure to cowpox, a similar disease often experienced by milkmaids, could protect an individual from smallpox. To test this idea, he took material from a cowpox sore on a milkmaid's hand and inoculated it into the arm of a local 9-year-old boy. Several months later, the boy was exposed to smallpox multiple times and never developed the disease – the theory had proved successful. Doctors were quick to pick up the new technique, which led to a dramatic decrease in cases. Research continued and vaccination eventually replaced the process of variolation as a preferred method of protection against smallpox. At some point in the 1800s, the virus material used in the smallpox vaccine changed from cowpox to the variola virus.[21]

The image on this slide depicts the success of the smallpox vaccine, as well as the severity of disease for those who were infected. Dr. Allan Warner, of Leicester, England famously photographed and compared patients who had received the smallpox vaccine with those who had not, to show the vaccine's effectiveness. Here, two 13-year-old boys are depicted – the boy on the left never received the smallpox vaccine, while the boy on the right was vaccinated in infancy. They were both exposed on the same day, however the unvaccinated boy was the only one to develop a smallpox infection. Dr. Warner's photographs have been republished throughout history but were first published in 1904.[23]

Slide 23: To date, smallpox is the only vaccine-preventable disease that has been globally eradicated, meaning the variola virus that causes smallpox is no longer present anywhere on the globe. Achieving global eradication did not come easy and took several decades of work.

The World Health Organization (WHO) began the global eradication effort of smallpox in 1959, however, the campaign struggled for much of the next decade, and smallpox was still widespread throughout many parts of the world in the late 1960s. The Intensified Eradication Program started in 1967 and proved much more successful due to increased capacity for vaccine manufacturing in countries with the disease, case surveillance systems, and mass vaccination campaigns. The program made strides towards ridding smallpox from the world, and smallpox was eradicated in South America in 1971, Asia in 1975, and finally Africa in 1977.[21,24]

The World Health Assembly declared the world free of smallpox disease on May 8th, 1980. To date, smallpox is the only disease which has been eradicated across the globe, a feat that many consider to be one of the greatest achievements of public health.[21]

After eradication, smallpox vaccination was discontinued except for select researchers who may be at special risk.[2] Currently, only two locations continue to store and handle the variola virus under WHO supervision, the Centers for Disease Control and Prevention in Atlanta, Georgia, and the State Research Center of Virology and Biotechnology (VECTOR Institute) in Koltsovo, Russia.[21]

Slide 24: Pertussis is a serious respiratory illness that is more commonly known as whooping cough. Pertussis is caused by a bacteria that affects the upper respiratory system. The disease is highly contagious and spread through close person to person contact, such as sneezing or coughing or spending lots of time in the same breathing space, such as indoors. Sadly, many babies are unknowingly infected by older family members or caretakers who do not realize they have the disease.[25]

Symptoms of pertussis are similar to that of a cold, and include runny nose, low grade fever, a mild cough and in babies a condition called apnea, which is a pause in breathing. Early symptoms can last for 1-2 weeks.

More serious symptoms may occur if the disease progresses after 1-2 weeks and include rapid coughing fits, followed by a high-pitched “whoop” sound, vomiting often following a coughing fit, and exhaustion. The rapid coughing from more serious pertussis will cause all the air to be gone from your lungs, which forces a large inhale that cause the loud “whooping” sound.[19] The coughing fits can become worse as the illness progresses, but are not always present, particularly in more mild disease, which is typical in older children and adults.

Babies and younger children are at greatest risk for complications from pertussis, particularly those who are unvaccinated or lack full protection from a completed vaccine series. Half of all babies who develop pertussis before the age of 1 will need to be treated in a hospital setting, and the younger the baby, the more likely they’ll need hospital treatment.[19] Out of those babies requiring hospitalization, 1 in 4 will develop pneumonia, 1 in 100 will have convulsions or uncontrolled shaking, 3 in 5 will develop apnea (or a pause in breathing), 1 in 300 will develop encephalopathy (which causes damage to the brain), and 1 in 100 will die.[25]

There are two vaccines available to prevent pertussis: DTaP which is used for children younger than 7 and Tdap, which is used for older children, teens and adults. These vaccines also provide protection against tetanus and diphtheria.

Slide 25: Even with vaccines available, pertussis remains a common disease in the United States and frequent outbreaks continue to occur across the country.

On this page you can see the history of case numbers in the United States since 1922. After the introduction of the initial DTP vaccine in the 1940s, a dramatic decline in pertussis cases was observed in the following decades. A new version of the same vaccine that protects against diphtheria, tetanus, and pertussis was introduced in the mid 1990s, known as DTaP. Additionally, a booster for pertussis and diphtheria in older children and adults was combined with a tetanus vaccine and introduced as Tdap in 2005.[26]

Unfortunately, you can also see that in recent decades there has been an increase in pertussis cases, and this has coincided with large numbers of parents refusing to vaccinate their children against the disease. 2012 was the worst year in recent history, with 48,277 cases of pertussis being reported in the United States. From 2014-2019, almost 120,000 cases were reported to the CDC and outbreaks have continued since.[19]

Slide 26: Texas has experienced significant numbers of pertussis cases in recent years, most notably in 2013 when outbreaks occurred throughout the state.

Depicted here is the incidence rate of pertussis cases among the Texas population in 2013.[27]

Slide 27: Ensuring herd immunity for pertussis or whooping cough requires vaccinating individuals of all ages, as this diagram shows.

While babies and children receive a DTaP vaccine to protect against diptheria, tetanus, and pertussis, older children and adults receive a Tdap vaccine, which is considered a booster dose. Some vaccines require additional doses later in life to help maintain immunity levels, these are commonly referred to as boosters.

The CDC recommends that the following groups receive a Tdap vaccine to help maintain immunity levels and protect against diptheria, tetanus, and pertussis. Adolescents should receive a single dose of Tdap, ideally in the age range of 11-12 years. Pregnant people should also receive Tdap during the early weeks of their third trimester. This is advised for every pregnancy and helps protect the newborn from whooping cough, which as we've learned, can be particularly threatening to infants. Adults who have never received a dose of Tdap should also receive Tdap. Finally, all adults should receive a booster of Tdap every 10 years.[28]

It is important to talk with your healthcare provider about when you should receive your Tdap booster and understand that vaccines are needed across the lifespan, not just in childhood.

Slide 28: Measles is a vaccine preventable illness that has made a resurgence in the United States in recent years. Measles is a highly contagious disease that is spread through the air when an infected person coughs or sneezes. An infected person can spread measles before they know they have it, usually indicated by a tell-tale rash that may take several days to appear. Measles is so infectious that 9 out of

10 people near an infected individual are likely to become infected.[29] Common symptoms of measles include a high fever, cough, runny nose, watery eyes, and a rash. Measles can also lead to serious health consequences, including brain swelling, pneumonia, and even death. In the United States, 1 in 5 people with measles will be hospitalized. Groups at greatest risk to experience severe complications include children under 5, adults over 20, individuals with compromised immune systems, and pregnant people.[29,31]

Prior to the measles vaccine, most children in the United States would get measles by the time they were 15. An estimated 3 to 4 million people in the United States got measles each year, and an estimated 48,000 were hospitalized, 1,000 suffered encephalitis (swelling of the brain), and 400-500 people died.[30] The initial measles vaccine was licensed for use in the United States in 1963 and was improved with a new version of the vaccine in 1968. The strain used in this vaccine continues to be the only one in use today.[30] The measles vaccine is typically combined with mumps and rubella in what's known as the MMR vaccine, or the MMRV vaccine, which also protects against varicella, known as chickenpox.

The CDC set a goal to eliminate measles from the country by 1982, which was not met. However, over the next several decades the measles vaccine was widely adopted, which led to 80% fewer cases in 1981 compared to the previous year.[32] In 1989 a widespread outbreak among vaccinated school children led to the recommendation of a second MMR dose. Improvements to the first dose and adoption of a second MMR dose led to significant reduction of measles in the United States, and in 2000 measles was declared eliminated from the United States.[32] Since 2000, the United States has maintained elimination status, which per the WHO, requires "the absence of endemic measles virus transmission in a defined geographical area (e.g., region or country) for at least 12 months in the presence of a surveillance system that has been verified to be performing well."[32] Unfortunately, measles is still active in several parts of the world, and recent declines in MMR vaccination rates in the United States have resulted in several significant outbreaks of the disease, threatening elimination status.

Slide 29: One example of a recent outbreak of measles in the United States occurred in Orange County California in late 2014 and into early 2015.

On January 5th, 2015 the California Department of Public Health was notified about a suspected measles case. The patient was 11 years old, hospitalized, and was unvaccinated. The classic rash symptoms associated with a measles infection appeared on December 28th, 2014. While measles is active in several countries across the globe, the patient's only recent travel had been to two Disney parks in Orange county California. The California Department of Public Health quickly received more reports of potential measles cases from residents of California as well as out of state, all of whom had visited the Disney parks between December 17th – 20.[33]

Ultimately, 147 cases of measles were linked to exposure in Disney parks in late December of 2014. Cases related to this outbreak were linked to individuals in seven states, Mexico, and Canada.[34]

Upon further inspection, health officials also discovered that a large portion of the cases were associated with individuals who were either unvaccinated or who's vaccination status was unknown/undocumented.[34] The original source of the outbreak was never determined, but the Disney case is a great example of how vulnerable herd immunity is, particularly in our global and highly connected world. While measles is no longer prevalent in the United States, it can be found in several

countries around the world, and the majority of cases here can still be traced to international travel and unvaccinated individuals.

Slide 30: Another significant measles outbreak occurred in the fall of 2018 and lasted well into the spring of 2019.

On October 1st, 2018, the Rockland County Department of Health, in New York state, alerted the state health department of an unvaccinated teenager with a history of recent travel, who had been diagnosed with measles.[35]

Quickly, additional cases were identified and reported, and all were linked to unvaccinated individuals traveling to Israel, where a large measles outbreak was currently happening. The New York state outbreak lasted well into the Spring of 2019 and in an effort to contain the outbreak, health officials took serious actions, including excluding unvaccinated students from schools for a period of 21 days following exposure and administering over 19,661 MMR doses between October 2018 and April 2019. Similar efforts were used by health officials in New Jersey to contain their outbreak.[35]

Both outbreaks occurred primarily among members of the Orthodox Jewish community and was associated with low community vaccination rates, particularly in some religious private schools, and recent international travel to Israel where a measles outbreak was occurring.[36]

Once again, the outbreaks in New York and New Jersey highlight the importance of high levels of community vaccination rates to ensure ongoing herd immunity, as well as the potential for exposure outside of the United States to come back to the country through travel.

Slide 31: 2019 was a bad year for measles cases in the United States overall, with 1,282 cases reported, of which 89% were associated with individuals who were unvaccinated or had an unknown vaccine status.[37,38] Texas also experienced its own increase in measles cases in 2019, after several years of very low case numbers.

A total of 22 laboratory-confirmed cases of measles were identified in Texas in 2019 and occurred in 13 counties throughout the state.[39] The first sets of cases were identified in early 2019 in the counties of the Greater Houston metro region, Harris, Montgomery, and Galveston counties.[40]

9 cases occurred in children younger than 18, some of whom were too young to have been fully vaccinated against measles. The remaining 13 cases occurred in individuals 18 years and older.[39]

15 of the 22 cases occurred in individuals who were either unvaccinated, only had one dose of their MMR vaccine, or who's vaccine status was unknown. This was the most significant outbreak of measles the state had experienced since 2014.[39]

Slide 32: As we've learned, herd immunity depends on a large portion of the population being immune to a disease. For infectious diseases that we have vaccines for, herd immunity is primarily achieved through strong vaccination levels, however, not everyone in the population can be vaccinated.[2] Young babies are not eligible for many vaccines in their first months of life, and there are other individuals who may not be able to receive a vaccine for medical reasons, such as allergies or immunosuppressant treatment. And for others, sometimes a vaccine may not offer full protection depending on their own body's immune response. These individuals rely on the collective immunity of their surrounding

community to protect them, as high vaccine levels prevent transmission on a population level. But when we see outbreaks of vaccine-preventable diseases, this indicates that a community may have dipped below the threshold required to achieve herd immunity for a particular disease.[2]

The last several decades has seen the rise of an aggressive anti-vaccine movement in the United States that has threatened herd immunity as vaccine coverage levels for many routine childhood vaccines have dropped. Oftentimes, pockets of unvaccinated individuals live close together, as people who live in the same communities are more likely to share the same beliefs and ideas. This can lead to pockets of the population where the herd immunity threshold is no longer achieved, and lead to outbreaks like we've seen in the past examples.[2] Additionally, there is no denying that we live in a globally connected world, and many parts of the globe still have diseases such as polio and measles present. Unvaccinated individuals traveling to these countries always risk bringing back the disease to their own communities.

Slide 33: The National Vaccine Advisory Committee (NVAC) created standard immunization practices for adults and children. The standards were created for clinical practices to help raise immunization rates. It is known there are missed opportunities for vaccination because the vaccine status is not routinely assessed. The following slides are helpful tips to ensure your clinic is not missing any vaccination opportunity in the journey to achieve herd immunity. [41]

Slide 34: One of the best ways to offer vaccines, is to keep them in stock. If any vaccines are missing when patients are asked for their vaccination status at patient intake, the clinic can offer the needed vaccines as long as they are in stock.

It is important to have immunization services responsive to the needs of patients. For example, in large urban areas, public immunization clinic services should be available daily, 8 hours per day. In smaller cities and rural areas, clinics may operate less frequently. To be fully responsive, providers in many locations should consider offering immunization services each working day as well as during some off-hours like on weekends, evenings, early mornings, or lunch hours. This will allow patients to get immunized when they have time and remove possible barrier of having to take time off work. [41]

Slide 35: Another method for increasing immunization rates is using standing orders in a clinical setting. It is a single document that empowers physician assistants, nurses, and medical assistants to assess the patient's eligibility for vaccination based on specific criteria. The standing order serves the same purpose as a written or verbal prescription, so if patients meet that criteria, clinic staff are authorized to administer the vaccine without the provider present. Additionally, the orders explain monitoring and documentation guidelines following vaccination. [42]

Standing orders are highly effective because they make the whole process of administering routine immunizations much more efficient and allows extra flexibility for physicians to focus on more complex care. In studies reviewed by the Community Guide Task Force regarding the use of standing orders alone, results showed a 16% increase in vaccination rates and when used in combination with other immunization interventions, a 27% increase in rates. [43] This practice is also extremely cost effective, as it is requires very few resources to implement.

Slide 36: Each encounter with a health-care provider, including an emergency room visit or hospitalization, is an opportunity to screen vaccination status and, if indicated, administer needed vaccines. Before discharge from the hospital, a patient should receive vaccinations for which they are

eligible by age or health status. Pediatric and Primary health-care provider should be informed about the vaccinations administered and when the next is due. Providing follow up instructions about when to come back for the next recommended vaccine(s) is important to achieving herd immunity. [41]

When health-care providers assess the immunization status at each encounter, they should strongly recommend and administer the vaccines at that very moment in time. Also, implementation of this practice minimizes the number of missed opportunities to vaccinate.[41]

Slide 37: Reminder/recall is the process of identifying patients who are due for doses – either because they have one coming up which is called reminder, or because they missed one which is called recall. A reminder would be, for example, identifying all 11 year olds in the clinic that they are due for the first dose of HPV or identifying patients who are needing to come back in for the second or third dose of HPV. These patients are not yet overdue for their vaccines. A recall would be to identify those patients that have missed doses. For example, a 13 year old who has yet to receive a single dose of HPV. [44]

In either case, the clinic contacts the patient or the patients' parents or caregivers to ask them to schedule an appointment or come in for the vaccine. Clinics can use a wide variety of methods to make this contact, whether it be automated systems through an electronic health records system that call or text patients, or low-tech options like simple postcards that are hand-written and mailed out or phone calls made by clinic staff.

This method has been shown to be effective in a range of clinical settings and with all age groups. According to a systematic review of client reminder and recall systems studies by the Community Guide Task Fore, this method alone showed a 6% increase in vaccination rates. And when used in combination with other immunization interventions, studies showed a 12% increase. [45]

Slide 38: Providers of immunization-only services that require an appointment should co-schedule immunization appointments with other needed health-care services such as WIC, dental examinations, or developmental screening. Such scheduling removes time barriers. [41]

Available evidence suggests that the simultaneous administration of childhood vaccinations is safe and effective. In addition, evidence suggests that the simultaneous administration of multiple needed vaccines can potentially raise immunization coverage by 9% -17%. [41]

Vaccines should be discussed at each appointment to normalize the conversation and create open dialog for any questions. Also, the CDC suggests using bundling language for vaccinations. For example, making the statement of "your daughter is due for Tdap, HPV and meningitis, she will be getting these during todays visit. Do you have any questions about these vaccines?" The bundling language makes it clear that all vaccines are important to receive not just the ones required for school. [46]

Slide 39: Now we'll discuss some helpful resources that cover immunity types, general knowledge about herd immunity, and why it's important to keep diseases at bay with vaccines.

Slide 40: The first helpful resource listed is the CDC's "Immunity Types" which describes the different types of immunity. This site is helpful to better understand the ways in which our bodies build immunity to protect from infectious disease.

Next is the Association for Professionals in Infection Control and Epidemiology's "Herd Immunity" page, which has a breakdown of the concept of herd immunity and how it is impacted by vaccination rates.

Finally, Vaccinate Your Family's page titled "Outbreaks of Vaccine-Preventable Diseases" provides examples of why vaccination is important to continuing to keep diseases that we have vaccines for at bay. This page also includes disease information for common vaccine preventable diseases like the Flu and Measles and explains why it is important to protect against them with vaccines.

Slide 41: Be sure to follow us on Twitter, Facebook, Instagram, and LinkedIn.

Also, if you'd like to stay updated on the latest information from The Immunization Partnership sign up for our alerts at www.immunizeusa.org.

Slide 42: People like you are vital in helping promote the importance about how to eliminate vaccine-preventable diseases from spreading in your communities. We hope you will take the tools, strategies, and resources you've learned about to help explain herd immunity. The work is ongoing as organizations like The Immunization Partnership and healthcare professionals like yourselves work to push the message that vaccines are safe and effective.

Remember, immunize. Prevent what's preventable.

Slide 43: Here are the references for today's presentation.

Slide 44: If you have any questions about this presentation please reach out to myself, Ashley Beale, at abeale@immunizeusa.org. If you'd like to further expand your immunization awareness and knowledge, feel free to explore our additional immunization courses offered on our Immunization University platform hosted on the TIP website, www.immunizeusa.org. We offer other nursing-approved courses for professional continuing education credit through a partnership with Cizik School of Nursing at UTHealth. Non-continuing education courses are open to individuals in other professions and to students as well. Thank you for listening.

REFERENCES:

1. https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/herd-immunity-and-coronavirus/art-20486808
2. https://apic.org/monthly_alerts/herd-immunity/
3. https://www.cdc.gov/vaccines/vac-gen/immunity-types.htm
4. https://medlineplus.gov/ency/article/002223.htm
5. https://www.chop.edu/centers-programs/vaccine-education-center/human-immune-system/types-immunity
6. https://www.technologynetworks.com/immunology/articles/active-vs-passive-immunity-differences-and-definition-335112
7. https://www.chop.edu/centers-programs/vaccine-education-center/vaccine-safety/immune-system-and-health
8. https://www.cdc.gov/vaccines/vac-gen/whatifstop.htm
9. https://www.historyofvaccines.org/content/herd-immunity-0

10. https://www.jhsph.edu/covid-19/articles/achieving-herd-immunity-with-covid19.html
11. https://www.path.org/articles/understanding-journey-herd-immunity/
12. https://www.healthline.com/health/r-nought-reproduction-number
13. https://www.vaccinestoday.eu/stories/what-is-r0/
14. https://www.mdanderson.org/cancerwise/what-is-covid-19-coronavirus-herd-immunity-when-will-we-achieve-herd-immunity.h00-159383523.html
15. Mallory, Michael L et al. (2018) "Vaccination-induced herd immunity: Successes and challenges." Accessed: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6433118/
16. https://www.cdc.gov/salmonella/reportspubs/salmonella-atlas/serotyping-importance.html
17. Gostic KM, et al. (2019) "Childhood immune imprinting to influenza A shapes birth year-specific risk during seasonal H1N1 and H3N2 epidemics." Accessed: https://journals.plos.org/plospathogens/article/authors?id=10.1371/journal.ppat.1008109
18. https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section10.html
19. https://vaccinateyourfamily.org/questions-about-vaccines/outbreaks-of-vaccine-preventable-diseases/
20. https://immunizationevidence.org/featured_issues/vaccine-preventable-outbreaks-becoming-all-too-common-and-costly/
21. https://www.cdc.gov/smallpox/history/history.html
22. https://www.cdc.gov/smallpox/transmission/index.html
23. https://vaxopedia.org/2018/06/18/vaccinated-vs-unvaccinated-smallpox-edition/
24. https://www.who.int/health-topics/smallpox#tab=tab_1
25. https://www.cdc.gov/pertussis/about/complications.html
26. https://www.nature.com/articles/d42859-020-00013-8#:~:text=In%20the%20late%201940s%20the,the%20USA%20decreasing%20150%2Dfold.
27. https://www.dshs.texas.gov/IDCU/disease/pertussis/statistics/Pertussis-Data.aspx
28. https://www.cdc.gov/vaccines/vpd/pertussis/index.html
29. https://www.cdc.gov/measles/about/parents-top4.html
30. https://www.cdc.gov/measles/about/history.html
31. https://www.cdc.gov/measles/symptoms/complications.html
32. https://www.cdc.gov/measles/elimination.html
33. https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6406a5.htm?ref=tjournal.ru
34. https://blogs.cdc.gov/publichealthmatters/2015/12/year-in-review-measles-linked-to-disneyland/
35. https://www.cdc.gov/mmwr/volumes/68/wr/mm6819a4.htm
36. https://khn.org/news/why-measles-hits-so-hard-within-n-y-orthodox-jewish-community/
37. https://www.cdc.gov/measles/cases-outbreaks.html
38. https://www.texaschildrens.org/blog/2019-us-measles-outbreaks-public-health-crisis
39. https://www.dshs.state.tx.us/IDCU/disease/measles/Measles-2019.aspx
40. https://www.houstonpublicmedia.org/articles/news/health-science/2019/02/21/322683/harris-county-officials-confirm-fourth-case-of-measles/
41. https://www.cdc.gov/mmwr/preview/mmwrhtml/00020935.htm
42. https://www.hhs.gov/nvpo/nvac/reports-and-recommendations/the-standards-for-pediatric-immunization-practice/index.html
43. https://www.thecommunityguide.org/findings/vaccination-programs-standing-orders
44. https://www.cdc.gov/hpv/partners/outreach-hcp/reminder-recall.html

45. https://www.thecommunityguide.org/findings/vaccination-programs-client-reminder-and-recall-systems
46. https://www.cdc.gov/hpv/hcp/boosting-vacc-rates.html