Exploring Vaccine-Preventable Pediatric Illnesses and Vaccine Hesitancy

Review from LG Health's Second Annual Pediatric Conference


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Practice guidelines summarized in this article were presented at Penn Medicine Lancaster General Health's Second Annual Pediatric Conference by four infectious disease specialists: Sarah Long, MD; Jessica Ericson, MD, MPH; Lori Handy, MD, MSCE; and Nitin Patel, MD. The event, held in November 2024, was organized by Pia Fenimore, MD; Harry Bramley, DO; and Lyndsay Tawney, Lancaster General Health Foundation. Full conference recordings are available as CME Enduring Materials online.

Vaccines can be a challenging topic for clinicians and parents. Some clinicians look forward to intellectual debates during well-child visits, helping parents better understand the risks and the benefits of vaccines; others might dread these time-intensive discussions. Most of us fall somewhere in between.

This article outlines three vaccine-preventable pediatric illnesses — polio, respiratory syncytial virus (RSV), and Bordetella pertussis — and debunks some vaccine-related myths, before concluding with time-saving strategies for clinicians navigating vaccine hesitancy. Vaccine-preventable illnesses have not disappeared, and we must be ever-vigilant to educate our patients regarding even routine vaccines.

To begin, let's consider the two broad ways to conceptualize the benefits of vaccinations: for the individual and for the population.

INDIVIDUAL IMMUNITY

To state that the purpose of vaccines is to prevent infection may be misleading. Rather, flu and RSV vaccines induce antibodies that offer basic protection against infection; they are most effective at reducing the risk of hospitalization and preventing progressive life-threatening infections.[1,2] For example, a child vaccinated against RSV is less likely to need bilevel positive airway pressure (BiPAP) in the hospital and less likely to die from RSV-related complications.

Studies show that vaccinated infants develop fewer complications from infection compared to their unvaccinated peers.[3-6]

Studies suggest that vaccine-induced immunity is initially strong but may decrease over time. That is, there is a decrease in antibody levels or immune memory. Either can occur when vaccination rates or exposure to vaccines decrease in a community. This is why routine recommended vaccines include booster doses, which help the body maintain antibody levels. This offers protection from transmittable illnesses mutating with time.[7]

Vaccination campaigns help to mitigate the effects of waning immunity,[8] which are more pronounced in those with compromised immune systems, like newborn infants.[9] This is worth highlighting at the well-child visit when parents seem hesitant about vaccines.

POPULATION IMMUNITY

Vaccines also contribute to population immunity, previously called herd immunity.[10] This public health concept suggests that a community is protected from an infection when 95% of its members have antibodies to that infection. Immunity comes from either a prior infection or the antibodies arising from the body's response to a vaccine. When 95% of a community is immune, there is enough protection to prevent an infection outbreak.

Immunized individuals effectively create a barrier to prevent further disease transmission. In essence, routine infant vaccinations protect more than just the individual infant — they protect the community, including those who cannot receive vaccines such as immune-suppressed infants with autoimmune disorders (e.g., thyroid disorders) or malignancies.[11-15] These infants are usually not able to receive live or attenuated vaccines, although they can safely receive immunizations against RSV and pertussis.[12-15]

Waning population immunity describes the progressive and gradual decline of immunity within a population, particularly following vaccination or infection. Vaccination campaigns help to mitigate this herd immunity as well. However, if vaccines are not given, then population immunity decreases and individuals become more susceptible to infections, leading to potential disease outbreaks. Community members may spread disease like RSV or pertussis without knowing they are doing so. Inadequately vaccinated populations have increased risk of weakened response and run the risk of reinfection.[16-17]

Consider measles as an example. After decades of eradication, researchers are now suspicious of measles returning to America based on several large-scale outbreaks and more than 1,200 confirmed cases across the country.[18,19] In March 2025, Pennsylvania's Montgomery County reported measles in an unvaccinated child,[20] and in April a case was diagnosed in Ephrata, here in Lancaster County.

Measles case numbers recently surpassed those recorded in prior years largely due to decreased vaccination rates.[21] In Lancaster County in the 2023-2024 school year, 88% of seventh graders had received all required measles, mumps, and rubella (MMR) vaccines. Compare this to Philadelphia County where almost all children (97%) of the same age cohort had received all recommended MMR vaccinations. Interestingly, vaccination rates among the Amish population have been declining since 2014 when they were 52% to 2022 when they were down to 30%.[22]

PREVENTABLE PEDIATRIC ILLNESSES

Polio

Mass vaccine campaigns gained appeal during the polio epidemic. The polio virus paralyzed approximately 500,000 children worldwide each year during the 1940s and 1950s. For comparison, the entire state of Montana was home to 558,000 people in 1940. Imagine polio paralyzing nearly the entire state of Montana year after year. Due to scarce treatment options, many children died.

Vaccine campaigns heralded Dr. Albert Sabin's oral polio vaccine, which was soon replaced by Dr. Jonas Salk's intramuscular polio vaccine. It took more than 50 years to eliminate polio from developing countries. This was possible thanks to funding from global organizations such as Rotary International and the Gates Foundation. Sadly, anecdotal evidence today shows that polio infections still lead to varying degrees of paralysis in hard-to-reach parts of the world.[23]

Respiratory Syncytial Virus

Like polio, RSV can affect countless infants each season. RSV causes pernicious flu-like symptoms and inflammation of the small lung bronchioles, leading to bronchiolitis. Studies show that almost 2 in 50 infants aged 1 month or younger are hospitalized with RSV each year.[24,25] For comparison, the average daycare in Pennsylvania might have 25 infants.

Hospitalizations for infants who require breathing treatments contribute to significant newborn morbidity and mortality. Unfortunately, RSV-related hospitalization rates are even higher for premature infants, and for infants born between December and March. Thus, the RSV vaccine is crucial: receiving the vaccine decreases the risk of hospitalization.[24]

Infants can acquire RSV immunization in two ways. Pregnant individuals can receive RSV vaccines so that maternal antibodies offer protection in the newborn period. The vaccine can be given safely between 32 and 36 weeks estimated gestational age (EGA) to optimize newborn protection during the initial eight months of life. If the infant is born more than 14 days after the birthing person received the RSV vaccine, the infant is protected via passive immunization. Alternately, if the opportunity for immunity through maternal antibodies has been missed, infants can safely receive a

monoclonal antibody vaccine (nirsevimab, brand name Beyfortus®) at birth through 8 months of age.[26]

Pertussis

In addition to the RSV vaccine, pregnant individuals are also encouraged to receive tetanus, diphtheria, and pertussis (Tdap) vaccines to protect newborns against Bordetella pertussis. This bacterial infection causes whooping cough — a characteristic high-pitched cough progressing to intense coughing fits that can lead to apnea, emesis, and even broken ribs. Infants younger than age 2 months are at risk of developing pulmonary hypertension, which can lead to death. The whole-cell pertussis vaccine was rolled out in 1914 and replaced by the better-tolerated acellular vaccine in the 1990s.

Pregnant women should receive the inactive Tdap vaccine in the third trimester; newborns usually receive pertussis immunity from their mothers. Vaccine-induced maternal antibodies in pregnancy protect infants during the first three months of life. Unfortunately, studies show that fewer than 60% of pregnant women agree to receiving this vaccine.[27-29] Without the vaccine, pregnant women cannot confer immunity to unborn infants, placing the newborn babies at risk for pertussis infections. From a public health perspective, this contributes to waning population immunity.

VACCINE HESITANCY

Misinformation about unsubstantiated vaccine side effects can confuse parents and clinicians. This may lead parents to make choices without understanding the true benefits and risks of vaccines.

While all vaccines can cause mild fevers, muscle pain, or self-limiting rash, these can be explained by the body's immune response. This response creates antibodies that will protect an infant from severe infections and/or hospitalizations in the future. Side effects beyond these well-tolerated reactions have been described elsewhere. The following paragraphs aim to debunk misnomers surrounding vaccine side effects.

From the time of its inception, vaccination with the oral polio vaccine has been associated with reports of vaccine-derived paralysis as a rare side effect.[30] This is described by infectious disease specialist Paul Offit, MD, in his hallmark book, *The Cutter Incident.* Out of 220,000 people receiving the vaccine, there were 70,000 reports of muscle weakness, 164 cases of paralysis, and 10 deaths.[31] This was because Cutter Laboratories failed to properly inactivate the live virus in the oral polio vaccine. It appeared that the live vaccine, in turn, was supposedly associated with paralytic poliomyelitis for 1 in 2.4 million vaccine doses.

No scientific studies could corroborate this.[32] Still, worried parents became hesitant to allow their children to receive the vaccine. It was this kind of hesitancy that resulted in one of the last polio epidemics in the United States, which occurred in part here in Lancaster County in 1979. Thankfully, swift efforts to make vaccinations available among those who were most vulnerable helped stop the spread.[33]

The oral polio vaccine was replaced by Dr. Jonas Salk's inactivated intramuscular polio vaccine, which has resulted in few to no side effects since its rollout in the early 2000s. While the intramuscular vaccine does not counteract the polio virus within the gut biome in the same way that the oral vaccine did, the overall benefits it offers and its benign side-effect profile make it the vaccine of choice today.

Post-marketing studies for the RSV vaccine suggested that the vaccine might increase the risk of contracting Guillain-Barré syndrome.[34] This syndrome causes ascending bilateral paralysis that can eventually suppress breathing support. Therefore, early detection and treatment are crucial. Further clinical trials, however, have not substantiated an association between RSV vaccines and Guillain-Barré syndrome, while many clinical studies have demonstrated an increased incidence of pneumonia among infants infected with RSV.

Regarding the risks of receiving the RSV vaccine, recent publications yield conflicting conclusions. In one trial, those who received the RSV vaccine were 1.9% more likely to deliver early.[35] This risk appeared higher in those from low- to middle-income countries; notably, the timing of vaccine administration in this study — the vaccine was given as early as 24 weeks EGA — was inconsistent with how it is given in the United States, where patients receive the RSV vaccine between 32 and 36 weeks EGA.

Another observational study conducted on U.S. women showed preterm birth was less likely among individuals receiving RSV immunization.[36] Since late preterm babies have a higher risk of hospitalization due to RSV infection, it is not recommended that clinicians withhold RSV immunization due to concerns for preterm labor.

Before the RSV vaccine, approximately 500 children died from the infection every year in the United States.[37] Since the vaccine became available, the rates of severe infection and hospitalization have decreased dramatically.[38] The Centers for Disease Control and Prevention continues to recommend RSV vaccine be given to pregnant persons who are between 32 0/7 and 36 6/7 weeks EGA during RSV season in most of the continental United States where RSV season is predictable.

Regarding pertussis vaccine, parents and clinicians may worry that immunization may lead to fever-induced seizures,[39,40] but that has never been demonstrated.[41] In fact, the study that led to this initial suggestion described seizures that occurred due to untreated fevers; "vaccine-related" seizures were thus unrelated to the vaccine.

Febrile seizures are uncommon and must be distinguished from vaccine-induced fevers. Febrile seizures are caused by the rate-of-rise of body temperature, not a statically elevated body temperature. It follows that treating a fever does not do much to prevent a febrile seizure, since the rate of rise in body temperature has already occurred. In most cases, febrile seizures occur in the setting of infections to which the immune system mounts its natural response and do not occur as the result of vaccination. In fact, vaccines decrease illness severity and therefore decrease the risk of a viral illness progressing to febrile seizures.

Still, some infants may experience temperature elevation after receiving vaccines. These vaccine-induced fevers are typically low grade in nature and can be attributed to the body's immune response as antibodies are generated and stored to fight future infections. It is this immune response that will protect the infant when exposed to infections within the community. This is how vaccines decrease illness severity and ultimately prevent infant hospitalizations. Yet, fevers can be concerning for many parents, and clinicians should discuss this vaccine reaction during the well-child visit.

A STRATEGY FOR CLINICIANS

One remaining challenge is how to appropriately convey the role vaccines are intended to play. Clinicians can guide vaccine discussions to ensure that families understand the risks, benefits, and challenges of vaccine-preventable conditions while helping to manage social media myths. One discussion guide is the 3A approach: *avoid fear tactics, ask permission,* and *adapt language.*

Avoid fear tactics when counseling parents during a well-child visit. During discussions with parents, clinicians should provide objective knowledge about vaccine risks and benefits. Consider dividing the conversation into three core areas: knowledge, behavioral changes, and access. Discussing the plethora of recommended childhood vaccines with a vaccine-hesitant parent is a daunting task. Fear-based tactics are to be avoided at all costs. Moreover, clinicians should avoid overwhelming parents with excess information.

Ask for permission to debunk myths in the office. In 2020, researchers found that 4 in 10 parents were hesitant about certain vaccines (especially the SARS-CoV-2 vaccine) for their children.[42] Hesitancy decreased when clinicians offered parents detailed, scientific evidence regarding vaccine safety and effectiveness.

Vaccine hesitancy is complex. It involves a combination of factors: misinformation, misunderstanding, fear, personal beliefs, and cultural values. Addressing vaccine hesitancy requires demonstrating respect, showing empathy, and offering evidence-based information.

Clear communication is crucial to combat misinformation. Clinicians should validate — rather than dismiss — concerns. Also, acknowledge that other parents have similar worries.

Normalizing concerns about vaccines may comfort parents. Clinicians can build rapport by offering flexible after-hours vaccine workshops during the busy back-to-school season, as well as offering personalized attention to address each family's concerns and values.

Adapt language and key phrases to use with every family. This can help clinicians offer neutral reactions to vaccine acceptance or hesitancy. Clinicians may convey presumptive phrases such as, "We will return in a minute with the vaccines." Studies show that using this kind of language makes it 17.5 times more likely for vaccines to be given to an infant.[43]

Clinicians can also try using conversational language: "What are you thinking about vaccines for your child?" Statements such as "Most infants who come to this clinic receive this vaccine" can be helpful for a parent or guardian to hear. Key phrases with positive connotations such as "Giving the vaccine is a great thing to do for your child" tend to result in more favorable outcomes than using phrasing with negative connota-

tions. Changing clinician behavior is perhaps one of the best ways to engage hesitant parents.

Below we share an example case where clinician and parent interact during a well-child visit. We outline a few ways that a clinician might mold the 3A approach to reflect personal style and then use this framework to address a hesitant parent.

CONCLUSION

Most clinicians recognize that vaccine hesitancy is a growing global challenge that may have disastrous public health consequences. This article is offered to share information from LG Health's Second Annual Pediatric Conference, shed light on vaccine-preventable pediatric illnesses, and debunk some of the myths that may fuel vaccine hesitancy.

Parental hesitancy regarding the use of pediatric vaccinations underscores the ongoing importance of primary care, where clinicians can take advantage of the confidence they can instill while building proactive, long-term patient relationships. Discussing vaccines can strengthen the sanctity of the parent-clinician relationship. Conversational strategies like the 3A approach encourage us to avoid fear tactics, ask permission, and adapt language; in this way clinicians can negotiate emotional discussions about vaccines. Ultimately, parents and clinicians can bond over a shared goal: a healthy, happy child.

Case Example

Clinician: Today your child is here for a well-child visit. I noticed we haven't yet discussed the measles, mumps, rubella — the MMR — vaccine.

Dad: Honestly, I'm just not sure about it. I've heard a lot of things, especially about autism. I don't want to risk it.

Clinician: I understand your concern. There's a lot of misinformation out there, especially about vaccines and a possible link to autism. If you're open to it, I can explain some of the facts and clear up the myths. Would that be alright?

Dad: Well, I'm not sure. But I am listening.

Clinician: Thank you for being open to a discussion. First, let me reassure you that extensive research has been done with the MMR vaccine. Because of this, we know that there is no credible scientific evidence linking this vaccine, or any vaccine, to autism. The study that started this rumor was thoroughly discredited and retracted long ago. Since then, many studies have been done. No studies have found a connection between the MMR vaccine and autism.

Dad: Really? I had no idea the studies were retracted.

Clinician: The MMR vaccine is safe and effective. It protects infants from diseases like measles that can be life-threatening. Measles is highly contagious and can cause severe complications like pneumonia and brain swelling. In fact, there was a measles case reported here in Lancaster County just two months ago.

Dad: I had no idea this was so serious. I just thought measles caused a cold.

Clinician: Well, I am not trying to scare you. Hopefully, I'm sharing what you have already seen on the news. The reality is that I want the same thing you want — for your baby to grow up healthy. I understand that, as a parent, you want to make the best decision for your child. The beauty of the MMR vaccine is that it is incredibly effective at preventing measles, which will protect your infant and those around your child. By vaccinating, you are not only protecting your baby, but also your family and your community. Giving the vaccine is an important thing to do for your baby.

Dad: Well … are there any side effects?

Clinician: Like any vaccine, there can be mild side effects. Most parents notice low-grade fevers or rash within the first 7-12 days. Serious side effects are rare. The overall benefit — protecting your baby from potentially severe diseases — outweighs potential side effects. And those mild side effects are much more manageable than what your child could face if they needed to be admitted to the hospital because of a measles infection.

Dad: It still feels like there is so much to worry about.

Clinician: I hear you. It is important to understand what these vaccines are for and how they can help your child. Many parents in my clinic ask the same questions you have, and I encourage these discussions so we can learn together.

Dad: Oh, it's not just me? That makes me feel better. This makes more sense. I did not realize the risks of measles. I guess I was just influenced by things people around me said.

Clinician: I am here to support you in making the best choice for your baby's health. I think it is great that you are asking these questions. I hope this helped.

Dad: I really appreciate you taking the time to explain all of this.

Clinician: I am happy to help. If you feel ready, we can go ahead with the MMR vaccine today. It is safe, effective, and will help ensure your child is protected against some serious illnesses.

Dad: Yes, let's do it. After hearing this, I feel more comfortable with vaccines in general.

Clinician: Great, I will let your nurse know. If you have any questions down the road, please reach out. We are here to make sure your baby is healthy and safe.

Clinician icon by Wilson Joseph, Dad icon by Jamil Akhtar — from Noun Project (CC BY 3.0).

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