WHY IMMUNIZATIONS MATTER

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Introduction

Immunizations are among the most important achievements in public health, providing both individual and community-level protections against many diseases with potentially devastating consequences. In this explainer, we discuss how immunizations provide immunity against disease, the different types of vaccines, standards used to determine vaccine safety and effectiveness, and immunization recommendations.

Immunity

Immunity to a disease is achieved through the presence of antibodies to that disease in a person's system.[1] Antibodies are proteins that the body produces to eliminate toxins or disease-carrying organisms. Immunization is the process of becoming immune to (protected against) a disease, typically through the administration of a vaccine.[2] People may gain protection from infectious diseases through individual immunity or by living in a community where a sufficient percentage of a population is immune to a contagious disease, indirectly protecting those who are not immune.

INDIVIDUAL IMMUNITY

There are two ways to acquire individual immunity — actively or passively.[1]

- Active immunity is acquired through disease infection or vaccination.
- Passive immunity is acquired from antibodies produced by another source. An example is immunity passed from mother to child. This provides only limited protection.

A vaccine is a substance that helps the body develop immunity to a disease by stimulating the immune system to recognize and fight

TABLE 1: VACCINE EFFECTIVENESS FOR FOUR DISEASES BY NUMBER OF DOSES

Vaccine	Effectiveness	Doses
Measles	97%	2
Mumps	88%	2
Inactivated Polio	99-100%	3
Varicella	82%	1

specific germs, such as viruses or bacteria, without causing illness. When the vaccine is injected, the body's immune system reacts by producing antibodies against the organism.[3] Depending on the disease, one or more doses of a vaccine may be required for maximum protection, but rates of effectiveness vary among vaccines (see Table 1).[4,5,6]

HERD OR COMMUNITY IMMUNITY

Herd immunity, also known as community immunity, occurs when enough people in a defined community are immune to an infectious disease through vaccination and/or prior illness to limit the spread of the disease when it occurs.[7] For herd immunity to protect people who are not individually immune, a large percentage of people in the community must be resistant to the disease. This percentage is the herd immunity threshold. The threshold varies by the contagiousness of the disease. For example, a highly contagious disease such as measles requires at least 95% of the population to be immune to the disease for herd immunity to be achieved.[8]

A case study of a measles outbreak in 1970 on the Texas-Arkansas border highlights two issues: the effectiveness of vaccinations and the importance of herd immunity in protecting all individuals, vaccinated or unvaccinated.[8]

CASE STUDY: 1970 TEXAS-ARKANSAS BORDER MEASLES OUTBREAK

- Between June 1970 and January 1971, there was a measles outbreak in Texarkana, Texas, and Texarkana, Ark.
- Of 633 reported cases, 96% (606) occurred in Texarkana, Texas.
- Measles immunization was required for children admitted into school in Arkansas, but not in Texas.
- In Arkansas, the vaccination rate was 95% for children ages 1-9, compared to 57% in Texas.

Increased immunity at the individual level leads to greater community-level immunity. Projections indicate that vaccinations of children born between 1994 and 2021 will prevent 472 million illnesses, help avoid 1,052,000 deaths, and save nearly $2.2 trillion in total societal costs, including $479 billion in direct costs.[9]

A measles outbreak in west Texas and New Mexico that began in January 2025 also reinforces the importance of immunizations. By mid-March, more than 250 cases had been identified — most of them among unvaccinated children — and at least 34 people had been hospitalized.[10] Sadly, the outbreak also resulted in the death of one unvaccinated school-aged child, the first measles death in the U.S. since 2015.[11] In light of these outbreaks, adults without presumptive evidence of immunity (e.g. written documentation of vaccination, birth before 1957 with presumed natural immunity) are advised to receive at least one dose of the measles, mumps, and rubella (MMR) vaccine. Specific groups, such as students at post-secondary institutions, healthcare personnel, and international travelers, should make sure they have received two doses of the MMR vaccine, spaced at least 28 days apart.

TYPES OF VACCINES

There are multiple types of vaccines and many factors that go into their development. These factors include how the immune system responds to the germ, the types of individuals who need to be vaccinated against the germ, and the best available technology to develop the vaccine. Table 2 provides an overview of the major types of vaccines, including their methods of action, common examples, dosage requirements, and overall effectiveness.[12,13]

TABLE 2: VACCINES TYPES

Type of Vaccine	Method of Action	Examples of Diseases Vaccine Protects Against	Effectiveness
Inactivated vaccines	Uses a killed version of the germ; requires booster doses for long-term immunity	Hepatitis A, flu, polio, rabies	Immunity wanes over time; booster shots required for ongoing protection
Live attenuated vaccines	Uses a weakened form of the germ; mimics natural infection for strong immune response	Measles, mumps, rubella, rotavirus, smallpox, varicella (chickenpox), yellow fever	1-2 doses typically provides lifetime protection
mRNA vaccines	Provides genetic instructions to cells to produce a non-infectious protein that triggers immunity	COVID-19	Immunity wanes over time; booster shots required for ongoing protection
Subunit, recombinant, polysaccharide, and conjugate vaccines	Uses specific pieces of the germ (e.g., protein, sugar, or capsid) to generate immune response	Hepatitis B, HPV, whooping cough, meningococcal disease, shingles, COVID-19	Immunity duration varies by vaccine; some may require boosters
Viral vector vaccines	Uses a harmless virus as a vector to deliver genetic instructions for immunity	Ebola, COVID-19	Immunity duration varies by vaccine; some may require boosters
Toxoid vaccines	Uses an inactivated toxin from the germ to build immunity against the disease-causing substance	Diphtheria, tetanus	Immunity wanes over time; booster shots required for ongoing protection

IMMUNIZATIONS AT WORK

Before the introduction of vaccinations at the beginning of the 20th century, vaccine-preventable infectious diseases exacted an enormous toll on the U.S. population. For example, at its peak in 1952, there were more than 21,000 cases of paralytic polio.[14] During the 20th century, some of the diseases that had caused significant numbers of illnesses and deaths were eradicated or significantly reduced by vaccines and other advances in science.[15] Table 3 shows pre-vaccine-era annual cases and deaths and 2023 case numbers for certain diseases.[16,17] Preventing diseases with vaccines not only protects health but also leads to significant financial savings.[18] For example, a 2007 report noted a benefit of $4.76-$5.61 for each dollar spent on varicella, or chickenpox, vaccine and a benefit of $1.96 for each dollar spent on the hepatitis A vaccine.[19]

TABLE 3: DECREASES IN VACCINE-PREVENTABLE DISEASES

	20th Century Annual Avg. Cases	20th Century Annual Avg. Deaths	2023 Reported Cases	Percentage Decrease in Cases
Polio (Paralytic)	16,316	1,879	0	100%
Measles	530,217	440	47	> 99%
Mumps	162,344	39	429	> 99%
Rubella	47,745	17	3	> 99%
Diptheria	21,053	1,822	2	> 99%
Tetanus	580	472	15	97%
Pertussis	200,752	4,034	5,611	97%

Safety and Effectiveness

Modern vaccines are safe and effective, but no vaccine is completely effective or completely safe for all recipients. Unfavorable or adverse events after immunization have been reported with all vaccines. These range from minor, local reactions, which are common, to — in rare cases — severe, systemic illnesses such as those associated with the yellow fever vaccine.[20] Despite anecdotal reports and considerable media attention regarding a purported connection between vaccines and autism spectrum disorder (ASD), no credible scientific proof has connected vaccines to ASD. This issue has been studied extensively in the U.S. and abroad, and no linkage between vaccines and ASD has been found.[21] Nevertheless, it was reported in March 2025 that the CDC planned to conduct a large study to explore whether there is a connection between vaccines and ASD.[22]

In the U.S., vaccine candidates must pass through a rigorous regulatory process overseen by the Food and Drug Administration (FDA). There are multiple steps leading to the traditional licensure, or approval, of a vaccine.[23] First, there is the pre-licensure phase. This phase includes the development of the vaccine by its manufacturer, requiring laboratory testing to ensure the vaccine has the potential to prevent a disease and that it is safe for people to use. A vaccine sponsor, such as a private company developing a vaccine or a vaccine researcher, must also submit to the FDA an Investigational New Drug application, which describes the vaccine, how it is manufactured, and what quality-control tests will be conducted.

The next part of the pre-licensure phase includes clinical trials.[20,24] These typically include three distinct phases:

- Phase 1: Researchers gather information on the vaccine's safety, including identifying side effects and testing how well the vaccine causes an immune response. Small groups of people, typically 20 to 100, receive the trial vaccine.
- Phase 2: The trials expand, typically to include hundreds of participants with characteristics similar to the intended vaccine recipients. Researchers continue to monitor side effects and gather other key information they need to begin designing Phase 3.
- Phase 3: The trials expand, typically to include 1,000 or more participants. Researchers confirm the vaccine's effectiveness, monitor side effects, and collect data to support safe usage.

Following successful clinical trials, the vaccine sponsor submits a Biological License Application to the FDA. Findings may be presented to the FDA's Vaccines and Related Biological Products Advisory Committee for recommendations. The process also requires the submission of adequate product labeling to allow healthcare providers and consumers to understand how to use the vaccine, along with potential risks and benefits.

Once approved, the vaccine may enter the market, at which time the post-licensure vaccine safety monitoring period begins. The FDA and the CDC use the Vaccine Adverse Event Reporting System (VAERS) to track adverse events that happen after people receive the vaccine.[25] Additionally, scientists use the CDC's Vaccine Safety Datalink to perform studies to determine if side effects reported to VAERS are related to specific vaccines.

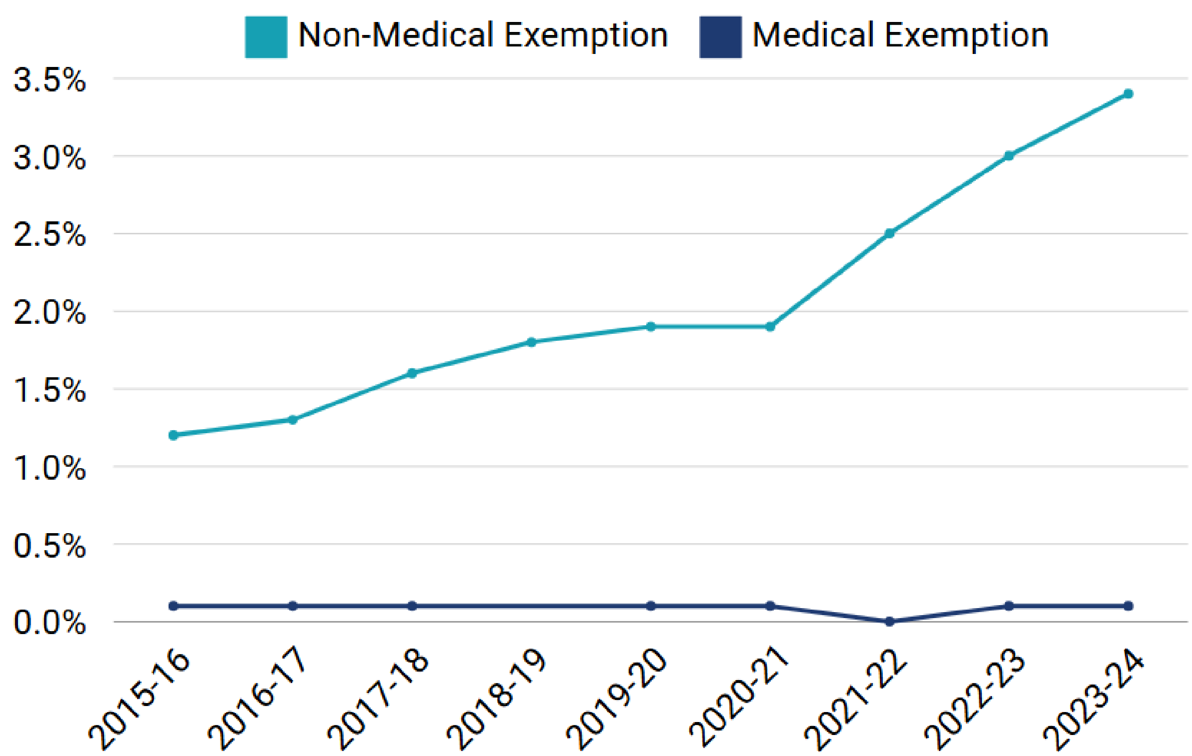
During a public health emergency such as the COVID-19 pandemic, the FDA can provide access to vaccines through the expedited emergency use authorization (EUA) mechanism.[26] It is important to note that an emergency use authorization does not equate to FDA approval, and an EUA is only in effect for the duration of the public health emergency. For this reason, it is critical that vaccines receiving EUAs still undergo clinical trials and are continually monitored for their efficacy.

In recent years, mRNA vaccines developed to fight COVID-19 have often been the subject of misinformation. While the COVID-19 mRNA vaccines were rapidly deployed due to the public health emergency, they were built on decades of existing research and still underwent rigorous clinical trials to ensure safety and effectiveness through the emergency use authorization process.[27] Additionally, mRNA vaccines do not change a person's DNA. Instead, these vaccines transmit temporary instructions to cells to produce an immune response and then are broken down by the body.

Immunization Recommendations, Exemptions, and Insurance Coverage in Arkansas

For children starting kindergarten, the Arkansas Department of Health follows the CDC's recommendations in requiring children to have the following vaccinations: at least three doses of polio vaccine; two doses of MMR vaccine; three doses of hepatitis B vaccine; one dose of hepatitis A vaccine; two doses of varicella vaccine; and at least four doses of diphtheria, tetanus, and acellular pertussis (DtaP) vaccine, diphtheria, tetanus, and pertussis (DTP) vaccine, or diphtheria and tetanus (DT pediatric) vaccine.[28]

FIGURE 1: PERCENTAGE OF ARKANSAS KINDERGARTEN STUDENTS WITH AN EXEMPTION FROM ONE OR MORE VACCINES BY SCHOOL YEAR



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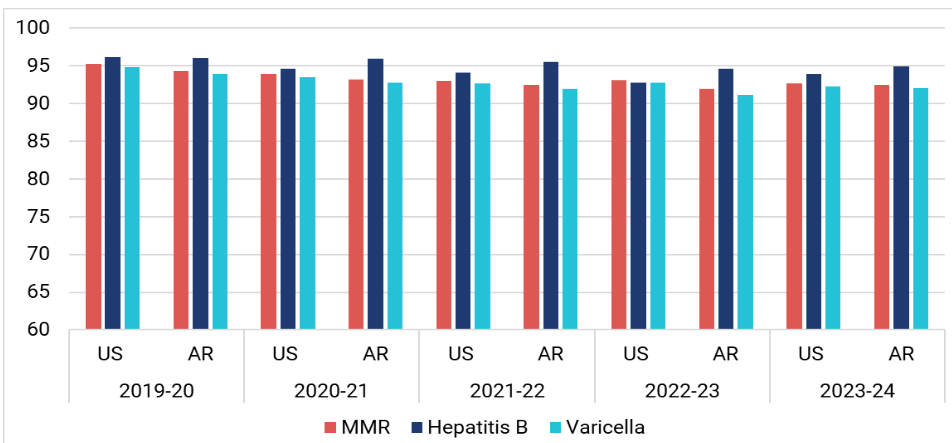
As of August 2024, 13 states, including Arkansas, provided non-medical exemptions for either religious or personal reasons.[29] Increased concentrations of individuals with exemptions may decrease overall herd immunity and contribute to increased outbreaks of vaccine-preventable diseases.[30] Figure 1 depicts an upward trend in the percentage of kindergarten students in Arkansas with an exemption from one or more vaccines.[31] Notably, Arkansas's rate of non-medical exemptions has generally increased since the 2015-16 school year, with 3.4% of all Arkansas kindergarten students having non-medical exemptions during the 2023-24 school year.

Figure 2 depicts vaccination coverage among kindergarteners by school year in the U.S. and in Arkansas from the 2019-20 school year to the 2023-24 school year.[31] Arkansas's vaccine coverage rates have typically lagged behind the national average for both the MMR and varicella vaccines, but the state has experienced higher hepatitis B vaccination rates compared to the national average.

The COVID-19 pandemic was associated with disruptions in routine vaccinations due to missed or delayed clinical visits. The pandemic also exacerbated previously known vaccine-related disparities, with lower rates of vaccination experienced by children living below the poverty level or residing in rural areas.[32]

FIGURE 2: VACCINE COVERAGE AMONG KINDERGARTENERS BY SCHOOL YEAR



Conclusion

Immunizations remain one of the most effective public health tools in reducing the burden of infectious diseases and protecting communities. Strong immunization policies and sustained efforts to increase vaccine coverage are essential to limiting both the spread and impact of preventable diseases. A continued commitment to these efforts will help ensure Arkansas remains prepared to manage and mitigate future risks from vaccine-preventable diseases.

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References

[1] Centers for Disease Control and Prevention. (2024, July 30). *Immunity types.* https://www.cdc.gov/vaccines/basics/immunity-types.html
[2] U.S. Department of Health and Human Services. *Vaccine basics*. Retrieved March 14, 2025, from https://www.vaccines.gov/basics/index.html
[3] Centers for Disease Control and Prevention. (2024, August 10). *Explaining how vaccines work.* https://www.cdc.gov/vaccines/basics/explaining-how-vaccines-work.html
[4] Centers for Disease Control and Prevention. (2025, January 17). *Measles, mumps, and rubella (MMR) vaccination: What everyone should know*. https://www.cdc.gov/vaccines/vpd/mmr/public/index.html
[5] Centers for Disease Control and Prevention. *Polio vaccination: Information for healthcare professionals.* Retrieved March 14, 2025, from http://www.cdc.gov/vaccines/vpd/polio/hcp/index.html
[6] Centers for Disease Control and Prevention. *About the varicella vaccines.* Retrieved March 14, 2025, from https://www.cdc.gov/vaccines/vpd/varicella/hcp/about-vaccine.html
[7] Desai, A.N., & Majumder, M.S. (2020). What is herd immunity? *JAMA, 324*(20), 2113. doi:10.1001/jama.2020.20895.
[8] Landrigan. P.J. (1972). Epidemic measles in a divided city. *JAMA*, *221*(6), 567–570. doi:10.1001/jama.1972.03200190013003.
[9] Centers for Disease Control and Prevention. (2022, October 28). *Vaccines for children: Protecting America's children every day.* https://vaccines.cdc.gov/PDFDocs/2023/vfc-infographic.pdf
[10] Kekatos, M. (2025, March 11). *Texas measles cases grow to 223, mostly among children and teens*. ABC News. https://abcnews.go.com/Health/texas-measles-cases-latest/story?id=119663844
[11] Texas Health and Human Services Commission. *Measles outbreak – March 14, 2025.* https://www.dshs.texas.gov/news-alerts/measles-outbreak-2025
[12] U.S. Department of Health and Human Services. *Vaccine types.* Retrieved March 14, 2025, from https://www.hhs.gov/immunization/basics/types/index.html
[13] Centers for Disease Control and Prevention. (2024, September 23). *COVID-19 vaccine basics*. https://www.cdc.gov/covid/vaccines/how-they-work.html
[14] Centers for Disease Control and Prevention. (2024, May 1). *Epidemiology and prevention of vaccine-preventable diseases: Chapter 18: Poliomyelitis*. https://www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-18-poliomyelitis.html
[15] Centers for Disease Control and Prevention. (1999). Achievements in public health, 1900–1999: Impact of vaccines universally recommended for children — United States, 1990–1998. *MMWR. Morbidity and Mortality Weekly Report, 48*(12), 243–248. https://www.cdc.gov/mmwr/preview/mmwrhtml/00056803.htm
[16] Roush, S.W., Murphy, T.V., & the Vaccine-Preventable Disease Table Working Group. (2007). Historical comparisons of morbidity and mortality for vaccine-preventable diseases in the United States. *JAMA, 298*(18), 2155–2163. doi:10.1001/jama.298.18.2155.
[17] Centers for Disease Control and Prevention. (2024, February 14). *Comparison of 20th century annual morbidity and current morbidity: Vaccine-preventable diseases*. https://www.cdc.gov/ncird-surveillance/media/VPD-morbidity-slide1-mmwr-508.pdf
[18] Hinman, A.R., Orenstein W.A., & Schuchat, A. (2011). Vaccine-preventable diseases, immunizations, and the Epidemic Intelligence Service. *American Journal of Epidemiology, 174*(11 Suppl), 16–22. doi:10.1093/aje/kwr306. PMID:22135390.
[19] Armstrong, E.P. (2007). Economic benefits and costs associated with target vaccinations. *Journal of Managed Care & Specialty Pharmacy, 13*(7 Suppl B). doi:10.18553/jmcp.2007.13.s7-b.12. PMID:17955624.
[20] Centers for Disease Control and Prevention. (2024, May 15). *Yellow fever vaccine.* https://www.cdc.gov/yellow-fever/vaccine/index.html
[21] Centers for Disease Control and Prevention. (2024, December 30). *Vaccine safety: Autism and vaccines.* https://www.cdc.gov/vaccine-safety/about/autism.html
[22] Hillyard, V., & Uribe, R. C. (2025, March 8). *CDC will research widely debunked link between vaccines and autism*. NBC News. https://www.nbcnews.com/politics/trump-administration/cdc-research-debunked-link-vaccines-autism-rcna195499

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[23] U.S. Food and Drug Administration. (2011, July). *Ensuring the safety of vaccines in the United States.* https://www.fda.gov/files/vaccines,%20blood%20&%20biologics/published/Ensuring-the-Safety-of-Vaccines-in-the-United-States.pdf
[24] Centers for Disease Control and Prevention. (2024, August 10). *How vaccines are developed and approved for use.* https://www.cdc.gov/vaccines/basics/how-developed-approved.html
[25] U.S. Department of Health and Human Services, Vaccine Adverse Event Reporting System. *About VAERS.* https://vaers.hhs.gov/about.html
[26] U.S. Food and Drug Administration. (2024, December 23). *Emergency use authorization*. https://www.fda.gov/emergency-preparedness-and-response/mcm-legal-regulatory-and-policy-framework/emergency-use-authorization
[27] National Institutes of Health, National Institute of Allergy and Infectious Disease. *Decades in the making: mRNA COVID-19 vaccines*. Retrieved March 14, 2025, from https://www.niaid.nih.gov/diseases-conditions/decades-making-mrna-covid-19-vaccines
[28] Arkansas State Board of Health. *Rules and regulations pertaining to immunization reporting.* Retrieved March 14, 2025, from https://healthy.arkansas.gov/wp-content/uploads/ImmunizationRequirements.pdf
[29] National Council of State Legislatures. (2025, March 10). *State non-medical exemptions from school immunization requirements.* https://www.ncsl.org/health/state-non-medical-exemptions-from-school-immunization-requirements
[30] Helft, L., & Willingham, E. (Sept. 4, 2014). *What is herd immunity?* PBS. http://www.pbs.org/wgbh/nova/body/herd-immunity.html
[31] Centers for Disease Control and Prevention. (2024, October 2). *SchoolVaxView: Vaccination coverage and exemptions among kindergarteners.* https://www.cdc.gov/schoolvaxview/data/index.html
[32] Hill, H.A., Yankey, D., Elam-Evans, L.D., Chen, M., & Singleton, J.A. (2023, November 3). Vaccination coverage by age 24 months among children born in 2019 and 2020: National Immunization Survey–Child, United States, 2020–2022. *MMWR. Morbidity and Mortality Weekly Report, 72*(44), 1190–1196. https://www.cdc.gov/mmwr/volumes/72/wr/mm7244a3.htm#:~:text=For%20most%20recommended%20childhood%20vaccines,%2Dvaccine%20series%20(69.1%25)