

DO VACCINATION RATES IN SANTA BARBARA COUNTY CREATE A PUBLIC HEALTH RISK?



SUMMARY

If our friends and neighbors are unvaccinated against childhood diseases for whatever reason, the entire community may be put at risk. Over past decades, there has been increasing public discourse about the potential risks of vaccines, which may help to explain why vaccination rates have decreased across the United States. Exacerbating this trend has been an unfortunate lack of information about the differences between the various vaccines, most importantly the significant difference between childhood vaccinations and others.

This report focuses on vaccinations that protect against serious childhood diseases such as mumps, measles, and polio. The investigation examines the level of community protection in Santa Barbara County provided by vaccinations administered to children and adults. It also considers vaccination concerns in the county's juvenile detention facilities and adult jails, both of which are congregate settings from which a disease outbreak could quickly grow and impact the public.

Santa Barbara County does an excellent job of assuring that children who attend public and private schools receive mandated vaccinations. However, there are no readily available data in Santa Barbara to determine the level of vaccination rates in adults, who make up over 75 percent of the County population. It is therefore unknown whether there are significant numbers of unvaccinated individuals in the County. If this is the case, there is a real risk of a resurgence of dangerous diseases in our community. The Grand Jury recommends studies to determine whether our County

has reached a tipping point below which reduced vaccination levels pose a significant risk of an outbreak.

BACKGROUND

Many studies over decades have shown that mandated vaccinations given in childhood to prevent communicable diseases, such as measles, mumps, chicken pox, diphtheria, pertussis, and polio have been proven to provide enormous benefits. For example, a recent report from the Centers for Disease Control and Prevention (CDC) projected that among U.S. children born from 1994 to 2023, routine childhood vaccinations prevented approximately 508 million illnesses, 32 million hospitalizations, and more than 1 million deaths. Global projections from the World Health Organization (WHO) indicate that since 1974, routine childhood vaccinations have averted 154 million deaths worldwide. That total includes 101 million infant deaths, accounting for 40 percent of the observed decline in global infant mortality (Reference 1-3). Following the California requirement for school immunization in 1977, the number of cases of measles in the state decreased by over 99 percent, and by 2000 measles had been eliminated.

Herd Immunity

Herd immunity refers to the indirect protection against an infectious disease that occurs when a large enough proportion of a population becomes immune, either through childhood vaccination or previous infection. When most individuals are immune, the overall amount of pathogen transmission is reduced, which in turn protects those who are not immune, such as people who cannot be vaccinated for medical reasons. This protective effect depends on the virus' basic reproduction rate, with highly contagious diseases requiring a higher percentage of immune individuals to interrupt transmission. Consequently, maintaining high vaccination coverage is essential for achieving and sustaining herd immunity, thereby preventing large-scale outbreaks and reducing disease burden across the entire community (Reference 4-5).

The loss of herd immunity would occur if childhood vaccination rates dropped below the required thresholds brought on by:

1. Increased vaccine hesitancy causing people to refuse vaccines; and
2. Global mobility bringing infections into communities with lower immunity.

The Common Good: Balancing Rights and Responsibilities

Concerns about vaccine safety and mandates must be balanced with an appreciation of the enormous benefits of certain childhood vaccines against dangerous diseases, including measles, mumps, rubella, chicken pox, diphtheria, whooping cough, and polio. Accurate information is critical to address public distrust of vaccine mandates and recommendations from governmental and public health agencies.

In any community there must be a consideration of the common good, which involves a balance between individual rights and the responsibility of the individual to society. There has been a growing number of individuals who are questioning whether or not to vaccinate themselves and their children. This concern about vaccinations is associated with a growing distrust of government recommendations regarding vaccines, in part associated with confusing media coverage about the effects of vaccinations. The trend has been termed vaccine hesitancy, which has been determined by the World Health Organization to be one of the greatest current threats to global health. Currently, many citizens of Santa Barbara County and across the United States are vaccine hesitant; they believe they should have the freedom to choose whether or not to receive vaccinations. The question can be rephrased in terms of whether the choice regarding vaccination is a right or whether vaccination is a responsibility of individuals to protect other citizens in the community (Reference 1, 6-9).

There are some useful analogies when discussing the issue of mandatory vaccination. Our society has decided that individuals do not have the right to drive while intoxicated, because doing so puts the lives of other citizens at risk. Requiring seatbelts when in automobiles and wearing helmets when operating motorcycles are losses of freedom. However, there is consensus that seatbelts and helmets are responsibilities because they lessen the burden on the community of caring for preventable injury and disability. Similarly, the freedom to use a cellphone while driving has been removed because of the risk of preventable crashes.

Some vaccinations—but not all—fall into this same category. For some vaccinations, there is a risk of spread of dangerous diseases if enough individuals choose to refuse vaccination. This is because there is a threshold of vaccinated individuals which creates the level of herd immunity that protects the greater population. This is particularly true of childhood vaccinations. Failure to accept such vaccinations puts the greater community at risk. In other words, it can be argued that it is the responsibility of individuals to forgo their freedom to refuse vaccination for the good of the community. In contrast, there are some other types of vaccinations that have benefits for vaccinated individuals, but have not been proven to protect the community, and, while controversial, it is reasonable to allow individuals the freedom to choose whether or not to receive these vaccinations.

The Grand Jury fully supports the right of individuals to choose whether to receive vaccines that may offer only personal benefit. Such vaccines include those against COVID, influenza, RSV, shingles, and others (see Appendix). However, childhood vaccines which have been proven to protect herd immunity are essential for the health of the entire Santa Barbara population. These include the vaccine against measles, mumps and rubella (MMR), the polio vaccine, the tetanus and diphtheria vaccine (Tdap), and the varicella (chicken pox) vaccine. Therefore, this report will focus upon this important subset of childhood vaccinations.

Vaccination Rates

In California, children entering kindergarten are required to be vaccinated against certain communicable diseases. As a result, vaccination rates have remained above the national level and are at more than 95 percent overall.

After a 2015 measles outbreak, California implemented stricter laws (SB277 (2015)) eliminating non-medical exemptions for school vaccinations. As a result, overall vaccination rates in California have remained relatively high. Santa Barbara childhood vaccination rates have remained above the California average; however, regional rates within California vary. In 2023, about one-third of California counties reported measles, mumps and rubella (MMR) rates for children below the herd immunity threshold of 95 percent, and a number of counties had rates below 90 percent, including Sutter County (76%), El Dorado County (80%), and Glenn County (81%) (Reference 10-12).

Importantly, the Jury has found no data on the vaccination rates in adults, who comprise more than 75 percent of the population, neither nationally nor locally. As of 2025, most adults in Santa Barbara County who attended school in California can be assumed to have been vaccinated, but the actual number who were not vaccinated is unknown. There are no available data on vaccination rates for adults in Santa Barbara County, so the overall vaccination rates in the population have not been documented. Potential unvaccinated people in the County include:

- Santa Barbara County adults who did not receive school vaccinations prior to the 2015 change in the exemption law;
- Unvaccinated individuals who moved to Santa Barbara County as adults;
- Unvaccinated workers who commute to Santa Barbara County from adjacent counties;
- Unvaccinated domestic and international tourists;
- Children who are home schooled;
- Children with medical exemptions; and
- Unvaccinated immigrants living in Santa Barbara County.

Disease Outbreaks

Measles

The decline in vaccination rates in the United States has led to recent outbreaks of preventable diseases. For example, due to successful vaccination, the Centers for Disease Control and Prevention (CDC) declared measles to be eliminated in the United States in 2000. However, due to decreased rates of vaccination, measles has reemerged. For example, there was a 2015 outbreak linked to Disneyland, which resulted in at least 131 infections among California residents. Also, there were six measles outbreaks in California totaling 73 confirmed cases in 2019, primarily associated with healthcare settings (Reference 13-14).

As of May 6, 2025, there is currently an active reemergence of measles cases across the United States. In Texas, there have been more than 702 cases in 2025, resulting in numerous hospitalizations and two childhood deaths. This outbreak has spread to neighboring Oklahoma and New Mexico, where one adult has died, and at least fifteen other states, including California, where nine cases have been confirmed. The current measles outbreaks are directly related to low vaccination rates (Reference 15-16).

National and local data on vaccination rates are available for children attending public schools. Nationally, the rates of vaccination have progressively declined in school-aged children over the past two decades, and this rate of decline is accelerating. For children entering public kindergarten in 2019, the national rate of MMR vaccination was 95 percent but decreased to 93.1 percent in 2023. A notable shift has been that the number of states achieving herd immunity levels has fallen. Nearly 75 percent of states had MMR coverage below the 95 percent target in 2023, and 12 states plus the District of Columbia fell below 90 percent. Measles outbreaks are likely to continue to spread in populations that have fallen below the 95 percent herd immunity vaccination rate (Reference 12, 17).

The vaccination rate against measles in the overall Santa Barbara County population is unknown. At the time of this report, there have been no measles cases reported in Santa Barbara County in 2025. However, if the rate of vaccination is below the herd immunity threshold of 95 percent in the overall population, Santa Barbara County is at risk of a measles outbreak.

Whooping Cough

There has also been a resurgence of whooping cough in the United States, causing the highest number of cases in a decade. In 2024, over 35,000 cases were reported, a five-fold increase from 7,063 in 2023. While 2025 data is incomplete, the number of whooping cough cases in the United States appears to continue to increase. In California, available data show that there were over 2,000 whooping cough cases between January and October of 2024, an increase from a total of 400 cases in 2023. These 2024 cases resulted in 62 infant hospitalizations and one death (Reference 18-20).

In Santa Barbara County, there were 12 whooping cough cases reported in 2024 as of October 2024 (Reference 21). Again, increasing whooping cough cases appear to be related to decreased vaccination rates. If immunity in a population is below the herd immunity threshold of 92-94 percent, a whooping cough outbreak is a risk (Reference 22). The immunization rate against whooping cough in the overall Santa Barbara population is unknown.

Chicken Pox

Chicken pox (varicella) remains a threat in the United States, but rates of infection have declined dramatically since widespread varicella vaccinations in the mid-1990s. Before the development of a vaccine, an estimated 4 million cases of chicken pox occurred in the United States each year. The

infection rate has since decreased by over 95 percent. There were approximately 5,000 cases reported nationally in 2019, although not all states have mandatory chicken pox reporting. The number of reported chicken pox cases decreased between 2020-2021, most likely associated with fewer children attending school during the COVID-19 pandemic. However, rates of reported chicken pox cases have increased nationally since 2022. In California, the Department of Public Health only requires reporting of chicken pox cases that result in hospitalization or death (Reference 23-25).

Data are not available on the number of chicken pox cases in Santa Barbara County, but no hospitalizations or deaths have been reported in 2025 to date. If the immunization rate of vaccination against chicken pox falls below the herd immunity threshold of 90 percent, an outbreak of chicken pox is a threat. The immunization rate against chicken pox in the overall Santa Barbara population is unknown. Of note, vaccination against chicken pox may also reduce the risk of shingles later in life.

Mumps

Mumps remains endemic in the United States, but rates of infection are currently relatively low. In 2024, there were 259 reported cases in the United States. However, mumps remains common in Africa and Asia in communities with low vaccination rates. The World Health Organization reports that there were at least 387,000 cases of mumps globally in 2024, and probably more as most countries do not have mandatory reporting (Reference 26-28).

The herd immunity threshold for mumps is 75-86 percent (Reference 22). If vaccination rates fall below this threshold in a population, a mumps outbreak is a risk. The vaccination rate against mumps in the overall Santa Barbara population is unknown. No mumps cases were reported in Santa Barbara County in 2024.

Rubella

Rubella, also known as German measles, is a viral infection that can cause severe disease. It is especially dangerous if contracted during pregnancy, as it can lead to serious birth defects. Rubella was declared eliminated from the United States in 2004, due to the effectiveness of widespread MMR vaccinations. However, the disease persists in countries with low vaccination rates. There have been no recent cases in Santa Barbara County. The vaccination rate against rubella in Santa Barbara County is unknown. The herd immunity threshold for rubella is 80-85 percent. If the MMR vaccination rate were to fall below that threshold, populations would be at risk of reemergence of rubella (Reference 22).

Diphtheria

Diphtheria cases have not been reported in the United States in recent years, but the disease continues to cause severe illnesses and deaths in countries with low vaccination rates. The herd

immunity threshold for diphtheria is 85 percent. If the rate is below this threshold, diphtheria could reemerge in US populations. The vaccination rate against diphtheria is unknown in the overall Santa Barbara population (Reference 22, 30).

Polio

Polio (poliomyelitis) is a highly infectious viral disease. Polio often causes only mild symptoms, but in a subset of infections the virus invades the nervous system and can then cause paralysis and death. Polio was historically a common cause of death and disability in the United States. Following introduction of vaccines, polio was eradicated in the United States by 1979; this was a major public health success. Unfortunately, however, polio has now reappeared in the United States, with one recent case of paralytic polio appearing in Rockland County, New York (Reference 31-32).

There are two types of polio outbreaks currently occurring globally. Vaccine-derived polio is caused by infection from the weakened polio virus found in oral polio vaccines. In rare cases, the weakened polio virus can circulate in under-immunized communities, mutate and become a strain capable of causing polio outbreaks. The case that was detected in New York was from a vaccine-derived polio strain transmitted by a traveler to the United States. These oral polio vaccines are no longer approved in the United States but continue to be utilized in parts of Africa and Asia. In addition, the more virulent naturally occurring wild poliovirus continues to remain endemic in several countries, including Pakistan and Afghanistan. While wild polio virus cases have not been reported in the United States since 1979, there continues to be a potential risk, particularly if vaccination rates decrease below the herd immunity rates of 80-86%. The vaccination rate against polio in the total Santa Barbara population is unknown (Reference 22, 33-34).

Table: Herd Immunity Thresholds and Vaccination Rates in Santa Barbara County

Disease	Herd Immunity Threshold	Overall Vaccination rate in Santa Barbara
Measles	95%	Unknown
Mumps	75-86%	Unknown
Rubella	80-85%	Unknown
Chicken Pox	90%	Unknown
Diphtheria	85%	Unknown
Pertussis	92-94%	Unknown
Polio	80-86%	Unknown

Vaccinations in Immigrants

Applicants for immigration are currently required to receive the following vaccinations: MMR, Polio, Tdap, Hepatitis A and B, Varicella, Meningococcal disease, and Influenza. Immigrants are

required to be vaccinated during a medical examination conducted by a physician certified by the United States Immigration Service. However, data on compliance with mandated vaccinations is not available for documented immigrants. Additionally, there are no data available to document the number of immigration medical examinations or vaccinations that are performed, either in California or in Santa Barbara County. Thus, the actual vaccination rates in this population are unclear.

Further, there are no data available on the vaccination status of the estimated 44,000 undocumented immigrants in Santa Barbara County. The most relevant study found by the Jury was published by the National Center for Farmworkers Health in 2023, which primarily examined migrant farmworkers, including documented and undocumented individuals, from a number of U.S. counties (not including Santa Barbara). This survey showed that vaccination rates were low, with MMR vaccination rates of 68 percent and Tdap vaccination rates of 59 percent. While the vaccination rates of Santa Barbara County immigrants or migrant workers have not been studied and are unknown, the above considerations provide reason to believe that they may also be low (Reference 35).

Vaccinations in the Santa Barbara County Jails

The inherent conditions in jails and prisons create a high-risk environment for infectious disease outbreaks. Correctional facilities are particularly vulnerable to disease outbreaks due to factors such as overcrowding and limited healthcare resources. Implementing robust infection prevention and control measures, including vaccination programs, is essential to mitigate the risk of outbreaks in these environments. While California does not have a legal requirement for vaccination in county jails, the Federal Bureau of Prisons requires a review of each inmate's immunization status. For inmates who are unvaccinated, vaccines are administered with the inmate's consent. In addition to childhood vaccinations, other vaccinations, such as against respiratory viruses, meningitis, and hepatitis may also prevent disease outbreaks in jail populations (Reference 36).

To highlight the risks, there have been instances of serious disease outbreaks in U.S. detention facilities. Notably, in 2016, a measles outbreak occurred at a privately operated Immigration and Customs Enforcement (ICE) detention facility in Arizona (Reference 37). Other well-publicized examples are outbreaks of chickenpox which occurred in 2012 in the San Quentin State Prison, highlighting the need for better prevention and disease control measures in detention centers (Reference 38). In the Santa Barbara County jails, there have been no recent reports of outbreaks of childhood diseases, but the experience during the pandemic illustrates the risk.

The experience with COVID-19 disease during the pandemic illustrates the challenges of managing outbreaks in the County jails. Outbreaks of COVID-19 in the Santa Barbara County Jails were severe and poorly prevented or contained. In February of 2021, 26 inmates contracted COVID-19. Subsequently, in August of 2021, 83 additional inmates and 5 staff contracted COVID-

19. In December of 2021, another outbreak of COVID-19 occurred at the Santa Barbara County Main Jail, when 249 inmates contracted the disease, nearly a quarter of the jail's population. In May of 2022, 64 further COVID-19 cases occurred at both the Main Jail and the Northern Branch. During these outbreaks, 338 staff members of the Sheriff's office also contracted the disease.

METHODOLOGY

The Jury conducted the following:

1. Interviews with public health officials, infectious disease physicians, and staff of the California Department of Public Health involved with the California Immunization Registry (CAIR), researchers from the University of California, Santa Barbara, staff of California Forensic Medical Group, Inc. (Wellpath) and, staff of the County of Santa Barbara Health Department (County Health) and Santa Barbara County Office of Education.
2. Review of data from the websites of the County of Santa Barbara Health Department, the California Department of Public Health and CAIR, the Centers for Disease Control and Prevention (CDC), and the World Health Organization (WHO).
3. Review of published scientific literature and news articles (see References section at the end of this report).

DISCUSSION

Vaccination in Children Attending School

The vaccination team of County Health has demonstrated that they are dedicated to meeting state law requirements for vaccinations in children attending public and private schools. They have done an exemplary job of educating schools on vaccination requirements and collecting data on compliance. The rates of vaccination in children attending Santa Barbara public and private schools exceed the state averages and are above the 95 percent threshold to protect herd immunity.

California does not allow exemptions for religious preference or for personal belief. Families with students attending public and private schools in Santa Barbara have complied with this law.

There are vaccination exemptions allowed for children for legitimate medical reasons, such as immunosuppression. Such exemptions require certification by physicians who are registered with the State (CAIR). The rate of reported medical exemptions in Santa Barbara County school children is approximately 1 percent, consistent with the numbers in other California counties.

County Health Department does not collect data on vaccination status for children who are home-schooled. A 2020 report documented that 8.7 percent of California children were being educated in home school; the number of home-schooled children was increasing, and this trend was likely to continue. There are no data available on the number of home-schooled children in Santa Barbara County. Thus, the number of unvaccinated children attending home schools in Santa Barbara County is unknown (Reference 39-40).

Vaccination Rates in Adults in Santa Barbara County

Adults comprise more than 75 percent of the Santa Barbara County population. County Health has not studied, nor does it have data on the vaccination status of this adult population. Thus, the vaccination rates of adults in Santa Barbara County are unknown.

Potential data regarding the adult vaccination rates in Santa Barbara County could be available from the California Immunization Registry (CAIR). CAIR is the primary statewide vaccine database used by healthcare providers, schools, and public health officials. It records vaccines administered in and reported by clinics, pharmacies, hospitals, and public health departments. The primary function of CAIR is to provide vaccination information on individuals. California residents can request their personal vaccine records from CAIR online, and healthcare providers can access the CAIR database to obtain the vaccination status of individual patients.

At the present time, CAIR does not provide aggregated population data on vaccination rates, neither at the state nor county level. In discussion with California Department of Public Health and County Health Department staff involved with CAIR, there is acknowledgement that useful population vaccination data could be extracted from the CAIR database. However, at the present time, this has not been done.

How Could Santa Barbara County Obtain Data on Adult Vaccination Rates?

There are several additional methods which have been utilized in other populations to estimate adult vaccination rates. These include:

- The Centers for Disease Control and Prevention has a population Immunization Survey Tool. This tool utilizes statistical samples of populations to determine rates of vaccination against multiple diseases. A survey in Santa Barbara utilizing this tool could estimate the adult vaccination rate. Survey results could also identify whether there may be certain vulnerable populations within the County that may have especially low vaccination rates (Reference 41).
- Pharmacies have data related to the vaccines they administer. This data could be obtained from the pharmacies for study.
- Insurance claims help track vaccine uptake across different demographics. Such data could be collected to provide information on the number of adults receiving vaccinations.

- Current wastewater testing technology allows antibody testing to estimate the degree of immunity in the community. This technology is new but is rapidly developing. Wastewater testing has the additional benefit of acting as an early indicator to detect the presence of a disease outbreak in the community (Reference 42-43).
- Individuals who do not know their immunization status can have their immunity tested with blood tests (titers). This method can also be utilized in specific high-risk populations such as jails or chronic care facilities to determine vaccination rates, both in individuals and in populations (seroprevalence). For example, Genesis Healthcare, a national network of nursing homes, uses titers for staff and residents with uncertain vaccination records. As another example, the California Department of Corrections and Rehabilitation uses MMR and hepatitis B titers to check immunization status of high-risk prisoners. In 2020, the Santa Clara County Public Health Department performed a community-based seroprevalence study using titers on sample populations to estimate the incidence of immunity against COVID-19 (Reference 44-46).

These methods, used alone or in combination, can be utilized to determine vaccination rates in populations. Data could be obtained to estimate vaccination rates not only in the population as a whole, but also in vulnerable communities within the population. Obtaining these data is an important first step in assessing the need for vaccination improvement, both in the overall population and in subsets who would benefit from vaccination outreach efforts tailored to address barriers such as culture and language.

At the current time, none of these methods have been utilized to measure adult vaccination rates in Santa Barbara County.

Public Education and Information

County Health Department has engaged in public education to attempt to increase community vaccination rates. County Health maintains an immunization webpage (<https://www.countyofsb.org/1637/Immunization>) that provides excellent information. Most of the County Health information and educational effort has focused upon school vaccinations and seasonal respiratory vaccinations such as influenza.

To its credit, County Health released a statement in March 2025 to the local press recognizing that measles was a threat in Santa Barbara County and recommending that the public get vaccinated (Reference 47). However, the public statement did not identify where or how individuals could receive vaccinations, nor did the statement identify which groups in Santa Barbara County may be at particular risk.

Furthermore, to date there have not been sufficient initiatives or resources allocated to identify, educate, and provide access to adult populations who may not have received childhood vaccinations. Additional efforts which would have further benefit include:

1. Public Education & Awareness Campaigns
 - Publish reliable information to dispel vaccine misinformation.
 - Leverage media – social media, TV, radio, and community events can spread vaccine awareness.
 - Personalize messaging – Tailor outreach for different communities, addressing specific concerns such as cultural and ethnic differences.
2. Improve Access & Convenience
 - Offer vaccines in more locations – Pharmacies, workplaces, schools, and community centers.
 - Mobile & pop-up clinics – Bring vaccines to underserved or rural areas.
 - Extend clinic hours – Evening and weekend availability can help working individuals.
3. Partner with Healthcare Providers
 - Train doctors & nurses – Ensure they consistently recommend vaccines.
 - Use reminder systems – Texts, calls, or emails to notify people when they're due for shots.
 - Integrate vaccines into routine care – Offer them during regular check-ups.
4. Implement Policy & Mandates
 - School & workplace requirements – Enforce vaccination for students and employees in healthcare or public service.
 - Financial incentives – Discounts on insurance, tax credits, or small rewards for getting vaccinated.
 - Remove financial barriers – Ensure vaccines are free or low-cost through public programs.
5. Engage Community Leaders & Influencers
 - Partner with faith-based, non-profit, and cultural organizations – Trusted leaders can encourage vaccination.
 - Use peer ambassadors – Train community members to advocate for vaccines.

Combining these strategies can increase trust, accessibility, and motivation, leading to higher vaccination rates and better public health outcomes.

Vaccinations in Santa Barbara County Jails and the Juvenile Justice Center

Medical care in the County jails is provided by Wellpath. The County Board of Supervisors has designated County Health to oversee the medical care provided by Wellpath. At the present time, the Santa Barbara County contract with Wellpath does not require that medical providers check

inmates for childhood vaccination status, nor that they provide childhood vaccinations to those who are unvaccinated.

The County's jails do not include determining childhood vaccination status in their medical intake or evaluation processes. As a result, neither County personnel nor Wellpath employees have any information about whether or not inmates have received childhood vaccinations. The Sheriff's Office, working with Wellpath, has not established a program to offer vaccination to inmates who have not received childhood vaccinations. Thus, the number of unvaccinated in the County's jails is unknown.

The only vaccination that has been administered in the County's jails over the past three years is the influenza vaccine. This is also the only vaccine stocked in the jails' pharmacies. In 2023, 46 influenza vaccines were administered in the jails; in 2024, 46 doses were administered. No influenza vaccines have been administered as of March 2025.

The County jail pharmacies do not store or provide any childhood vaccinations. There is no record of a childhood vaccination being administered in the County's jails over the past three years.

As the vaccination status of inmates is unknown, there is also no process to isolate unvaccinated individuals from the general jail population.

In contrast, the Juvenile Justice Center of Santa Barbara County does have a robust vaccination program administered by Wellpath. Medical staff at the Juvenile Justice Center inquire about childhood vaccination status on intake of all new detainees. In addition, the vaccination history of new detainees with undocumented vaccination status is verified with the California Immunization Registry. The Juvenile Justice Center pharmacy stores and dispenses a variety of vaccines, including vaccines against MMR, Varicella, Hepatitis A and B, Tdap, polio, HPV, meningitis, influenza and COVID-19.

CONCLUSION

Vaccination rates against childhood diseases have decreased in many communities in the United States. As a result, there has been a disturbing trend of new outbreaks of dangerous diseases across the County. In the overall Santa Barbara County population, the vaccination rates against childhood diseases are unknown. If the numbers of vaccinated individuals have fallen below herd immunity thresholds, our County is also at risk of outbreaks.

The Jury recommends that County Health carry out studies to determine childhood vaccination rates. These studies should focus upon adults, and be inclusive of diverse populations, including

immigrants and migrant workers. In addition, the Jury recommends that two particular at-risk populations require special attention: children who are receiving home schooling, and inmates in the County jails.

COMMENDATIONS

1. The 2024-25 Santa Barbara County Grand Jury commends the County of Santa Barbara Health Department for its work in achieving high vaccination rates among children in public and private schools.
2. The 2024-25 Santa Barbara County Grand Jury commends the Santa Barbara County Probation Department for its work in monitoring and achieving high vaccination rates in incarcerated youths.

FINDINGS AND RECOMMENDATIONS

Finding 1: The lack of County-wide childhood vaccination data for homeschooled children means that County Health knowledge of community immunity levels is incomplete.

Recommendation 1: The Grand Jury recommends that the County Board of Supervisors require County Health to study and estimate childhood vaccination levels of homeschooled children in the County. To be implemented by December 1, 2025.

Finding 2: The lack of County-wide childhood vaccination data for adults means that County Health knowledge of community immunity levels is incomplete.

Recommendation 2: The Grand Jury recommends that the County Board of Supervisors require County Health to study and estimate childhood vaccination levels of adults in the County. To be implemented by December 1, 2025.

Finding 3: The Sheriff's Office has not determined childhood vaccination rates of inmates in County jails, potentially placing the inmates and staff at risk.

Recommendation 3: The Grand Jury recommends that the Sheriff's Office collect data during health intake screenings at the County's jails to determine childhood vaccination rates. To be implemented by December 1, 2025.

Finding 4: There is no program in place at the County's jails to provide childhood vaccinations to unvaccinated inmates, increasing risk for the inmates and staff.

Recommendation 4: The Grand Jury recommends that the Sheriff's Office implement a program to administer required childhood vaccinations to unvaccinated inmates. To be implemented by December 1, 2025.

Finding 5: There is no procedure in place at the County's jails on when or how to isolate unvaccinated inmates, increasing potential risk of a disease outbreak in the jails.

Recommendation 5: The Grand Jury recommends that the Sheriff's Office develop and enforce a procedure on when and how to isolate unvaccinated inmates. To be implemented by December 1, 2025.

REQUIREMENTS FOR RESPONSES

Pursuant to California Penal Code §933 and §933.05, the Grand Jury requests that each entity or individual named below respond to the findings and recommendations within the specified statutory time limit.

Responses to Findings shall be either:

- Agree
- Disagree with an explanation
- Disagree partially with an explanation

Responses to Recommendations shall be one of the following:

- Has been implemented, with a summary of the implementation actions taken
- Will be implemented, with an implementation schedule
- Requires further analysis, with an analysis completion date of fewer than 6 months after the issuance of the report
- It will not be implemented with an explanation of why

Santa Barbara County Board of Supervisors - 90 Days

Findings 1, 2, 3, 4, 5

Recommendations 1, 2, 3, 4, 5

Santa Barbara County Sheriff's Office - 60 Days

Findings 3, 4, 5

Recommendations 3, 4, 5

GLOSSARY

The California Immunization Registry (CAIR): The California vaccine registry developed in 1997 that contains information on individuals who have been vaccinated.

Childhood Vaccinations: Immunizations required by the State of California to be given to infants, children, and adolescents to protect them from serious infectious diseases.

Chicken Pox (also known as Varicella): A highly contagious viral infection. It primarily affects children but can occur at any age. The disease is usually mild, but can result in hospitalization and death, especially in high-risk populations.

COVID-19: A highly contagious viral infection, usually spread by airborne droplets from infected individuals.

Diphtheria: A serious bacterial infection that is highly contagious. Diphtheria can cause severe disease resulting in hospitalization and death.

Endemic: A disease that is consistently present within a population. Unlike epidemics, endemic diseases persist over time without causing large-scale outbreaks.

German Measles: See Rubella

Herd Immunity: A form of indirect protection from infectious diseases that occurs when a large percentage of a population becomes immune to infection.

Influenza: A highly contagious seasonal viral infection spread by respiratory droplets from infected individuals. It can result in serious complications, hospitalizations, and deaths.

Santa Barbara Juvenile Justice Center: The Santa Barbara County facility focusing on the detention, rehabilitation, and supervision of minors who have been detained. It is operated by The Santa Barbara County Probation Department.

Measles: An extremely contagious viral infection spread by respiratory droplets from an infected individual. Measles can result in hospitalization and death, and in serious complications including pneumonia, brain inflammation, and blindness.

MMR: The vaccine against measles, mumps and rubella.

Mumps: A viral infection spread by respiratory droplets or contact with contaminated surfaces. It can cause severe disease resulting in hospitalization and death.

Pertussis (also known as whooping cough): A highly contagious bacterial infection caused by the bacterium *Bordetella pertussis*. It can result in serious complications, hospitalization, and death, especially in infants.

Polio (also known as poliomyelitis): A highly contagious viral disease that can lead to serious complications (including paralysis) and death. Polio was previously nearly eradicated worldwide but remains endemic in parts of the world where vaccination rates are low.

RSV (Respiratory Syncytial Virus): A highly contagious virus spread through respiratory droplets or direct contact. It can cause severe disease, especially in infants and older individuals.

Rubella (also known as German Measles): A highly contagious viral infection spread by respiratory droplets. Rubella is especially dangerous for pregnant women, as it can cause severe birth defects.

Seroprevalence: The use of blood tests (titers) to determine the number of individuals in a population who have immunity against an infectious disease.

Shingles (also known as herpes zoster): A painful infection caused by reemergence of the latent varicella virus.

Tdap: The immunization against tetanus, diphtheria, and pertussis.

Tetanus: A serious bacterial infection caused by bacterial spores entering the body through cuts, wounds, or burns.

Titer: A blood test performed on an individual to determine whether antibodies are present to indicate immunity to a specific disease.

Vaccine hesitancy: Vaccine hesitancy refers to a delay in acceptance or refusal of vaccines despite the availability of vaccination services. It is influenced by factors such as mistrust in healthcare systems, misinformation, cultural or religious beliefs, concerns about vaccine safety, and complacency regarding disease risk.

Varicella: See chicken pox.

Whooping cough: See pertussis.

REFERENCES

1. Zhou, Fangjun, et al. “Health and Economic Benefits of Routine Childhood Immunizations in the Era of the Vaccines for Children Program — United States, 1994–2023.” *Morbidity and Mortality Weekly Report* 73, no. 31 (2024): 682–685.
<https://doi.org/10.15585/mmwr.mm7331a2>
2. Shattock, A. J., et al. “Contribution of Vaccination to Improved Survival and Health: Modelling 50 Years of the Expanded Programme on Immunization.” *The Lancet* 403, no. 10441 (2024): 2307–2316. [https://doi.org/10.1016/S0140-6736\(24\)00850-X](https://doi.org/10.1016/S0140-6736(24)00850-X)
3. Roush, Sandra W., and Trudy V. Murphy. “Historical Comparisons of Morbidity and Mortality for Vaccine-Preventable Diseases in the United States.” *JAMA* 298, no. 18 (2007): 2155–2163. <https://doi.org/10.1001/jama.298.18.2155>
4. Ashby, Ben, and Alex Best. “Herd Immunity.” *Current Biology* 31, no. 4 (2021): R174–R177. <https://doi.org/10.1016/j.cub.2021.01.006>
5. National Institutes of Health. “Community Immunity: How Vaccines Protect Us All.” *NIH News in Health*, Published October 2011. <https://newsinhealth.nih.gov/2011/10/community-immunity>
6. Tekin, Ç., et al. “Reasons for Parental Hesitancy or Refusal of Childhood Vaccination in Türkiye.” *East Mediterranean Health Journal* 29, no. 5 (2023): 343–353.
<https://doi.org/10.26719/emhj.23.059>
7. Ali, K. A., and L. P. Celentano. “Addressing Vaccine Hesitancy in the ‘Post-Truth’ Era.” *Eurohealth* 23, no. 4 (2023): 16–20. <https://iris.who.int/handle/10665/332615>
8. World Health Organization. “Immunization Coverage.” *World Health Organization*. Last modified July 15, 2024. <https://www.who.int/news-room/fact-sheets/detail/immunization-coverage>
9. Jones, Jeffery F. “Far Fewer in U.S. Regard Childhood Vaccinations as Important.” *Gallup News*. Published August 7, 2024. <https://news.gallup.com/poll/648308/far-fewer-regard-childhood-vaccinations-important.aspx>
10. Wiley, H., Nelson, L. J., & Nakajima, K. “Fewer California Kindergarten Students Immunized Against Measles Last Year, New Data Show.” *Los Angeles Times*, March 19, 2025. <https://www.latimes.com/california/story/2025-03-19/california-school-vaccines-measles-immunity>

11. Seither, R., et al. “Coverage with Selected Vaccines and Exemption Rates Among Children in Kindergarten — United States, 2023–24 School Year.” *Morbidity and Mortality Weekly Report* 73, no. 41 (2024): 925–932. <https://doi.org/10.15585/mmwr.mm7341a3>
12. “ChildVaxView Interactive!” *Centers for Disease Control and Prevention*. Published August 26, 2024. <https://www.cdc.gov/childvaxview/about/interactive-reports.html>
13. California Department of Public Health. “Measles.” *California Department of Public Health*. Last modified May 21, 2025. <https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Immunization/measles.aspx>
14. “Measles (Rubeola) | Questions About Measles.” *Centers for Disease Control and Prevention*. Last modified March 29, 2024. <https://www.cdc.gov/measles/about/questions.html>
15. “Measles Outbreak – May 6, 2025.” *The Texas Department of State Health Services*. Published May 6, 2025. <https://www.dshs.texas.gov/news-alerts/measles-outbreak-2025>
16. “Adult Infected with Measles Dies in New Mexico, Health Officials Say.” *The Guardian*. Published March 6, 2025. <https://www.theguardian.com/us-news/2025/mar/06/measles-death-new-mexico>
17. “Measles and Herd Immunity: What It Is and How It Protects Our Community.” *Carnegie Science Center*. March 25, 2025. <https://carnegiesciencecenter.org/herd-immunity/>
18. “Pertussis.” *World Health Organization*. https://www.who.int/health-topics/pertussis#tab=tab_1
19. California Department of Public Health. “As Whooping Cough Cases Increase, CDPH Encourages Tdap Vaccination.” *The Santa Barbara Independent*. Published January 6, 2025. www.independent.com/2025/01/06/as-whooping-cough-cases-increase-cdph-encourages-tdap-vaccination/
20. “2024 Provisional Pertussis Surveillance Report.” *Centers for Disease Control and Prevention*. Published January 2025. https://www.cdc.gov/pertussis/media/pdfs/2025/01/pertuss-surv-report-2024_PROVISIONAL-508.pdf

21. "Pertussis Snapshot." *California Department of Public Health*. Published October 31, 2024. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/Immunization/Pertussis_Report_OCT2024.pdf
22. "Herd Immunity Threshold for Selected Global Diseases as of 2013." *Statista*. Published September 27, 2013. <https://www.statista.com/statistics/348750/threshold-for-herd-immunity-for-select-diseases/>
23. "Impact of U.S. Chickenpox Vaccination Program." *Centers for Disease Control and Prevention*. Published April 22, 2024. <https://www.cdc.gov/chickenpox/vaccination-impact/>
24. Epidemiology and Immunization Services Branch. "Monthly Communicable Disease Report: September 2021." Vol. 5, no. 9 (October 15, 2021). https://www.sandiegocounty.gov/content/dam/sdc/hhsa/programs/phs/Epidemiology/Monthly_CD_Report_September_2021.pdf
25. Egeskov-Cavling, Amanda Marie, et al. "Evaluating the Impact of Moderate and Severe Varicella Infections on Danish Children Under 18 Years Old: A Comprehensive Analysis From 2015 to 2023." *The Pediatric Infectious Disease Journal* 44, no. 3 (March 2025): 270–276. <https://doi.org/10.1097/INF.00000000000004612>
26. "Mumps Vaccination." *Centers for Disease Control and Prevention*. Last modified January 17, 2025. <https://www.cdc.gov/mumps/vaccines/index.html>
27. "New Cases of Mumps per 100,000 Population in the U.S. from 1970 to 2019." *Statista*. Published September 2022. <https://www.statista.com/statistics/186404/cases-of-mumps-in-the-us-since-1970/>
28. "Mumps – Number of Reported Cases." *World Health Organization*. <https://www.who.int/data/gho/data/indicators/indicator-details/GHO/mumps---number-of-reported-cases>
29. "Impact of U.S. MMR Vaccination Program." *Centers for Disease Control and Prevention*. Published January 17, 2025. <https://www.cdc.gov/rubella/vaccine-impact/index.html>
30. "About Diphtheria, Tetanus, and Pertussis Vaccines." *Centers for Disease Control and Prevention*. Last modified September 6, 2022. <https://www.cdc.gov/vaccines/vpd/dtap-tdap-td/hcp/about-vaccine.html>

31. Rai, Anushree, et al. "Polio Returns to the USA: An Epidemiological Alert." *Annals of Medicine and Surgery* 82 (October 2022): 104563.
<https://doi.org/10.1016/j.amsu.2022.104563>
32. Whitehouse, Erin R., et al. "Wastewater Surveillance for Poliovirus in Selected Jurisdictions, United States, 2022–2023." *Emerging Infectious Diseases* 30, no. 11 (November 2024): 2279–2287. <https://doi.org/10.3201/eid3011.240771>
33. "Polio Vaccination." *Centers for Disease Control and Prevention*. Last modified July 9, 2024. <https://www.cdc.gov/polio/vaccines/index.html>
34. "Poliomyelitis." *World Health Organization*. Last modified April 2, 2025.
<https://www.who.int/news-room/fact-sheets/detail/poliomyelitis>
35. "Vaccination Coverage Among Farmworkers in Selected U.S. Counties in 2022." *National Center for Farmworker Health, Inc.* Published August 2023.
https://www.ncfh.org/uploads/3/8/6/8/38685499/vaccine_fact_sheet.pdf
36. Federal Bureau of Prisons Clinical Guidance. *Immunization*. October 2020.
https://www.bop.gov/resources/pdfs/immunization_202105.pdf
37. Venkat, Heather, et al. "Measles Outbreak at a Privately Operated Detention Facility: Arizona, 2016." *Clinical Infectious Diseases* 68, no. 12 (June 2019): 2018–2025.
<https://doi.org/10.1093/cid/ciy819>
38. CBS San Francisco. "Chickenpox Outbreak Locks Down San Quentin." *CBS News*. Published October 30, 2012. <https://www.cbsnews.com/sanfrancisco/news/chickenpox-outbreak-puts-san-quentin-state-prison-on-lockdown/>
39. "California." *Homeschool Hub*, Johns Hopkins, School of Education, Institute for Education Policy. Last modified March 2025. <https://education.jhu.edu/edpolicy/policy-research-initiatives/homeschool-hub/states/california/>
40. Thorpe, E. L., et al. "Homeschooling Parents' Practices and Beliefs About Childhood Immunizations." *Vaccine* 30, no. 6 (2012): 1149–1153.
<https://doi.org/10.1016/j.vaccine.2011.12.019>
41. "About the National Immunization Surveys (NIS)." *Centers for Disease Control and Prevention*. Last modified February 26, 2025. <https://www.cdc.gov/nis/about/>

42. “How Wastewater Monitoring Works.” *Centers for Disease Control and Prevention*. Last modified March 18, 2025. <https://www.cdc.gov/nwss/how-wws-works.html>
43. Agan, Marie LittleFawn, et al. “Wastewater as a Back Door to Serology.” Preprint, *medRxiv* (October 20, 2023). <https://doi.org/10.1101/2022.11.11.22282224>
44. “Nationwide Commercial Laboratory Seroprevalence Survey.” *Centers for Disease Control and Prevention*. Last modified February 23, 2025. https://data.cdc.gov/Laboratory-Surveillance/Nationwide-Commercial-Laboratory-Seroprevalence-Su/d2tw-32xv/about_data
45. “Occupational Health: Services.” *MercyOne Genesis*. <https://www.genesishealth.com/genesis-at-work/occupational-health/services/>
46. Bendavid, Eran, et al. “COVID-19 Antibody Seroprevalence in Santa Clara County, California.” *International Journal of Epidemiology* 50, no. 2 (April 2021): 410–419. <https://doi.org/10.1093/ije/dyab010>
47. County of Santa Barbara Health Department. “Santa Barbara County Health Department Advises Residents on Measles Vaccination.” *The Santa Barbara Independent*. Published March 20, 2025. <https://www.independent.com/2025/03/20/santa-barbara-county-health-department-advises-residents-on-measles-vaccination/>

APPENDIX

Vaccinations Not Covered by This Report

Vaccinations for Respiratory Viruses

1. COVID-19 Vaccination

COVID-19 vaccines have been developed to protect against the SARS-CoV-2 virus, which causes COVID-19. Several vaccines are available, including mRNA vaccines (Pfizer-BioNTech and Moderna) and viral vector vaccines (Johnson & Johnson). These vaccines are not 100% effective in preventing infections nor in eliminating contagiousness but have proven effectiveness in reducing severe illness and death. However, COVID-19 vaccinating has been disappointing in not providing herd immunity. This is in part because the coronavirus rapidly mutates, making immunologic protection temporary.

2. Influenza Vaccination

The influenza vaccine is administered annually to protect against the flu, a respiratory illness that can lead to severe complications, especially in young children, the elderly, and individuals with certain health conditions. The efficacy of the influenza vaccine varies by year, as the virus continuously mutates. Although influenza vaccine is not 100% effective, it does decrease the risk of becoming infected and decreases the severity of disease and risk of hospitalization and death if infection occurs. However, the influenza virus mutates, so immunity is seasonal at best. Thus, the influenza virus does not provide permanent herd immunity.

3. Respiratory Syncytial Virus (RSV)

RSV is a common respiratory virus that can cause severe disease, especially in infants and older adults. To combat this, childhood and adult vaccines have been approved. Herd immunity is not achieved by RSV vaccination, but individuals are protected. Nirsevimab is recommended for all infants younger than eight months. While not a true vaccine, it is a monoclonal antibody that provides protection for approximately five months, covering the typical RSV season duration. For adults older than 60, several vaccinations against RSV are available.

4. Pneumococcal vaccines

Pneumococcal vaccines protect against pneumococcal disease caused by pneumococcus bacteria, which can cause pneumonia, meningitis, and bloodstream infections. These vaccines do not result in herd immunity but are protective against severe disease in high-risk individuals. They are recommended for children under 2 years old, adults over 65, and individuals with certain health conditions.

5. Hemophilus influenza vaccinations (H. Flu)

H. Flu vaccination protects against infections caused by the Hemophilus Influenza virus, which can cause serious disease in infants and young children but is also a risk in certain adult populations, such as individuals with kidney disease and those with weakened immunity.

Vaccines for Other Viruses Proven to Benefit Individuals and Special Populations

1. Hepatitis A

Hepatitis A is primarily transmitted through ingestion of contaminated food or water but can also be transmitted through sexual contact or illicit drugs. Hepatitis A vaccinations may provide some degree of herd immunity, particularly in high-risk populations. Hepatitis A vaccination is recommended for children as well as for high-risk adults and for international travelers.

2. Hepatitis B

Hepatitis B is a viral infection that can lead to acute infections of the liver. In addition, chronic hepatitis B infection can lead to cirrhosis and liver cancer. Hepatitis B may be spread from infected mothers to babies, through sexual transmission, or through blood-blood. Herd immunity against hepatitis B may be achieved if 50-80 per cent of a population is vaccinated. The CDC recommends hepatitis B vaccination for all children and adults.

3. HPV (Human Papillomavirus) Vaccine

The HPV vaccine protects against the human papillomavirus. While a threshold for achieving herd immunity is not established for HPV, vaccination has been demonstrated to reduce the prevalence of the disease. HPV is usually asymptomatic, but infection is associated with developing several cancers, including cervical cancer, as well as genital warts. HPV is primarily transmitted by sexual contact with infected individuals. It is recommended for preteens and young adults.

4. Meningococcal Vaccine

The meningococcal vaccine protects against meningococcal disease, a serious bacterial illness that can cause meningitis and bloodstream infections. Transmission occurs through respiratory droplets or close contact with an infected person. Herd immunity against meningococcus has not been clearly demonstrated, as there are different types of the disease, and efficacy of immunization may also decrease over time. However, meningococcal vaccination in high-risk populations has been shown to significantly reduce the risk of disease. Vaccination is especially recommended for adolescents and young adults, particularly those living in close quarters such as dormitories, as well as in some high-risk populations such as those in sub-Saharan Africa.

5. Shingles Vaccine

The shingles vaccine protects against shingles, a painful rash caused by the reactivation of the varicella-zoster virus (the same virus that causes chickenpox). It is recommended for adults over 50 years old.

6. Rotavirus Vaccine

Rotavirus is a highly contagious virus that causes severe gastroenteritis, particularly in infants and young children. Oral vaccines protect against severe infections and are recommended for administration as a two-dose series, beginning in infancy.

7. Tetanus Vaccine

Tetanus is a serious bacterial infection caused by bacterial spores entering the body through cuts, wounds, or burns. Previously common in the United States, tetanus is currently rare due to the widespread administration of tetanus vaccine to children. Elsewhere in the world, where vaccination rates are low, tetanus remains a common cause of serious illness and death. Tetanus vaccine does not achieve herd immunity, as the disease is not spread between people. However, the vaccine offers enormous individual benefit.

Travel Vaccinations

These vaccines are not meant to provide herd immunity but are protective for individuals traveling to locations where infections may be present. They may also be required for entry into certain countries.

1. Yellow Fever Vaccine

The yellow fever vaccine is required for travel to certain countries in Africa and South America. Yellow fever is a viral disease transmitted by mosquitoes, and vaccination is necessary to prevent outbreaks.

2. Typhoid Vaccine

The typhoid vaccine protects against typhoid fever, a bacterial infection spread through contaminated food and water. It is recommended for travelers to areas where typhoid is common.

3. Rabies Vaccine

The rabies vaccine is recommended for travelers who may be at risk of exposure to rabid animals, particularly in areas where rabies is prevalent. Rabies is a fatal viral illness if not treated promptly.

4. Cholera Vaccine

Oral cholera vaccines are available for travelers who may be at risk of disease from contaminated water. The protection from these vaccines is limited to a period of months.

Other Vaccines

1. Smallpox Vaccine

The smallpox vaccine was the first successful vaccine to be developed and has played a crucial role in the eradication of smallpox, a devastating infectious disease. The World Health

Organization declared smallpox eradicated in 1980, thanks to an extensive global vaccination campaign. Although smallpox is not a current naturally occurring threat, the vaccine is still produced and stored as a precautionary measure against potential bioterrorism.

2. M-Pox Vaccine

The M-Pox vaccine is designed to protect against monkeypox, a viral disease similar to smallpox but generally less severe. The vaccine is recommended for individuals who may be at high risk of exposure, such as laboratory personnel, certain healthcare workers, and individuals participating in M-pox outbreak response efforts. While its efficacy is uncertain, it could be a useful public health resource for high-risk individuals or if an M-Pox outbreak became widespread.

3. Anthrax Vaccine

Anthrax is a serious infectious disease caused by the bacterium *Bacillus anthracis*. The anthrax vaccine is primarily recommended for individuals who are at higher risk of exposure, such as military personnel, laboratory workers handling anthrax, and individuals who work with animals or animal products that may be contaminated. The vaccine can help prevent all three types of anthrax infections: cutaneous, inhalation, and gastrointestinal. Anthrax vaccine would become a valuable public health resource in the event of a bioterrorism attack.

4. Malaria Vaccine

The malaria vaccine is a groundbreaking development in the fight against malaria, a mosquito-borne disease caused by *Plasmodium* parasites. Malaria remains a significant global health challenge, particularly in sub-Saharan Africa, where it is a leading cause of illness and death. The vaccine offers a promising tool for reducing the burden of malaria, especially among young children who are most vulnerable. It is currently recommended for use in areas with moderate to high malaria transmission and is administered in multiple doses to ensure optimal protection.

4.Ebola Vaccine

Vaccines against the Ebola and other hemorrhagic fever virus, such as Marburg disease, have been developed but have largely only been tested in animal models. They are not currently widely utilized but might be a valuable tool in case of a large-scale outbreak.

5. HIV Vaccine

The HIV vaccine is a critical advancement in the fight against the Human Immunodeficiency Virus (HIV), which causes AIDS. Despite significant progress in treatment and prevention, HIV remains a major global public health issue, particularly in regions like sub-Saharan Africa. The development of an effective HIV vaccine has been a challenging endeavor due to the virus's high mutation rate and ability to evade the immune system. Current research includes various approaches such as vector-based vaccines, protein subunit vaccines, and mRNA vaccines. While

no fully effective HIV vaccine is available yet, ongoing clinical trials and scientific breakthroughs provide hope for a future where HIV can be prevented through vaccination.

6. ZIKA Vaccine

The Zika vaccine is a significant stride in combating the Zika virus, which has emerged as a notable public health threat in recent years. Transmitted primarily by Aedes mosquitoes, the Zika virus can cause severe birth defects in unborn children when pregnant women are infected. The development of a Zika vaccine has been driven by the urgency to protect those most at risk, particularly in regions prone to mosquito-borne diseases.

Vaccination efforts have focused on creating immunity in populations where Zika virus outbreaks are likely, including parts of South America, Central America, and the Caribbean. Researchers are exploring various vaccine platforms, including DNA-based vaccines, inactivated virus vaccines, and vector-based vaccines, to ensure safe and effective immunization.

Clinical trials have shown promising results, with several vaccine candidates moving forward in the development pipeline. The Zika vaccine aims to provide long-term immunity and prevent the severe consequences associated with congenital Zika syndrome. As these vaccines become more widely available, they will play a crucial role in safeguarding vulnerable populations and curbing future outbreaks.