

# Review of Vaccination Coverage Assessed by the Kindergarten Immunization Survey in Delaware

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## Abstract

Vaccinations are the primary means used in public health to avert morbidity and mortality from preventable diseases and are crucial for reducing the development of infectious disease outbreaks. To ensure a high level of vaccine coverage, the State of Delaware requires that all children receive specific vaccinations against dangerous pathogens prior to enrolling in a school. By requiring all children to be vaccinated against certain diseases, individuals who have religious or medical exemptions for receiving vaccines are also protected. The percentage of vaccine coverage among kindergarten students is surveyed annually by the Delaware Immunization Program and the Centers for Disease Control and Prevention (CDC), via random sampling. Data acquired during the period from 2016 to 2021 shows that vaccine coverages have a declining trend, which may be due in part to the COVID-19 pandemic and increased vaccine hesitancy. Reviewing these data allows for a more robust understanding of disease trends and provides an indication as to where resources may need to be allocated to address lagging vaccine rates.

## Introduction

Vaccines are the cornerstone of public health interventions and one of the most important tools used in the protection of our population's health. The creation of vaccines has saved countless lives, increased life expectancies, decreased health disparities, improved quality of life for many, and saved trillions of dollars in health care costs.<sup>1</sup> Many vaccines have been approved for children starting at just two months of age when maternal antibodies begin to wane.<sup>2</sup> Administering vaccines to children on schedule and from an early age has been proven to decrease their risk of infection from harmful pathogens and any complications that may be associated with them, and additionally interrupts potential transmission to adults and their peers.

To protect its population, the State of Delaware requires all children attending licensed daycare centers, as well as those entering kindergarten through grade 12 at public, private, and home schools, to receive several age-appropriate vaccines prior to enrolling. These immunizations provide protection against measles, mumps, and rubella (MMR); tetanus, diphtheria, and pertussis (Tdap/DTaP); and polio (IPV or OPV).<sup>1</sup> These diseases can be fatal or have serious complications which may result in chronic conditions or disabilities. To ensure this regulation is followed, the Delaware Immunization Program works with the CDC to conduct an annual survey of kindergarten students to monitor the level of coverage for each required vaccination. The State of Delaware recognizes religious and medical exemptions to the vaccine requirement, they are accounted for in the annual survey. As routine vaccination frequency begins to wane during adolescence and into adulthood, conducting a survey of school-aged children is a good indicator of immunity for cohorts as they age.<sup>3</sup>

High vaccine coverage is critical for preventing poor outcomes for the individual receiving them and for those who are unable to receive vaccines due to medical contraindications or their

religious beliefs. When the population around susceptible individuals are vaccinated, it supports the effects of herd immunity and can decrease the likelihood of these individuals being exposed to dangerous pathogens. Despite the proven success of vaccinations, there has been a recent increase in controversy and misinformation regarding primarily COVID-19 vaccines, which has led to increased hesitancy in whether a parent decides to vaccinate their children.<sup>4</sup> If this hesitancy leads to less people getting vaccinated, many vaccine-preventable diseases could re-emerge. Small numbers of these re-emerging diseases could impart large public health implications and require intervention to mitigate further risk and transmission.

## Background

Since the previous review of the kindergarten survey data in 2019, several outbreaks of vaccine-preventable diseases occurred nationwide and within Delaware.<sup>1</sup> These occurrences emphasize the importance of maintaining a high level of vaccine coverage in Delaware, starting with children, who have the potential to easily spread diseases among their peers and families. In 2019, the United States had the highest number of measles cases (1,249 confirmed cases) reported since 1992, prior to measles being eliminated in the U.S. in 2000.<sup>5</sup> While the bordering states of New Jersey, Pennsylvania, and Maryland experienced measles cases during this outbreak, Delaware did not have any cases. Similarly, in 2014, the United States reported 667 cases of measles and Delaware once again did not observe any.<sup>1</sup> In both situations, cases had spread rapidly through communities with low MMR vaccination rates after a single person was exposed during international travel.<sup>5</sup> The lack of cases seen in Delaware was credited to Delaware's high immunization coverage, which the CDC recognized at the 2018 National Immunization Conference.<sup>1</sup> Without this high level of protection, Delaware citizens could have contributed to the case counts, and illnesses that these outbreaks brought to many other states.

As national hepatitis A outbreaks began to emerge in many states beginning in 2017, transmission was identified as person-to-person and was associated with people who partake in intravenous drug use as well as those experiencing unstable housing, rather than transmission via contaminated food products as had been seen in the past.<sup>6</sup> As the nation continued to see a rise in the opioid epidemic, hepatitis A cases also continued to surge. Due to these trends, Delaware began to take steps to protect its population in 2018 by partnering with homeless shelters, transitional housing organizations, and outpatient facilities to provide the hepatitis A vaccine. In Delaware, cases associated with this outbreak were detected in August 2019 and a statewide outbreak was declared soon after. The Delaware Division of Public Health (DPH) took quick action to increase access to the hepatitis A vaccine by adding it to the flu vaccination clinics and connecting contacts of cases with the vaccine as post-exposure prophylaxis (PEP). Over the course of this outbreak, which was declared to be over in July 2021, 38 cases were identified. The hepatitis A vaccine is not required for school enrollment but has been more routinely recommended for children. While the outbreak-associated cases in Delaware did not include children, they are still at risk of being exposed to individuals, either in public or at home, and to contaminated food sources. Many children infected with hepatitis A are asymptomatic or mildly symptomatic carriers, which may lead to further transmission to their caregivers and increases the potential for a larger outbreak.

Mumps outbreaks have also been observed nationwide, largely at university campuses and among those considered to be up to date on immunizations. Unfortunately, the mumps component of the MMR vaccine has been noted to wane in efficacy over time.<sup>7</sup> However,

individuals infected with mumps who were previously vaccinated are less likely to develop severe symptoms or complications.<sup>7</sup> Delaware experienced a small outbreak of mumps cases (seven confirmed cases and four probable cases) in early 2020 at a school where all the afflicted individuals were up-to-date on the MMR vaccine. It has been demonstrated that the attack rate of mumps is lower in vaccinated populations compared to those with unvaccinated individuals.<sup>7</sup> During this outbreak, a small number of susceptible students were identified and excluded post-exposure, though it is believed that transmission was indeed slowed due to the overall vaccination coverage of the student body. None of the cases associated with this outbreak reported severe symptoms or complications.

Delaware has experienced multiple pertussis outbreaks in the past decade, with major case counts recorded in 2014 (202 cases) and 2018 (183 cases). The individuals impacted by these outbreaks were members of Delaware's Amish communities as well as those who are involved with or live near these communities. In 2019, a small cluster of pertussis cases were detected in an Amish community where transmission was likely introduced from an out-of-town guest. DPH quickly communicated with affected families and provided increased testing and PEP to vulnerable individuals. Pertussis outbreaks experienced within Amish communities typically do not expand due to the high Tdap/DTaP coverage of the surrounding population.

Despite the declining number of observed cases of varicella, chickenpox infections can still create difficult situations in school settings. In 2021, a varicella outbreak was detected in a Delaware daycare center. The affected classroom was comprised of infants too young to receive the varicella vaccination. Once introduced into the classroom, 56% of the roster became infected along with two sibling contacts who were only partially vaccinated. Since the other 44% of the class remained susceptible and could have potentially developed chickenpox from exposure, these susceptible contacts were asked to quarantine for 21 days and monitor for symptom development per CDC guidelines. Quarantines such as this can create problems for parents who may need to take time off from work to be with their children. There was no transmission to other classrooms from the infected siblings, most likely due to the partial vaccination status of the other students and lack of prolonged exposure.

With these pathogens still circulating locally and globally, it is of paramount importance to protect children and their families by maintaining a high proportion of vaccinated individuals in Delaware. The Delaware Administrative Code 4202, outlines the steps and regulations set forth by state government to ensure the safety of its people. This code calls for certain diseases to be reported to the state, allows for public health officials to intervene to mitigate and control infectious agents should the need arise, and to put preventative measures in place, such as requiring children to be vaccinated against certain diseases prior to enrollment in schools.<sup>8</sup> It is through these regulations that Delaware can prevent major outbreaks of infectious diseases from rapidly impacting the population at large and, in turn, protect vulnerable individuals.

## Methods

Data for the kindergarten survey is collected annually by coordinating with the Department of Education to obtain a list of all schools, both public and private, that have kindergarten-aged students. This list is subsequently sent to the CDC, which returns a randomized sample of schools to be surveyed. The school nurses from the selected school then provide immunization data on a sample of their students. Data collected includes number of doses received by the students for required immunizations and any exemption data available. These data are then

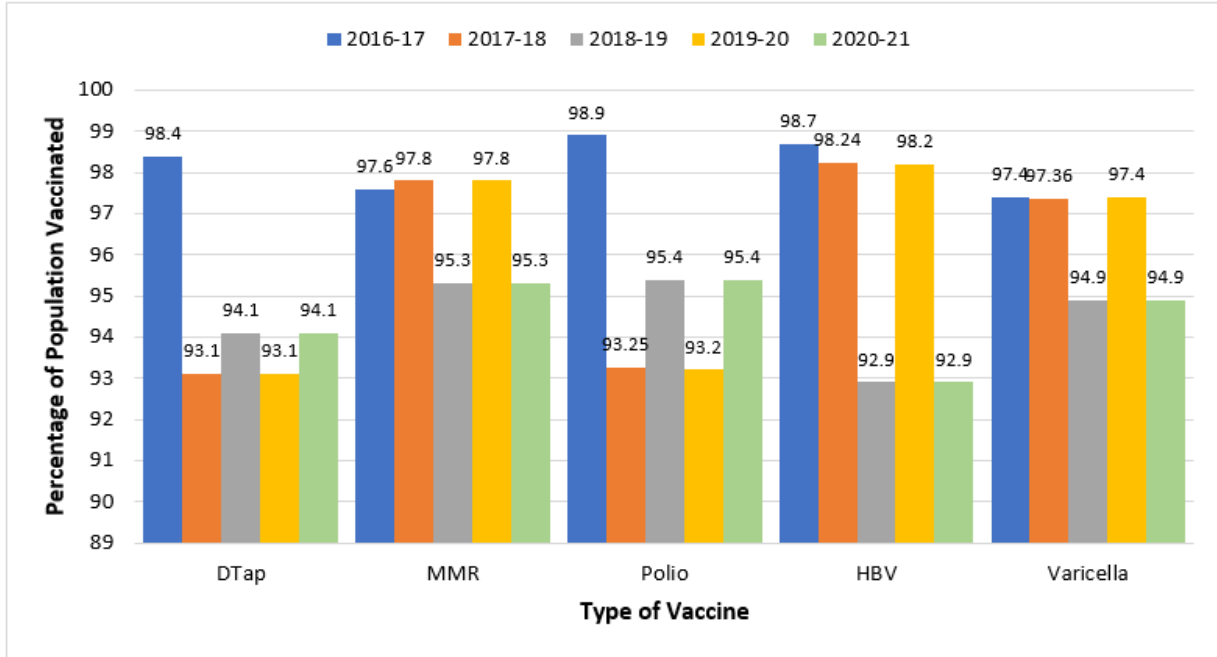
collected by the Delaware Immunization Program and are subsequently reported to the CDC. They are displayed on the DPH school immunization webpage with data currently extending through the 2020-2021 school year.<sup>9</sup>

The CDC also compiles vaccine coverage data for young children who are within the range of 0-36 months of age and can be found on their “SchoolVaxView” website. Currently, data provided through the CDC is updated through 2018. For the scope of this review, the data utilized from this source contained data from children age 36 months, or those closest to enrolling in school, and those born between 2016 and 2018, in order to collect accurate information on hepatitis A vaccine coverage. According to the CDC’s child immunization schedule, children are recommended to have two doses of the hepatitis A vaccine by 24 months of age.<sup>10</sup> Hepatitis A is not currently included on the kindergarten survey and is not required for school enrollment in Delaware.

## Results

In 2016, the coverage for all required vaccines for school enrollment were greater than 97% (Figure 1). In the subsequent five years, coverage followed a decreasing trend. The DTaP vaccine, which had 98.4% coverage, saw the greatest decrease in uptake over this time, falling as low as 93.1% and not exceeding 94.1% (Figure 1). In the 2020-2021 school year, the kindergarten immunization survey showed that only two vaccines surpassed 95% coverage, the MMR and polio vaccines, at 95.3 and 95.4%, respectively (Figure 1). Coverage for the hepatitis A vaccine in Delaware, with at least two doses recorded, was greater than the average coverages reported for the United States in children 35 months of age who were born between 2016 and 2018 (Table 1). Despite this, hepatitis A immunization coverage recorded in Delaware for these three cohorts was 83.3% in 2017, which was also lower than any of the school required vaccines observed within the state (Table 1).

Figure 1. Percentage of Immunized Kindergarteners, Delaware, 2016-17 through 2020-21 School Years.



Source: Division of Public Health, Delaware Immunization Program, 2022. \*The data for the school years 2019-20 and 20-21, may have been impacted by the COVID-19 Pandemic

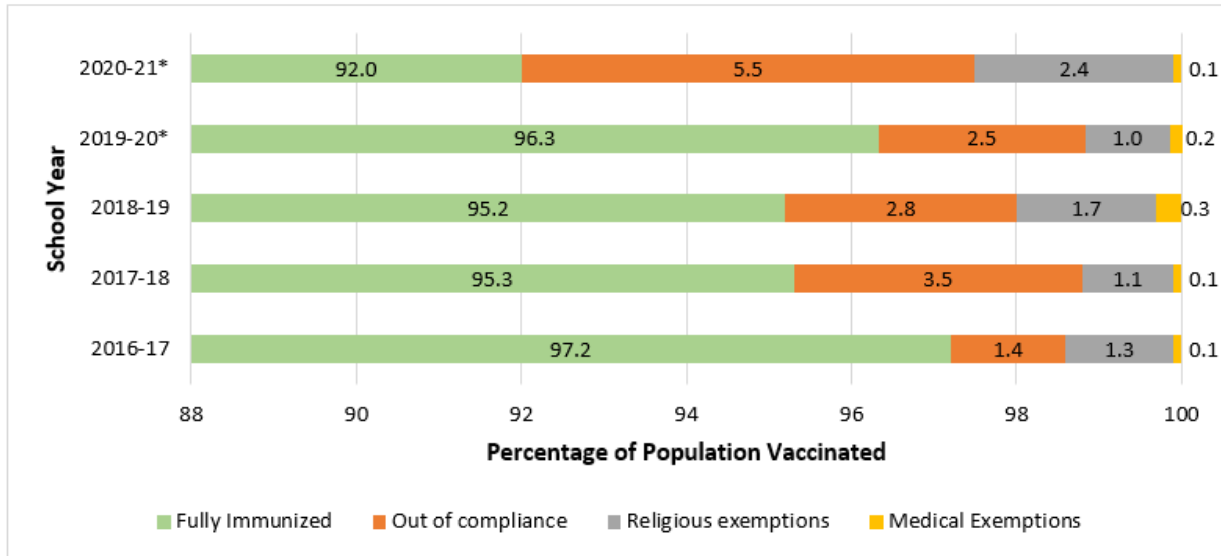
Table 1. Percentage of Children (aged 35 Months) with Two or More Doses of Hepatitis A Vaccine, Delaware and US, 2016-2018

	2016	2017	2018*
Delaware	78.1	83.3	81.6
United States	76.2	77.4	78.4

Source: Centers for Disease Control and Disease Prevention, National Immunization Survey – Child, 2016-2018. \*2018 data is preliminary and is not finalized by the CDC until after the release of the 2021 data

The level of compliance to vaccination requirements prior to school enrollment showed that the number of students found to be non-compliant, or considered not up to date on vaccination, had increased in the 2020-21 school year (Figure 2). Over 5% of students surveyed were missing some component of the required vaccines, without an approved exemption on file, which is twice as many from the previous year (Figure 2.). Of note, the 2020-21 school year also showed an increase of students with religious exemptions to the vaccine requirements, from 1.0% in the 2019-20 school year to 2.4% in the 2020-21 school year (Figure 2).

Figure 2. Percentage of Kindergarten Students Exempt from Immunization, Delaware, 2016-17 through 2020-21 School Years



Source: Division of Public Health, Delaware Immunization Program, 2022. \*The data for the school years 2019-20 and 20-21, may have been impacted by the COVID-19 Pandemic

## Conclusion

Vaccine-preventable diseases are actively circulating and could still have significant impacts on Delawareans. Major outbreaks such as measles, hepatitis, mumps, pertussis, and varicella have all been mitigated due to the effectiveness of vaccination campaigns. Review and analysis of the kindergarten survey data indicates a decreasing trend of vaccine coverage from previous years and an increasing amount of non-compliant students, which could be due to a multitude of factors. The 2019-20 and 2020-21 school years were greatly impacted due to the COVID-19 pandemic. It is possible that vaccine coverage was lower during this time because fewer people sought medical care or opted to have virtual instead of in-person health visits. In the future, it will be paramount to ensure the children of this cohort are caught up on their routine vaccinations as the world acclimates to living with endemic COVID-19. Decreases in vaccine coverage can also be detected prior to the pandemic, particularly in regard to hepatitis B and DTaP immunizations. This change could be an indicator that the public perception on vaccines has been shifting even before COVID-19. The key to boosting these percentages will be utilizing a targeted approach to determine which communities or populations exhibit lapses in vaccine coverage and to provide them with appropriate resources. These resources could include providing educational materials to combat vaccine hesitancy as well as facilitating increased vaccine availability to undersupplied practices. By working to increase vaccine coverage for both required and recommended vaccines in children, Delaware is taking preemptive steps to reduce morbidity and mortality.

The kindergarten survey is a useful tool to assess the vaccination trends of children in Delaware, but it does not cover all children enrolled in Delaware schools. While the random sampling design of the survey lends itself to being representative of the Delaware population, a comprehensive review of the complete immunization records of all enrolled students would provide the most accurate results. Delaware's immunization program is currently partnering with the Department of Education to integrate record systems, which potentially allows for this

analysis to cover all students in the state. This would provide a more robust indication of where the state's resources are most needed to promote vaccination.

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