An Analysis of Kindergarten Childhood Disease Vaccination Rates and Practices in Bay Area Counties

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An Analysis of Kindergarten Childhood Disease Vaccination Rates and Practices in Bay Area Counties

By

Janice Zelaya

A Thesis Quality Research Project
Submitted in Partial Fulfillment of the Requirements for the Master’s Degree in
PUBLIC ADMINISTRATION

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The Graduate School
San José State University
May 2022
TABLE OF LISTS AND FIGURES ................................................................. 3
BACKGROUND ........................................................................................... 4
    Research Question ..................................................................................... 4
    Importance of Immunizations ................................................................. 4
    History of Immunization Requirements .................................................... 5
    Required Vaccinations for Kindergarteners .............................................. 6
    Anti-Vax Movement .................................................................................. 8
    California Outbreaks ............................................................................... 10
    Vulnerable Members ................................................................................ 12
    Demographics .......................................................................................... 13
    Current Trends ........................................................................................ 19
LITERATURE REVIEW .................................................................................. 20
    Benefits of Immunizations Among Children ............................................ 20
    Benefits of Immunizations Among Adults ............................................... 21
    Anti-vax Movement History .................................................................... 22
    Anti-vax Movement Today ................................................................. 23
    Vaccine Barriers ..................................................................................... 27
    Role of Governments ............................................................................... 28
METHODOLOGY ......................................................................................... 30
    Type of Analysis ..................................................................................... 30
    Data Collection ....................................................................................... 30
    IRB Exclusion ......................................................................................... 31
FINDINGS .................................................................................................... 32
    Context .................................................................................................... 32
    Data .......................................................................................................... 32
    Alameda County ....................................................................................... 34
    Contra Costa County ............................................................................. 37
    Marin County ........................................................................................ 41
    Napa County ......................................................................................... 44
    San Francisco County ................................................................. 47
## TABLE OF LISTS AND FIGURES

Table 1: Breadown of Immunizations, Diseases and Potential Impacts ........................................... 7
Table 2: ODPHP Vaccination Goals for Kindergarten ........................................................................ 33
Table 3: Survey Alameda County ........................................................................................................ 35
Table 4: Survey Contra Costa County ................................................................................................ 39
Table 5: Telephone Survey Marin County .......................................................................................... 42
Table 6: Telephone Survey Napa County ............................................................................................ 45
Table 7: Website Analysis Alameda County ....................................................................................... 35
Table 8: Telephone Survey Contra Costa County .............................................................................. 39
Table 9: Telephone Survey Marin County .......................................................................................... 42
Table 10: Telephone Survey Napa County .......................................................................................... 45
Table 11: Website Analysis San Francisco County ............................................................................. 48
Table 12: Telephone Survey San Mateo County .................................................................................. 51
Table 13: Telephone Survey Santa Clara County ............................................................................... 53
Table 14: Telephone Survey Solano County ....................................................................................... 56
Table 15: Telephone Survey Sonoma County .................................................................................... 59
Table 16: Best Performing Bay Area Counties 0-9 Age Range ......................................................... 62
Table 17: Best Performing Bay Area Counties 0-9 Age Range ......................................................... 66
Table 18: Standards Met Bay Area Counties 0-9 Age Range ............................................................... 68
Table 19: Standards Met Bay Area Counties ....................................................................................... 72
Table 20: Standards Not Met Sonoma County .................................................................................... 76
Table 21: Best Practices for Bay Area Counties ............................................................................... 78

Figure 1: Percentage of 0-9 Age Range in Bay Area Counties ........................................................ 13
Figure 2: Race/Ethnicity of Bay Area Counties ................................................................................. 15
Figure 3: Median Household Income Bay Area Counties ................................................................. 17
Figure 4: Bachelor's Degree or Higher ............................................................................................ 18
Figure 5: Alameda County Kindergarten Vaccination Rates 2015-2020 ......................................... 34
Figure 6: Contra Costa Kindergarten Vaccination Rates 2015-2020 .............................................. 37
Figure 7: Marin Kindergarten Vaccination Rates 2015-2020 .......................................................... 41
Figure 8: Napa Kindergarten Vaccination Rates 2015-2020 ............................................................ 44
Figure 9: San Francisco Kindergarten Vaccination Rates 2015-2020 .............................................. 47
Figure 10: San Mateo Kindergarten Vaccination Rates 2015-2020 ................................................ 49
Figure 11: Santa Clara Kindergarten Vaccination Rates 2015-2020 ................................................. 52
Figure 12: Solano Kindergarten Vaccination Rates 2015-2020 ....................................................... 55
Figure 13: Sonoma Kindergarten Vaccination Rates 2015-2020 .................................................... 57
Figure 14: Best Performing Counties Race/Ethnicity ..................................................................... 63
Figure 15: Standards Met Race/Ethnicity ......................................................................................... 69
Figure 16: Standards Not Met Race/Ethnicity .................................................................................. 74
BACKGROUND

Immunizations are the most effective method for preventing communicable diseases, especially among children. Ensuring that children are vaccinated is of the utmost importance but remains a challenge due to misinformation and the growing anti-vaccination movement. With a population of 39.5 million people as of 2020 (Census Bureau, n.d.), California is the most populous state in the United States. In 2020, the San Francisco Bay Area, which includes the counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma, is home to 7.7 million of those people (Census Bureau, 2021).

Research Question

This research will explore how Bay Area counties have achieved childhood disease immunization goals for kindergarten students, and if they have not reached these goals, why may that be the case, and what can be learned from the counties that have succeeded?

Importance of Immunizations

According to the Centers for Disease Control and Prevention (CDC), if the recommended vaccination schedule has been followed, by the time children reach two years of age they are already protected from 14 serious diseases (CDC, 2017). According to the California Department of Public Health (CDPH), “Immunizations are injected into the body through a needle and contain medicine” (CDPH, 2019, para. 1). The CDC states that “Vaccines greatly reduce the risk of infection by working with the body’s natural defenses to safely develop immunity to disease” (CDC, 2018a, para. 2). Decades of research have found that vaccines are the most effective tool that can be used in the fight against communicable diseases (Kashiwagi et al., 1985; White et al., 1997; Green et al., 2009; Tseng et al., 2012). Children’s immune systems are not fully developed
at birth, so by vaccinating at the recommended schedule, children are protected from not only the disease itself, but complications that can result in pain, paralysis, disability, and possible death (CDC, 2019a).

Infectious diseases caused by both bacteria and viruses have negatively impacted populations since the beginning of mankind. Scholars such as Norrie (2016) have even argued that diseases such as smallpox, the bubonic plague, cholera, influenza, and measles played a major role in the fall of ancient empires, such as the Hittite Empire and Carthaginian Empire. Major pandemics, such as the bubonic plague which decimated 30 to 50% of the population of Europe starting in the 1300s (Shipman, 2014), as well as the smallpox pandemic which wiped out about 90% of Indigenous populations in the Americas (PBS, n.d.) further highlight the dangers posed by infectious diseases.

When the first inoculation was introduced by Edward Jenner to combat smallpox in 1796, an invaluable tool was added to the human arsenal in confronting diseases that were previously unstoppable (CDC, 2021a). Since then, vaccines have continually been tested and improved upon by advances in science and technology. However, public resistance has been present since the first inoculation and has increased up until the present day (Chatterjee, 2013), posing a serious challenge for governments in creating effective strategies and solutions for vaccinating their constituents.

**History of Immunization Requirements**

Compulsory immunization laws are not a new phenomenon and are a part of the history of the United States, with the first law being passed in Massachusetts in the 1800s (Chatterjee, 2013). These laws were strengthened and enforced depending on the occurrence of disease
outbreaks. In 1980, the CDC informed all 50 states that “federal vaccine funding would be tied to states’ laws and enforcement policies requiring immunization before school entry” (Chatterjee, 2013, p. 130). Since then, all public schools in California require proof of vaccination for children entering kindergarten and 7th grade. Required immunizations vary by state, however all 50 states require proof of vaccination for children to attend schools.

Until 2016, California accepted personal, religious, and medical exemptions for children’s vaccination requirements. However, since January 1, 2016, California no longer allows personal belief exemptions for either public or private schools for required vaccines (California Department of Education, n.d.).

Educational institutions are not the only entities that require proof of vaccinations. Certain professions, mainly those in the health care sector, require proof of vaccination for Hepatitis B, measles, rubella, diphtheria, tetanus, chickenpox, and whooping cough (Fox, 2017).

**Required Vaccinations for Kindergarteners**

For a child to be accepted into kindergarten, parents must present their child’s immunization record to prove that they are immunized against certain diseases. According to the CDPH (n.d.), the required immunizations and doses to enter kindergarten are Diphtheria, Tetanus, and Pertussis (DTaP, 4/5 doses); inactivated polio vaccine (IPV, 3/4 doses); chickenpox (varicella, 2 doses); measles, mumps, and rubella (MMR, 2 doses); and hepatitis B (hep B, 3 doses).

These required immunizations are to protect children and the rest of the population from serious, and at times deadly, diseases. Table 1 provides more information about the diseases that immunizations protect children from contracting.
Table 1

Breakdown of Immunizations, Diseases, and Potential Impacts

<table>
<thead>
<tr>
<th>Immunization</th>
<th>Disease</th>
<th>Potential Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTaP</td>
<td>Diphtheria</td>
<td>Bacterial infection can result in fevers, thick coating in the back of nose or throat, heart failure, paralysis, and death.</td>
</tr>
<tr>
<td>DTaP</td>
<td>Tetanus</td>
<td>Bacterial infection that can cause muscle stiffness, including lockjaw, that can result in paralysis, broken bones, and death.</td>
</tr>
<tr>
<td>DTaP</td>
<td>Whooping Cough (Pertussis)</td>
<td>Bacterial infection that can cause respiratory issues and distress that can result in pneumonia, seizures, and brain damage as well as death.</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>Hepatitis B</td>
<td>Viral infection that can be lifelong and can result in liver damage, and liver cancer.</td>
</tr>
<tr>
<td>IPV</td>
<td>Polio</td>
<td>Viral infection that can lead to weakness in body, lifelong paralysis, and even death.</td>
</tr>
<tr>
<td>MMR</td>
<td>Measles</td>
<td>Viral infection that can result in a rash, fever, pneumonia, brain damage, deafness, and death.</td>
</tr>
<tr>
<td>MMR</td>
<td>Mumps</td>
<td>Viral infection that can result in meningitis, deafness, encephalitis, orchitis, oophoritis, and death.</td>
</tr>
<tr>
<td>MMR</td>
<td>Rubella</td>
<td>Viral infection that can result in rash, aching joints, brain infections, and bleeding issues. Is especially dangerous for pregnant women due to threat of miscarriage and birth defects.</td>
</tr>
<tr>
<td>Varicella</td>
<td>Chickenpox (Varicella)</td>
<td>Viral infection that can result in blisters and in serious cases skin infections, pneumonia, encephalitis, dehydration, and death.</td>
</tr>
</tbody>
</table>

Note. The information adapted for chickenpox is from “Chickenpox/varicella vaccination,” ([https://www.cdc.gov/vaccines/vpd/varicella/index.html](https://www.cdc.gov/vaccines/vpd/varicella/index.html)). Copyright 2016 by CDC. The information for diphtheria is adapted from “Diphtheria Vaccination,” ([https://www.cdc.gov/vaccines/vpd/diphtheria/index.html](https://www.cdc.gov/vaccines/vpd/diphtheria/index.html)). Copyright 2020a by CDC. The information for hepatitis B is adapted from “Hepatitis B vaccination,” ([https://www.cdc.gov/vaccines/vpd/hepb/index.html](https://www.cdc.gov/vaccines/vpd/hepb/index.html)). Copyright 2015a by CDC. The information for measles is adapted from “Measles vaccination,” ([https://www.cdc.gov/vaccines/vpd/measles/index.html](https://www.cdc.gov/vaccines/vpd/measles/index.html)). Copyright 2021b by CDC. The information for mumps is adapted from “Mumps vaccination,” ([https://www.cdc.gov/vaccines/vpd/mumps/index.html](https://www.cdc.gov/vaccines/vpd/mumps/index.html)). Copyright 2021c by CDC. The information for polio is adapted from “Polio vaccination,” ([https://www.cdc.gov/vaccines/vpd/polio/index.html](https://www.cdc.gov/vaccines/vpd/polio/index.html)). Copyright 2018b by CDC. The information for rubella is adapted from the “Rubella (German measles) vaccination,” ([https://www.cdc.gov/vaccines/vpd/rubella/index.html](https://www.cdc.gov/vaccines/vpd/rubella/index.html)). Copyright 2021d by CDC. The information for tetanus is adapted from “Tetanus vaccination.” ([https://www.cdc.gov/vaccines/vpd/tetanus/index.html](https://www.cdc.gov/vaccines/vpd/tetanus/index.html)). Copyright 2020b, by CDC. The information for whooping cough is adapted from “Whooping cough (pertussis) vaccination,” ([https://www.cdc.gov/vaccines/vpd/pertussis/index.html](https://www.cdc.gov/vaccines/vpd/pertussis/index.html)). Copyright 2019b, by CDC.
Anti-Vax Movement

The anti-vax movement’s layered and complex history within the United States is mainly based in fear, misinformation, defiance, and suspicion. As mentioned previously, concerns were raised from the first inoculation, and this movement continued to strengthen or wane depending on vaccine mandates and laws. Some of this opposition was due to adverse reactions to inoculations, while for others, the inoculation process itself incited unfounded fears, such as the unnaturalness of vaccines and concerns that they could lead to disastrous and far-fetched consequences, such as a person turning into an animal (Reich, 2018).

As more states began mandating immunizations, the first anti-vaccination society was founded in 1879, with the mission of repealing laws that required vaccinations (College of Physicians of Philadelphia, 2018). This opposition reached the Supreme Court in 1905 in Jacobson v Massachusetts, where the court found that states had the constitutional authority to enact mandates for immunizations to protect the public against communicable diseases (College of Physicians of Philadelphia, 2018). Despite this ruling, the anti-vax movement was not deterred and continued to grow in the 1980s and beyond.

A particular point of contention within the anti-vax movement is immunization requirements for children. This opposition rests on biased fears, religious beliefs, the conviction that civil liberties are being infringed upon by the government, and the belief that vaccinations are unnatural and that the immune system is more than capable of protecting itself from harmful diseases. For some parents, their fears are directed towards the ingredients found in vaccines, or potential adverse reactions, while for others the act of vaccinating a healthy child poses too much of an apparent “risk.” As Chatterjee (2013) explains:
In addition, studies focusing on vaccine decision-making have found that parents may prefer to make errors of omission (bad outcomes due to lack of action; here, not vaccinating a child) rather than errors of commission (bad outcomes due to action; here, vaccinating a child) and that they may find it easier to accept “natural” risks rather than “man-made risks.” (p. 98)

It is apparent that there is a significant psychological component in certain parents’ resistance or hesitation when it comes to vaccinating their children, despite the number of studies that have shown vaccines’ safety and effectiveness (Kashiwagi et al., 1985; White et al., 1997; Green et al., 2009; Tseng et al., 2012). Additionally, improvements in the scientific process itself, in not only the way vaccines are developed, studied, and tested, but also in how departments of health have been established to oversee the vaccination process, exemplify the diligent safeguards that have been integrated in the vaccination creation and production process (Reich, 2018).

One possible explanation for why this cognitive dissonance occurs is because parents view themselves as experts when it comes to their children’s health and well-being, and some believe that their sources of information are superior to that of scientific experts, mainly because of their distrust towards the medical community and government (Reich, 2018). Some of these beliefs can be connected to the infamous paper written by Wakefield et al. (1998) alleging that the mercury-based preservative found in the measles vaccine caused autism. Even though this claim was quickly disproven by the scientific community, the fears incited strengthened the anti-vax–movement’s momentum, especially when it came to stoking heightened suspicions regarding the ingredients found in vaccines.

While there have been some adverse reactions caused by vaccines due to allergic reactions, for the rest of the population, vaccines remain an effective and safe choice in
combatting communicable diseases. Despite this, certain members within the anti-vax movement claim ingredients such as mercury and formaldehyde are examples of the dangers that vaccines pose. However, as explained by the CDC, “Thimerosal has a different form of mercury (ethylmercury) than the kind that causes mercury poisoning (methylmercury). It’s safe to use ethylmercury in vaccines because it’s processed differently in the body and it’s less likely to build up in the body — and because it’s used in tiny amounts” (CDC, 2019c, para. 3). Although there can be small traces of formaldehyde in certain vaccines, however, it is less than what the body naturally produces, and does not pose a health risk (CDC, 2019c).

Lastly, fears have continued to strengthen and spread within the anti-vax community and beyond due to the influence of the internet, specifically social media. The impact social media can have on “…disseminating and sensationalizing vaccine objections” (Kata, 2009, p. 1709) is due to the internet’s ability in connecting people with similar sentiments from around the world, with little oversight, which can lead to parents incorporating vaccination doubts and misinformation in their decision to not vaccinate their children. These virtual, and at times physical, communities are deeply distrustful towards traditionally credible sources of information and as such, challenge vaccination laws. Refusal to vaccinate children can make communities vulnerable to outbreaks.

California Outbreaks

During an outbreak, the immense public health and economic value of vaccines are clear. Unfortunately, the growing anti-vax movement has showcased how important and necessary immunizations continue to be, especially in states with dense populations such as California. Recent events in California’s history have clearly demonstrated the cost of failing to vaccinate
eligible children, such as the whooping cough (pertussis) outbreak of 2010, and the measles outbreak of 2014.

In 2010, California contended with one of the worst whooping cough outbreaks in 50 years, which resulted in 9,120 cases and 10 deaths from the highly contagious and vaccine-preventable whooping cough disease (Vaccine Refusals Linked to Outbreak, 2013). Unlike the measles vaccine, the pertussis vaccine does not provide lifelong immunity, which is why it is crucial for those who are vaccinated to receive the necessary booster shot. While CDPH mainly attributed the outbreak to a few factors such as “…the cyclical nature of pertussis, improved diagnosis, and waning immunity…” (Researchers from California…, 2013, para. 2), Emory University’s Rollins School of Public Health also concluded that another important factor to consider was the high rates of non-medical exemptions within certain regions of California among kindergarten-aged children (Vaccine Refusals Linked to Outbreak, 2013). After this epidemic, the state implemented a few new strategies, including passing a law that required a booster shot for older children, educating the public on the importance of immunizations, and increasing the availability of the pertussis vaccine (Dreier, 2012). However, despite this, the opt-out rate in private schools for kindergarteners continued to increase and almost doubled from 2004 to 2012 (Dreier, 2012). These numbers potentially foreshadowed the events that would occur just a few years later in Disneyland.

A measles outbreak that started in Disneyland in 2014 infected 125 people and spread to Arizona, Colorado, Nebraska, Oregon, Utah, Washington, as well as Canada and Mexico (CDC, 2015b). The main reason for this outbreak was that, of the California residents who were vaccine-eligible, 67% chose to be unvaccinated due to personal beliefs (CDC, 2015b). The personal and religious exemption rate was overall 3.1% among kindergarteners in 2013-2014.
Vulnerable Members

Vaccines, while extremely helpful in combating dangerous diseases, are not 100% effective, and therefore, it is essential for communities to reach what is known as herd immunity, or community immunity. Community immunity is reached when enough members of a community are immune to a disease, mainly due to vaccinations or a prior infection, which greatly reduces diseases’ ability to spread (CDC, 2020c). Herd immunity is vital because there are vulnerable members within a community who are unable to receive vaccinations, or are even more susceptible to diseases, such as infants, the elderly, those with serious vaccine allergies, and immunocompromised individuals (CDC, 2019a; Tullman & Chang, 1999; Gromis & Liu, 2020). Infants are especially susceptible to communicable diseases due to their developing immune systems and inability to be vaccinated (CDC, 2019a). Adults aged 65 or older are another vulnerable population, mainly because “…socioeconomic and environmental resources are lacking for many elders. This lack of resources added to physiologic decline places elders at increased risk for health problems” (Tullman & Chang, 1999, p. 333). Lastly, those who are immunocompromised may have severely weakened immune systems, to the point that live vaccines pose a serious risk, and those who have severe allergies to certain ingredients in
vaccinations are unable to be immunized and depend on the rest of the population to reach community immunity (Gromis & Liu, 2020).

Demographics

The nine Bay Area counties are home to diverse populations, so determining certain demographic factors, such as the percentage of age range from 0-9 years old that make up the population; race and ethnicity; median household income; and highest educational attainment are essential to understanding the possible factors at play when it comes to vaccination compliance or resistance.

Figure 1

Percentage of 0-9 Age Range in Bay Area Counties

Figure 1 displays the percentages of each county for children that range from 0-9 years in age. It is important to note that kindergarteners fall within this age range. The mean percentage for this group is 10.6%, with notable exceptions being Contra Costa and Solano, with 12% of their populations belonging to this group, and San Francisco, which only has 8% of its population belonging to this age range (Census Reporter, 2020a; Census Reporter, 2020b; Census Reporter, 2020c; Census Reporter, 2020d; Census Reporter, 2020e; Census Reporter, 2020f; Census Reporter, 2020g; Census Reporter, 2020h; Census Reporter, 2020i).
Figure 2

Race/Ethnicity of Bay Area Counties

![Race/Ethnicity Graph]


Figure 2 displays the race/ethnicity of each county. For the most part, those who identify as Alaska Native, Pacific Islander, or Other make up about one percent or less in many of the
counties. An interesting point is that those who identify as White make up the largest ethnic
group of the population of all the counties except for Alameda and Santa Clara. In both Alameda
and Santa Clara Counties, the largest ethnicity within their respective populations identify as
Asian (Census Reporter, 2020a; Census Reporter, 2020b; Census Reporter, 2020c; Census
Reporter, 2020d; Census Reporter, 2020e; Census Reporter, 2020f; Census Reporter, 2020g;
Census Reporter, 2020h; Census Reporter, 2020i).
Figure 3

Median Household Income Bay Area Counties


Figure 3 displays the median household income in the counties. The median household income for many of the counties is $100,000 or more, with the exception of Napa, Solano, and
Sonoma. The county with the highest median household income is San Mateo at $138,500. The county with the lowest median household income is Solano at $86,652 (Census Reporter, 2020a; Census Reporter, 2020b; Census Reporter, 2020c; Census Reporter, 2020d; Census Reporter, 2020e; Census Reporter, 2020f; Census Reporter, 2020g; Census Reporter, 2020h; Census Reporter, 2020i).

**Figure 4**

*Bachelor's Degree or Higher*

![Bar chart showing the percentage of bachelor's degree or higher for various counties in California.]

Figure 4 displays the percentage of a county’s population that achieved a bachelor’s degree or higher. The highest rate of individuals that have obtained a bachelor’s degree or higher is 59.7% in Marin. The lowest attainment rate of bachelor’s degree or higher is 28.9% in Solano (Census Reporter, 2020a; Census Reporter, 2020b; Census Reporter, 2020c; Census Reporter, 2020d; Census Reporter, 2020e; Census Reporter, 2020f; Census Reporter, 2020g; Census Reporter, 2020h; Census Reporter, 2020i).

**Current Trends**

Vaccination rates are fluid, and can, and have, been impacted by current events. Many parents were unable to follow the immunization schedule set forth by the CDC due to the COVID-19 pandemic. With many pediatricians opting for virtual visits during the height of the pandemic, and parents outright avoiding taking their children to their doctors over fears regarding COVID-19 exposure, many children were unable to get vaccinated (Barnes, 2022; Runcie, 2020). Moving forward, the impacts of these missed vaccinations may be observed, which makes the goal of reaching herd immunity for many communicable diseases a top priority for county public health departments.
LITERATURE REVIEW

Benefits of Immunizations Among Children

Immunizations are used to protect the community against illnesses that pose a great threat to children whose developing immune systems make them especially vulnerable to disease; vaccination is the most effective method for preventing these diseases. The vulnerability in children is exacerbated when a community fails to reach herd immunity. According to Griffith et al. (2020), “When a sufficiently high proportion of the population is vaccinated, the overall reduction of disease transmission in the community can prevent outbreaks and thus protect unvaccinated individuals” (p. 8041). Unvaccinated individuals can be infants or children not yet old enough to receive a specific immunization, or those who are immunocompromised, who have a severe and rare allergy, either due to an ingredient in the vaccine, or due to the vaccine itself, or take medication that weakens their immune system (Gromis & Liu, 2020).

Additionally, ensuring that children receive all necessary vaccinations not only impacts their health and the health of a community for the better, but also saves valuable time, money, and resources. Whitney et al. (2014) used a cost-benefit model which estimated that, if enough children born between 1994-2013 were vaccinated, it would most likely have prevented “…322 million illnesses, 21 million hospitalizations, and 732,000 deaths over the course of their lifetimes…[and] $1.38 trillion in total societal costs” (p. 1). The societal benefits gained by vaccinating children decreases not only the chances of death and severe illness, but also medical care costs. Childhood vaccination is also especially crucial in limiting the economic impact on productivity by preventing lost work time for parents (Hinman & McKinlay, 2016).
Benefits of Immunizations Among Adults

Studies have shown that immunizations for adults result in protection against infectious diseases, both from the dangers of the disease and by stopping the spread of these potentially deadly infections (Hale & Marshall, 2016; Nichol et al., 2003; Ozawa et al., 2016; Wilson et al., 2020). While some may assume that healthy adults under the age of 65 do not need vaccinations for diseases such as influenza, studies have shown that vaccination is helpful in avoiding serious illness/symptoms and work loss (Nichol et al., 2003). Additionally, Resnick (2014) states that in some cases the biggest health impacts occur after a person with an infectious disease is discharged from the hospital due to difficulty in regaining prior health levels. However, despite this knowledge, adult vaccination rates are not reaching the necessary levels (Hale & Marshall, 2016). Vaccines are beneficial for the older adult population struggling with serious health issues, and are especially necessary for those living in long-term-care facilities due to the potential risk of a disease spreading among people living in close quarters (Loeb et al., 2004), as was demonstrated in the COVID-19 pandemic (Ciglar, 2021).

Additionally, as was the case with children, there is an economic impact when adults choose not to get vaccinated. This economic impact reflects the cost of services and resources provided by the medical field, illnesses that can result in avoidable deaths or disabilities, lost income due to doctor visits or hospital stays, and lost productivity (Ozawa et al., 2016). Ozawa et al. (2016) examined the economic burden generated in 2015 due to unvaccinated adults by analyzing “…ten vaccines, which protect against fourteen different pathogens, recommended by the CDC for adults” (p. 159), and found $9 billion was accrued, with $7.1 billion attributed to unvaccinated adults. Thus, it is important to delve into why some adults choose to remain unvaccinated for themselves and their children and analyze the impacts of this decision.
Anti-vax Movement History

Vaccine hesitancy and outright refusal have been around since the first inoculation (Chatterjee, 2013; Jacobson et al., 2015). To understand why this attitude has persisted into the 21st century, despite the significant scientific advances, it is important to understand the history of vaccine use in the United States. As explained by Chatterjee (2013), the fiercest disease that the United States has ever had to contend with was smallpox, due to its highly contagious and deadly nature. To combat this disease, physician Edward Jenner devised a crude inoculation method by using cowpox scar tissue (Chatterjee, 2013). Although risky, this method proved to be an overall success. However, some were left with serious side effects and not everyone survived this procedure, and thus public resistance and skepticism towards vaccinations was born (Chatterjee, 2013).

Continued resistance to vaccines has been due, in part, to several factors. First, inoculations usually are administered to healthy individuals to prevent serious illness or death, so for some people the risks outweigh the benefits (Jacobson et al., 2015). Secondly, vaccines are so effective that fear of the original disease gets forgotten in the collective memory of a society (Chatterjee et al., 2013; Jacobson et al., 2015). Lastly, in very rare instances, vaccines have caused serious side effects to certain individuals, thus causing distrust to grow even more (Chatterjee, 2013); and if serious reactions occurred shortly after receiving the vaccine and before a thorough analysis can be done, the vaccine is cited as the cause (Chatterjee, 2013). These reasons have intensified over the years, due in part to several missteps from previous immunization policies and practices.

Examples of shortcomings from the government in dealing with diseases can be seen with cases such as the swine flu in 1976, and in subsequent responses to possible adverse
vaccination reactions. In the case of swine flu, the government attempted to enact the largest immunization campaign, but promptly ended it due to adverse vaccine side effects that later proved to be coincidental, and the swine flu failing to live up to the expected threat (Chatterjee, 2013). This experience, paired with the incident of two children becoming paralyzed after receiving the polio vaccine, caused some parents to doubt the necessity and safety of vaccines. Although the paralysis was found to be caused by other factors and not the vaccine, the public was left with a higher fear of vaccines than the disease itself (Chatterjee, 2013).

Chatterjee (2013) argues that these fears and anxieties about vaccinations grew even more in 1980 when all 50 states required compulsory vaccination for children to attend school. The main concerns from parents and guardians over these compulsory vaccination laws stemmed from “autonomy, privacy, and safety” (p. 130). Despite the low rates of preventable diseases thanks to the success of vaccinations, the concerns of parents were not allayed, and have grown due to misinformation from the internet, underestimation of the danger of the diseases that vaccinations are protecting against, and the so called “autism epidemic” that has been linked to vaccinations (Chatterjee, 2013), leading to the present-day anti-vax movement.

**Anti-vax Movement Today**

The anti-vax movement today is a mixture of adults refusing vaccinations for themselves and their children. This is due, in part, to their distrust of the government, fears their children will develop autism, and their general confusion and misconceptions over vaccinations, which allows these parents to use and abuse vaccine exemptions (Chatterjee, 2013; Lee et al., 2016; Reich, 2018). Lee et al. (2016) noted that distrust towards vaccines is mainly fueled by parents’ distrust towards government and medical professionals. Information from healthcare providers, the CDC, FDA, or local and state health departments is met with skepticism (Lee et al., 2016).
Some of these concerns can be traced to parents not agreeing with the standard schedule of vaccinations for infants, with some citing that it is an overload on their baby’s immune system (Lanzarotta & Ramos, 2018), and relying on sources of information that are not accurate nor credible (Kata, 2009).

In part, this skepticism and fear stems from misinformation linking vaccines to autism, which started in 1998 after a paper written by Wakefield et al. was published, alleging that the mercury-based preservative in the measles vaccine was the cause of autism. This incited fears, even though “critics quickly pointed out that the paper was a small case series with no controls, linked three common conditions, and relied on parental recall and beliefs” (Godlee et al., 2011, p. 64). This study, paired with cases such as Hannah Poling, whose parents sued the Department of Health and Human Services and won with claims that vaccines were the cause of their daughter becoming autistic, exacerbated the issue even further (Offit, 2008). This case has contributed to the overall narrative of distrust by the anti-vax movement, and why some parents choose to be completely anti-vax, or vaccine hesitant by picking and choosing which vaccines they will allow their children to receive.

Misinformation gathered from the internet and sensationalized by the media has also played a role in connecting anti-vaxxers together to discuss conspiracy theories and the perceived dangers of vaccines (Kata, 2009). With distrust towards the government and medical professionals, parents have turned to the internet as their source in finding out more information about vaccines, which can lead to affirmations of their “beliefs” about the dangers of vaccines. Studies have shown that parents who rely solely on the internet for information about vaccinations are more likely to be anti-vaxxers (Moran et al., 2015). Additionally, Kata (2009) found that 75% of anti-vaccination sites contained false information about government collusion.
in covering-up negative information about vaccines, along with accusations that profits generated by pharmaceutical companies is the main motivator in this deception. Additionally, information presented on anti-vax sites display statistics and data in selective, and in some cases, outright incorrect ways that blurs the line between reality and fiction (Kata, 2009).

Additionally, another factor contributing to misinformation about vaccinations is chiropractors. As explained by Vernon and Kent (2009), the founder of chiropractic services, D.D. Palmer, formulated the concept that “...the body is a self-healing mechanism possessing an innate intelligence [which] led Palmer and other chiropractors to eschew drugs, vaccines, and other treatments” (p. 37). Additionally, Palmer also was against the notion of government interfering in the health choices of its citizens (Vernon & Kent, 2009). Chiropractors who hold these opinions have been a vocal component in the anti-vaccination movement and have labeled themselves as medical authorities when voicing their opinions against the safety and necessity of vaccinations.

It is important to note that, among the anti-vax movement, distinctions can be found among race/ethnicities, and it is necessary to understand the possible reasons why this may be the case. Freed et al. (2010) found that Hispanic individuals had a higher chance of believing vaccines caused autism, but at the same time, they had the lowest rates of refusing to get their children vaccinated, when compared to Black and White respondents. Freed et al. (2010) recommended that educational efforts be conducted within this demographic to ensure that this belief does not change into outright refusal in the future. In the case of African Americans, racial discrimination and abuse perpetuated by the medical community (such as the Tuskegee experiments), have warranted government distrust within this community, and as such, misinformation has impacted vaccination rates (Webb Hooper et al., 2021). As is the case with
the COVID-19 pandemic, studies have shown that African Americans and Latinx members are less likely to view the vaccine in a favorable light, and strategic and thoughtful solutions should be implemented to allay the concerns of these two populations (Webb Hooper et al., 2021). However, some scholars, such as Khan et al. (2021), suggest that a reframing of the issue must occur to place the responsibility not on minority groups and labeling it as vaccine hesitancy, but rather focusing on accessibility and equity.

Additionally, Chatterjee (2013) points out that there is a difference between under-vaccinated, and unvaccinated, with the main difference lying in choice rather than circumstances:

While under-vaccinated children tend to be black, have a younger, unmarried mother without a college degree, and live in a household near the poverty level and in a central city, unvaccinated children tend to be white, have a married mother with a college degree, and live in a middle to upper-middle income household and in Western and Midwestern states. Families with similar attitudes and beliefs regarding vaccinations tend to cluster in particular communities. (p. 130)

This demonstrates how the anti-vax movement’s demographics can be nuanced and have different motivations and beliefs that cause certain communities to actively distrust authorities, and band together to reject vaccination mandates and requirements.

If misinformation and government distrust are not properly handled, then some parents will continue to resist vaccinations and refuse to follow the recommended schedule, compromising herd immunity. According to Jacobson et al. (2015), vaccine hesitancy “affects a quarter to a third of US parents” (p. 1). These perceptions of vaccines have caused some parents to pursue avenues of exemptions, whether that be medical, religious, or philosophical. The negative impacts of these exemptions can be seen in recent outbreaks, such as California’s measles outbreak in 2015. Jacobson et al. (2015) and Salmon and Halsey (2012) believe that this was due in part to the abuse and widespread use of the exemption system. “In 2014, California's
kindergarten exemption rate was 2.5%; however, 8 California counties reported kindergarten children with personal belief exemptions of 8% or higher, with Nevada County having the highest rate of 22%” (Jacobson, et al., 2015).

After the measles outbreak, California passed State Assembly Bill 277 which no longer allowed for personal belief exemptions, and only accepted medical exemptions (Gromis & Liu, 2020). However, after this bill passed there was a noticeable increase in medical exemptions, which before the passage of SB 277 were very rare. Based on a study conducted by Gromis and Liu (2020), these clusters of increased medical exemptions were in the same areas that used to have high numbers of personal belief exemptions. Despite enacting restrictive policies to reduce the number of unvaccinated children, parents/guardians have still maintained their beliefs about vaccinations and, in turn, have found ways around the system. This has further added to the responsibility of governments to ensure that they are protecting the public from vaccine-preventable diseases.

**Vaccine Barriers**

Scholars such as Kimmel et al. (2007) point out the barriers that can be present when it comes to vaccine access and vaccine-related education. Barriers include systems barriers, such as operational inefficiencies within the health care system when dealing with manufacturing capacity (Kimmel et al., 2007). Other barriers are immunization misinformation provided by clinicians, and logistical issues related to vaccine storage, access to immunization records, and missed opportunities for immunization (Kimmel et al., 2007). Issues related to funding can also cause barriers, as shown with programs such as Vaccines for Children. Vaccines for Children assist uninsured children or recipients of Medicaid, but only cover the cost of the vaccine, and
not the cost associated with the administration of the vaccine, which is undesirable for some health providers (Kimmel et al., 2007).

Campeau (2019) explains other barriers can be related to public health institutions failing to provide inclusive information related to vaccines in the appropriate language and cultural context for refugee or immigrant populations. This can lead to resistance or lack of understanding about the immunization programs and services available. Other scholars, such as Smith et al. (2015), mention that while unvaccinated individuals may cluster in the same counties, in the majority of cases low vaccination rates are not due to parent’s distrust towards vaccination, but missed immunization opportunities. With this in mind, local, state, and the federal government wield a tremendous amount of responsibility when it comes to ensuring the safety of their citizens via vaccinations.

Role of Governments

Government plays a large role in whether a country or state has high vaccination rates. Keeping this in mind, some developed countries such as the United States, Italy, Japan, Australia, and New Zealand are struggling with re-emergence of vaccine-preventable diseases (Siani, 2019). Governments, through their public health departments, which specialize in monitoring, preventing, and responding to vaccine-preventable diseases, have employed different methods, policies, and strategies to combat vaccine-hesitancy or low vaccination rates, such as enforcing mandatory vaccinations for children (Chatterjee, 2013), creating stricter exemption rules (Gromis & Liu, 2020), and carrying out educational campaigns (Siani, 2019). Additionally, local health departments “…play a pivotal role in maintaining high levels of community immunization rates, acting as leaders in their communities and strengthening their networks through partnerships with state immunization programs, coalitions, and the immunization
neighborhood” (Drezner et al., 2016, p. 318). However, based on the information presented in
this literature review, it is necessary to analyze whether California Bay Area counties are
reaching their goals when it comes to immunizing their kindergarten population against
childhood diseases.
METHODOLOGY

Type of Analysis

The research project utilizes a standards-based evaluation process (Sylvia & Sylvia, 2004). A standards-based evaluation allows for an analysis to be made about whether organizations are reaching the prescribed industry standard by comparing their performance with the standard (Sylvia & Sylvia, 2004). In this case, the standards established by the Office of Disease Prevention and Health Promotion (ODPHP) through their Healthy People initiative titled IID-10 “Maintain vaccination coverage levels for children in kindergarten” were used to assess whether the nine Bay Area counties reached the industry-established goals for kindergarten vaccination rates for each of the five required immunizations (Healthy People, 2022). Best practices were compiled from counties that met these standards in the hopes of assisting other counties to follow suit.

Data Collection

Data was compiled from each county to assess whether they are meeting the ODPHP kindergarten vaccination standards. The “Kindergarten Immunization Assessment” reports by the California Department of Public Health, Immunization Branch from 2015 to 2020 is the source of this data (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f). These reports break down the immunization rates of each disease in each California county. As previously mentioned, only the nine Bay Area counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma will be included in this analysis.

The second part of this analysis included qualitative data gathered from telephone surveys with a representative of each county’s immunization department. The phone surveys
differed depending on whether a county met the ODPHP standards, has not met the ODPHP standards, or used to not meet these standards but are now meeting them, with the goal of establishing best practices. The scripts for the telephone survey can be found in the Appendix section and are labeled as A, B, and C.

**IRB Exclusion**

This research project qualified for an exclusion under the Institutional Review Board’s (IRB) standards at San José State University. The data collected is publicly available either directly from government websites or from reports that are accessible to the public. Representatives from public agencies were asked a series of set questions that are strictly focused on their professional knowledge and insight related to their departments. Demographic information gathered is from the United States Census and does not contain identifiable information. In summation, since this research project is a systematic investigation, contributes to generalizable knowledge, does not involve human subjects, and does not contain individually identifiable private information, it qualified for an IRB exclusion.
FINDINGS

Context

This thesis-quality project was written during the COVID-19 pandemic when the delta strain was waning and omicron was surging. As such, due to many individuals working from home, there were some counties’ departments of public health that did not participate in the telephone survey. Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, and Sonoma participated, while San Francisco and Solano did not. For the counties that did not respond, the author of this paper relied on information gathered from the county’s public health department website. Unfortunately, certain questions where the answers were not readily available via the internet will be labeled as unknown.

Data

The goal of this research was to determine whether the nine Bay Area counties have met the standards outlined by the ODPHP for kindergarten vaccination rates titled “Maintain vaccination coverage levels for children in kindergarten” (Healthy People, 2022). Additionally, this research reviewed five years of the “Kindergarten Immunization Assessment” reports by the California Department of Public Health’s Immunization Branch from 2015-2020 to compare the nine Bay Area counties’ vaccination rates to the ODPHP vaccination goals. Additionally, the author of this paper reached out to representatives of each county’s department of public health/immunization branch to ask a series of questions to further analyze effective programs and possible setbacks. The quantitative and qualitative data are broken down by each county.
**Table 2**

*ODPHP Vaccination Goals for Kindergarten*

<table>
<thead>
<tr>
<th>Maintain Vaccination Coverage</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTaP 4 doses &gt;</td>
<td>95%</td>
</tr>
<tr>
<td>MMR 2 doses &gt;</td>
<td>95%</td>
</tr>
<tr>
<td>Polio 3 doses &gt;</td>
<td>95%</td>
</tr>
<tr>
<td>hepatitis B 3 doses &gt;</td>
<td>95%</td>
</tr>
<tr>
<td>Varicella 2 doses &gt;</td>
<td>95%</td>
</tr>
</tbody>
</table>

*Note.* Adapted from “Maintain vaccination coverage levels for children in kindergarten,” (https://www.healthypeople.gov/node/3527/data-details). Copyright 2022 by ODPHP.

The ODPHP sets the immunization target for all five required kindergarten vaccinations at 95% (Healthy People, 2022). This percentage pertains to the required minimum number of doses of each vaccine for a child to be considered in compliance. The required doses for DTaP are four or more; MMR two or more; polio three or more; hepatitis B three or more; and varicella two or more (CDPH, n.d.-a).
Alameda County

Figure 5

*Alameda County Kindergarten Vaccination Rates 2015-2020*

![Bar graph showing vaccination rates for DTaP, IPV, MMR, Hep B, and Varicella from 2015-2016 to 2019-2020.](image)


Between 2015 and 2020, Alameda County has surpassed the ODPHP’s 95% vaccination standard for the five required kindergarten immunizations. Overall, vaccination rates steadily increased since 2015, with some vaccinations, such as varicella, reaching over a 99% vaccination rate. Although some rates have decreased, and then subsequently increased, the overall rates remain well-above the 95% standard established by the ODPHP (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f).

Table 3

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpful Programs</td>
<td>Community immunity honor society</td>
</tr>
<tr>
<td>Community Initiatives</td>
<td>Community clinic partnerships, school support</td>
</tr>
<tr>
<td>Anti-vaccination movement impact?</td>
<td>Present, yet manageable</td>
</tr>
</tbody>
</table>

In a telephone survey, a representative of Alameda County’s Department of Public Health’s Immunization Program cited their Community Immunity Honor Society as the most helpful program for achieving high kindergarten vaccination rates (C. Scott, personal communication, February 7, 2022). Alameda relies on annual data collected from Shots for Schools to rank schools by their percentage of fully vaccinated students. Schools that achieve 95-100% kindergarten vaccination rates receive a signed certificate from Alameda’s Department of Public Health commending them for their coverage rates for the school year. The public health
representative stated these certificates are a source of great pride for the schools and that the certificates are usually on display in the schools’ administration offices. Additionally, there are categories for schools that fall below the 95-100% standard. Schools that reach 90-94% kindergarten vaccination rates are considered “honorable mentions.” Schools that reach 80-89%, are labeled as “hopefuls,” while schools that fall below 80% are labeled as “non-immune.” Lastly, schools that do not report their numbers are listed as “schools that did not report.” The goal of this annual report and certification is to motivate schools to reach prescribed standards, and for those that do not, the county aims to provide support and vital information, rather than condemnation (C. Scott, personal communication, February 7, 2022).

Community initiatives that contribute to Alameda’s consistent rates include partnerships with community clinics to extend vaccine only appointment hours for children. This is an added convenience for parents who forget to schedule vaccination appointments, or do not want to take time off work. Additionally, the immunization department sends packets to schools containing crucial immunization information from the CDC, instructions and resources on how to report immunizations correctly, and any updated information that schools need to know. Additionally, the immunization branch dedicates staff to answering phone calls and emails in a timely manner, as well as directly reaching out to struggling schools. As a verification of this quick turnaround time, it is important to note that Alameda County’s Immunization Department responded to this author’s request for a telephone survey just three hours after the initial email was sent (C. Scott, personal communication, February 7, 2022).

The main setback faced by Alameda County is high administration turnover within certain schools. Due to high turnover, schools are unable to accurately report their vaccination
rates, which can contribute to their reportedly low immunization rates (C. Scott, personal communication, February 7, 2022).

Lastly, the representative from Alameda County’s Immunization Department stated that while there are anti-vaccination groups within their county that are vocal, it does not reflect most of the county. For those that are either anti-vax or vaccine hesitant, the immunization department aims to address their mistrust or fears through engagement in one-on-one conversations, promotion of practitioners of color who connect with diverse communities, an emphasis on honesty about possible vaccine side effects, and to provide information in a clear and concise manner (C. Scott, personal communication, February 7, 2022).

**Contra Costa County**

**Figure 6**

*Contra Costa Kindergarten Vaccination Rates 2015-2020*

![Bar chart showing vaccination rates for Contra Costa County Kindergarten from 2015-2020 for DTaP, IPV, MMR, hep B, and Varicella.](https://eziz.org/assets/docs/shotsforschool/2015-16CAKindergartenSummaryReport.pdf)

Contra Costa County met the ODPHP’s goal of 95% vaccination rates for all five required kindergarten immunizations since 2015, with a noticeable increase in rates after 2015-2016. Varicella immunization rates reached 99% between 2016-2018, however, much like Alameda, the rates dropped in 2019-2020 to 97.5%, but remain well-above the 95% standard (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f).
Table 4

Survey Contra Costa County

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpful Programs</td>
<td>IZ Task Force</td>
</tr>
<tr>
<td>Community Initiatives</td>
<td>School-based health clinics, mobile clinics, outreach</td>
</tr>
<tr>
<td>Anti-vaccination movement impact?</td>
<td>Present, yet manageable</td>
</tr>
</tbody>
</table>

Contra Costa County’s Immunization Manager stated the key reasons for their high rates of immunizations was due to a combination of programs and community initiatives (A. Lin, personal communication, February 23, 2022). A successful program is their IZ task force, which meets weekly with school nurses to gather performance metrics and relay any necessary updates. By establishing an open line of communication, the county is aware of schools that may need additional support, whether that be immunization reporting, or a stronger presence combatting vaccine misinformation within a community (A. Lin, personal communication, February 23, 2022).

Community-based initiatives that have assisted Contra Costa in reaching the ODPHP’s prescribed standards include mobile vaccination clinics that visit elementary and middle schools, on-site school health clinics, and walk-in immunization clinics. The main strategy Contra Costa County uses in developing and administrating these community initiatives is equity-based. In areas with high rates of free lunches, Contra Costa ensures the presence of mobile, walk-in, and on-site school clinics since access to care may be limited for these families. Walk-in
immunization clinics are available for students, their families, and the rest of the community. The goal is to not only reach kindergarten vaccination rate standards, but also ensure continued immunization rates and goals for children, teenagers, and adults by decreasing the number of potential barriers. Additionally, Contra Costa County maintains a strong internet presence through their official website, as well as through social media in an effort to share pertinent information to the public (A. Lin, personal communication, February 23, 2022).

A manageable set-back Contra Costa County faces is from vaccine-hesitant parents. To combat this hesitancy, the county emphasizes vaccine-related outreach and education. In many cases, these parents have unanswered questions and concerns for which the county steers them to trusted sources that can speak to them in-person, such as their medical providers or school nurses (A. Lin, personal communication, February 23, 2022).
Marin County

Figure 7

Marin Kindergarten Vaccination Rates 2015-2020

Note. 2015-2016 adapted from “2015-2016 Kindergarten immunization assessment,”
Copyright by CDPH. 2016-2017 adapted from “2016-2017 Kindergarten immunization
Kindergarten immunization assessment,”
“2018-2019 Kindergarten immunization assessment,”
Copyright by CDPH. 2019-2020 adapted from “2019-2020 Kindergarten immunization
Marin County did not meet the ODPHP’s goal from 2015-2016 for all five of the required kindergarten immunizations. DTaP rates were the lowest at 90.5%. However, much like other counties, after 2015-2016, the rates increased for all five required immunizations. Unlike Alameda and Contra Costa, Marin did not reach a 99% rate for any of the required immunizations. However, much like Alameda and Contra Costa, in 2019-2020, there was a drop in the rate of varicella immunizations. Despite this, Marin has continued to meet the ODPHP standards (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f).

**Table 5**

*Survey Marin County*

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpful Programs</td>
<td>School support</td>
</tr>
<tr>
<td>Community Initiatives</td>
<td>Surveys</td>
</tr>
<tr>
<td>Anti-vaccination movement impact?</td>
<td>Present</td>
</tr>
</tbody>
</table>

The representative for Marin County’s Department of Communicable Diseases and Prevention Unit stated that a multi-prong approach is used for vaccination compliance and rates (D. Hiser-Honda, personal communication, February 23, 2022). This multi-prong approach consists of relying on policy, outreach, and education. California’s passage of SB 277 greatly assisted Marin County’s immunization rates by adding the legislative support the department of public health needed to reach higher rates. This legislative support is paired with outreach to school administrators through workshops specifically focused on vaccination requirements and
reporting tools, so schools can accurately report their numbers. Additionally, representatives from the department of communicable diseases and prevention unit maintain a presence in schools through monthly meetings with school nurses during which they impart best practices and procedures (D. Hiser-Honda, personal communication, February 23, 2022).

Community strategies have ranged from distributing surveys to kindergarten parents to better understand vaccine-hesitancy and concerns, to passing along the survey results to pediatricians and nurses. In 2013 and 2015, the county sent out a survey to all parents of kindergarteners that asked questions which included, but are not limited to: their stance on personal-belief exemptions, demographic information, vaccination sources, and which immunizations their child did not have, and what were the reasons for non-vaccination. With the results of both years’ surveys, the county developed targeted talking points to address the most common concerns that were raised involving vaccinations and passed along this information to pediatricians and schools. The main goals from the survey initiative were to bring awareness to providers regarding parent vaccination concerns, and develop consistent vaccine messaging (D. Hiser-Honda, personal communication, February 23, 2022).

A setback the county faces are the high numbers of anti-vax, and vaccine-hesitant individuals in Marin County. Before SB 277 went into effect, Marin had the highest personal belief exemptions in the entire Bay Area. Like other counties, Marin has focused on outreach within the community through educational campaigns that demonstrate the benefit of vaccines and partnering with different entities, such as schools and pediatricians, to ensure that the correct information is being communicated (D. Hiser-Honda, personal communication, February 23, 2022).
Napa County

Figure 8

Napa Kindergarten Vaccination Rates 2015-2020

Napa County failed to meet the 95% vaccination rate in 2015-2016 for DTaP, IPV, and MMR (CDPH, n.d.-b). However, much like previous counties, after 2015-2016, all five required immunizations reached the recommended rates of 95%. Additionally, the general trajectory of required vaccinations has been upward, for the most part, except for the year 2018-2019 when all five required immunization rates decreased before increasing once again the following year. However, unlike Alameda and Contra Costa Counties, none of the vaccination rates reached 99% or more (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f).

Table 6

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpful Programs</td>
<td>SB 277</td>
</tr>
<tr>
<td>Community Initiatives</td>
<td>Immunization clinics at schools</td>
</tr>
<tr>
<td>Anti-vaccination movement impact?</td>
<td>Present</td>
</tr>
</tbody>
</table>

According to the Napa County representative, the most helpful push in increasing immunization rates was SB 277 (K. Relucio, personal communication, February 16, 2022). Although SB 277 is a state initiative and not a product of Napa County, once SB 277 went into effect in 2016, Napa’s overall immunization rates, which were hovering in the 94% threshold, reached the ODPHP’s established standards for all five required immunizations (K. Relucio, personal communication, February 16, 2022).
Community initiatives that have assisted Napa County in maintaining a 95% rate for all five required immunizations include their partnerships with schools in providing on-site immunization clinics. The convenience of these clinics allows for children to have all their necessary immunizations without having to worry about scheduling an appointment with their doctor and having their parent take time off work (K. Relucio, personal communication, February 16, 2022).

A setback faced by Napa County has been the anti-vax movement. To combat vaccine-related misinformation that has increased significantly during the COVID-19 pandemic, Napa County’s Immunization Branch developed a communications team specifically focused on social media to use various platforms to provide factual information, updates, and answer questions. Additionally, a Vaccine Outreach Collaborative was created that focuses on door-to-door outreach, distributing flyers, and tabling at community events to further engage and present information on a one-on-one basis. Much like other counties, the focus of Napa’s Immunization Department is to provide helpful information and support through educational outreach (K. Relucio, personal communication, February 16, 2022).
San Francisco County

Figure 9

San Francisco Kindergarten Vaccination Rates 2015-2020

Note. 2015-2016 adapted from “2015-2016 Kindergarten immunization assessment,”
Copyright by CDPH. 2016-2017 adapted from “2016-2017 Kindergarten immunization
assessment,” (https://eziz.org/assets/docs/shotsforschool/2016-
Kindergarten immunization assessment,”
(https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/Immunizatio
n/2017-2018KindergartenSummaryReport.pdf). Copyright by CDPH. 2018-2019 adapted from
“2018-2019 Kindergarten immunization assessment,”
Copyright by CDPH. 2019-2020 adapted from “2019-2020 Kindergarten immunization

San Francisco County failed to meet the 95% mark for DTaP, IPV, and MMR from 2015-2016. However, after this point in time, San Francisco County was able to meet the 95% standard for all five required immunizations. Unlike Alameda and Contra Costa, San Francisco has not reached a 99% vaccination rate for any of the required immunizations, but for immunizations such as varicella a 98% rate was reached in 2016-2017 and 2018-2019 (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f).

Table 7

Website Analysis San Francisco County

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpful Programs</td>
<td>Website</td>
</tr>
<tr>
<td>Community Initiatives</td>
<td>San Francisco Immunization Coalition</td>
</tr>
<tr>
<td>Anti-vaccination movement impact?</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Unfortunately, the Department of Disease Prevention & Control at San Francisco’s Department of Public Health did not respond to this author’s inquiries in participating in the telephone survey. As such, the information gathered was pulled from their immunization website (San Francisco Department of Public Health, 2022). On the website there is a variety of useful information ranging from kindergarten vaccine information, requirements, and corresponding laws, as well as clinic locations, and links to outside organizations such as Vaccines for Children and the San Francisco Immunization Coalition (San Francisco Department of Public Health,
2022). Overall, the website is easy to navigate and most likely assists county parents in obtaining necessary information regarding immunizations.

A nonprofit that the county actively supports and brings attention to is the San Francisco Immunization Coalition. Over the past 20 years, this coalition “has mobilized the community through advocacy, outreach, and public education events” (San Francisco Immunization Coalition, n.d.) in promoting the necessity of immunizations.

Unfortunately, potential setbacks faced by the county in maintaining kindergarten immunization rates is unknown.

San Mateo County

Figure 10

San Mateo Kindergarten Vaccination Rates 2015-2020

Since 2015, San Mateo County has met the 95% standard outlined by the ODPHP and consistently reached vaccination rates above 97% for all five required kindergarten immunizations. Most notably, from 2016-2019, San Mateo achieved 98.5% or more for varicella immunizations. In 2019-2020, varicella rates dropped to 97.4%, yet this number remains above the 95% standard established by the ODPHP (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f).
Table 8

Survey San Mateo County

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Helpful Programs</strong></td>
<td>Health Plan of San Mateo</td>
</tr>
<tr>
<td><strong>Community Initiatives</strong></td>
<td>Outreach to parents, and support to primary care providers</td>
</tr>
<tr>
<td><strong>Anti-vaccination movement impact?</strong></td>
<td>No notable presence or impact</td>
</tr>
</tbody>
</table>

The Immunization Program Coordinator from San Mateo County’s Department of Health relayed the importance of the Health Plan of San Mateo (HPSM) in consistently meeting the standard established by the ODPHP (R. Ziegler, personal communication, March 10, 2022). HPSM offers vital medical care to Medi-Cal beneficiaries, as well as to uninsured, undocumented individuals and low-income adults and their families (Health Plan of San Mateo, 2022). This comprehensive health plan assists parents in establishing a primary care provider for their children, who then ensures that these children are up to date with their immunizations at a drastically discounted rate (Health Plan of San Mateo, n.d.).

Additionally, the county provides support and helpful information to school nurses and school administrative staff about immunization requirements, updates, and clinic locations so that this information can be passed on to students and their parents. San Mateo also communicates directly to pediatric and primary care providers to emphasize the importance of reaching out to parents to schedule appointments for children who are behind on their immunizations (R. Ziegler, personal communication, March 10, 2022).
Lastly, San Mateo County is not currently impacted by the anti-vaccination movement, but has been impacted by COVID-19. Due to the shut-down and limited in-person services offered by primary care providers who prioritized immunizations for babies under two years of age, many older children’s vaccinations were deferred. As such, San Mateo expects there to be an impact from these limited immunization services on their kindergarten populations (R. Ziegler, personal communication, March 10, 2022).

Santa Clara County

Figure 11

Santa Clara Kindergarten Vaccination Rates 2015-2020

Santa Clara County has met the standard set by the ODPHP for all five required kindergarten immunizations since 2015-2016. For the most part, immunization rates have increased overall since then, with most reaching 98% to 99% (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f).

Table 9

Survey Santa Clara County

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpful Programs</td>
<td>Annual immunization update event and school support</td>
</tr>
<tr>
<td>Community Initiatives</td>
<td>Outreach via health events and social media</td>
</tr>
<tr>
<td>Anti-vaccination movement impact?</td>
<td>Present, yet manageable</td>
</tr>
</tbody>
</table>
Three representatives from Santa Clara County’s Immunization Program emphasized how SB 277 assisted in providing the legal backing needed for the county to reach higher vaccination rates (P. Cerrato; E. Olivares; A. Trujillo, personal communication, March 14, 2022). This legal backing, paired with cultivating strong partnerships with schools and medical providers by providing them with updated immunization information, requirements, and trainings on how to correctly input vaccination records via the state’s online portal, has assisted Santa Clara in consistently reaching the ODPHP standard and beyond. Additionally, for any schools that fail to input their immunization information before the state’s deadline, Santa Clara County’s Immunization Program reaches out individually and provides continued support until the required information is submitted. Before COVID-19, this support was provided in person rather than over the phone. Lastly, every year, the immunization program invites staff from public and private schools, as well as medical professionals, to an immunization update event where a representative from California’s Department of Public Health presents on new immunization requirements, procedures, and general information needed for the upcoming year. Within this event, there is a three hour training for nurses as well as for non-medical professionals, which results in a certificate of completion (P. Cerrato; E. Olivares; A. Trujillo, personal communication, March 14, 2022).

For community initiatives, Santa Clara County’s Immunization Program relies on social media, newsletters, and its website to spread vital immunization information to medical providers, schools, and families. Additionally, the immunization program maintains a presence at community health events and fairs to address any concerns or questions from the community in person (P. Cerrato; E. Olivares; A. Trujillo, personal communication, March 14, 2022).
While SB 277 substantially assisted Santa Clara County in increasing their vaccination rates, it also revealed the presence of those aligned with the anti-vaccination movement, especially in areas such as Los Altos. Keeping this in mind, the immunization program continues to listen to any concerns parents may have and refer them to trusted and valuable sources of information such as the CDC or their primary health physicians (P. Cerrato; E. Olivares; A. Trujillo, personal communication, March 14, 2022).

**Solano County**

**Figure 12**

*Solano Kindergarten Vaccination Rates 2015-2020*

![Solano Kindergarten Vaccination Rates 2015-2020](image)

Kindergarten immunization assessment,”

Solano County has consistently reached the 95% kindergarten immunization standard since 2015 for all five required immunizations. It is worth noting that in 2019-2020 there was a decrease in all immunizations, yet rates continue to be well-above the 95% ODPHP standard (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f).

Table 10

Website Analysis Solano County

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpful Programs</td>
<td>Immunization clinics</td>
</tr>
<tr>
<td>Community Initiatives</td>
<td>Immunization clinics</td>
</tr>
<tr>
<td>Anti-vaccination movement impact?</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Unfortunately, Solano County’s Department of Public Health did not respond to this author’s request for a telephone survey. As such, the information gathered was pulled from Solano’s immunization website (Solano County, n.d.).

Based on the limited information available, it would appear there is only one type of
vaccination service available and promoted throughout the county. A breakdown of immunization clinics and their locations, hours, and possible charges are listed on Solano County’s Immunization Program page. Clearly, this program is community-oriented by providing helpful information about clinic locations. However, it should be noted it was difficult for this author to navigate Solano County’s website to find this information (Solano County, n.d.).

Potential setbacks in maintaining kindergarten immunization rates, as well as additional information about the services and programs offered remain unknown due to Solano County not participating in the telephone survey.

**Sonoma County**

**Figure 13**

*Sonoma Kindergarten Vaccination Rates 2015-2020*
Sonoma County has been unable to meet the 95% standard for kindergarten vaccination rates established by the ODPHP for the majority of required immunizations. For DTaP, IPV, and MMR immunizations, this standard has only been met in 2016-2017. In the case of hep B, the standard was met in 2016-2017, as well as 2019-2020. Additionally, varicella also met the standard in 2016-2017 and 2017-2018; however after this point, the rate decreased to under 95% (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f).
Table 11

Survey Sonoma County

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpful Programs</td>
<td>SB 277</td>
</tr>
<tr>
<td>Community Initiatives</td>
<td>Vaccine brochure</td>
</tr>
<tr>
<td>Anti-vaccination movement impact?</td>
<td>Impacting numbers</td>
</tr>
</tbody>
</table>

According to the representative from Sonoma County’s Department of Public Health’s Disease Control and Surveillance Unit, the most helpful tool in reaching the required standards set by the ODPHP has been the passage of SB 277 (A.M, Zamora, personal communication, March 3, 2022). The first year after personal belief exemptions were no longer accepted, Sonoma County did indeed reach 95% or more immunization rates for all five required immunizations. However, since that time, many of the required immunizations have fallen below 95% (CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f).

For community initiatives, the immunization coordinator updates a vaccination brochure every three months that is then sent out to schools, community centers, and pediatric clinics to provide immunization updates, as well as share information regarding low-cost/free immunization clinics and their locations (A.M, Zamora, personal communication, March 3, 2022).

Certain obstacles that the county is facing are staffing issues for school nurses and the department of public health, which limits the county’s ability to respond to the anti-vaccination movement. School nurses have experienced cutbacks and insufficient staffing for the past two decades. Due to this staffing issue, responsibilities normally assigned to someone with a medical
background are passed onto school administrators. In many cases, these school administrators are overwhelmed with other tasks and therefore are unable to either report children’s immunization records correctly or remain vigilant in reaching out to remind parents about immunization requirements. Additionally, some schools do not have dedicated rooms for nurses to be able to speak with parents and address their concerns privately. (A.M, Zamora, personal communication, March 3, 2022).

Sonoma County is struggling with the anti-vaccination movement due to limited opportunities for school nurses to speak to parents. Vital conversations that require more than one interaction about immunization concerns and misinformation are not occurring. Lastly, the county itself has also dealt with limited staffing and is unable to dedicate as much attention to immunizations since staff are responsible for a variety of programs rather than just the immunization program (A.M, Zamora, personal communication, March 3, 2022).
ANALYSIS

Immunization is integral to protect communities from vaccine-preventable diseases. Counties’ public health departments play a role by providing support to schools and medical providers, delivering programs, and ensuring that their communities have scientifically proven information needed to make informed decisions.

This analysis will assess the different practices and strategies used by the nine Bay Area counties and draw best practices from the counties with the highest, and most consistent kindergarten vaccination rates from the years analyzed for this project. Counties labeled as “best performing” have met the ODPHP’s 95% standard for all five required immunizations since 2015, and consistently achieve high rates for one or all immunizations. Counties grouped as “standards met” originally did not meet the standards for all five required immunizations, but were able to reach the standards and increase their rates after 2015-2016. Lastly, any county struggling to meet the ODPHP’s 95% immunization standard for either one or more of the five required immunizations is labeled as “standards not met” with insights on possible reasons for this shortcoming. Counties that did not participate in the telephone survey will not be included in the analysis.
Best Performing

Demographics

Demographics, such as age range, race/ethnicity, median household income, and educational attainment need to be considered when analyzing why the best performing counties are performing at a consistently high rate to see whether there is a strong relationship between these factors and immunization rates.

Table 12

Best Performing Bay Area Counties 0-9 Age Range Percentage of Population

<table>
<thead>
<tr>
<th>County</th>
<th>Children 0-9 Years of Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alameda</td>
<td>11%</td>
</tr>
<tr>
<td>Contra Costa</td>
<td>12%</td>
</tr>
<tr>
<td>San Mateo</td>
<td>11%</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>11%</td>
</tr>
<tr>
<td>Solano</td>
<td>12%</td>
</tr>
</tbody>
</table>

Overall, these counties share similar percentages in population size for children ages 0-9 ranging from 11-12% (Census Reporter, 2020a; Census Reporter, 2020b; Census Reporter, 2020f; Census Reporter, 2020g; Census Reporter, 2020h). Kindergarteners fall within this age range, and as such, all best performing counties are dealing with similar proportions of their populations within this group.

**Figure 14**

*Best Performing Counties Race/Ethnicity*

The five best performing counties are multi-racial and multi-ethnic, with no clear majority population. In counties such as Santa Clara, people who identify as Asian represent the largest segment of their county’s population (38%) while those who identify as White are the second largest (30%), and those who identify as Hispanic are a close third (25%) (Census Reporter, 2020g). Meanwhile, Contra Costa, San Mateo, and Solano have a very high percentage of White-identifying members when compared to minority populations such as Asians, Hispanics, and African Americans, however, there is still no majority racial population (Census Reporter, 2020b; Census Reporter, 2020f; Census Reporter, 2020h). Meanwhile Alameda County’s Asian and White populations closely mirror one another with a difference of only one percent. As such, there does not appear to be a clear link between vaccination rates and race/ethnicity within the best performing Bay Area counties, however, there is some indication that multi-racial and multi-ethnic communities may be more predisposed to vaccinations. Despite some scholars arguing certain races and ethnicities may have reservations about vaccinations and may choose to not vaccinate (Freed et al., 2010), it appears that as long as a county offers a variety of programs, outreach, and support the issues with under-vaccination traditionally connected with communities of color, and lower economic means and education (Chatterjee,
2013), are no longer an issue. As mentioned by Khan et al. (2021) when governments address barriers to vaccination through the lens of accessibility and equity rather than labeling these communities as anti-vax, then immunization rates can be reached and maintained.

There appears to be no clear relationship related to household income and rates of vaccinations within the best performing Bay Area counties. As seen in Figure 3 (p. 16) San Mateo boasts the highest median household income of all the Bay Area counties at $108,322 while Solano has the lowest median household income at $86,652, yet both have consistently met, and gone above, the ODPHP’s kindergarten immunization standards (Census Reporter, 2020f; Census Reporter, 2020h). These best performing counties do not suffer from large segments of either under-vaccinated (those on the poverty line) or unvaccinated individuals (middle to higher income), as mentioned by Chatterjee (2013), despite the substantial difference in median household incomes.

When examining the percentage of counties whose members have achieved a bachelor’s degree or higher as shown in Figure 4 (p. 17), there appears to be no direct relationship between educational attainment and vaccination rates, since the percentages range from low to high. The best performing counties encompass both the lowest rate for highest educational attainment of all Bay Area counties, which is Solano at 28.9%, as well as the third highest of Bay Area counties which is Santa Clara at 53.7% (Census Reporter, 2020g; Census Reporter, 2020h). However, it is important to mention the top two counties in the Bay Area with the highest rates of their population obtaining a bachelor’s degree or more (San Francisco and Marin) do not belong to the best performing counties group, but rather the standards met group. As such, considering just educational achievement and vaccination rates, there does not appear to be a direct relationship between these two factors.
Takeaways

Table 13

*Best Performing Bay Area Counties Strategies*

<table>
<thead>
<tr>
<th>County</th>
<th>Strongest strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alameda</td>
<td>Community immunity honor society</td>
</tr>
<tr>
<td>Contra Costa</td>
<td>Robust school-based health clinics and mobile clinics</td>
</tr>
<tr>
<td>San Mateo</td>
<td>Health plan of San Mateo</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Annual immunization update and community initiatives</td>
</tr>
<tr>
<td>Solano</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Alameda, Contra Costa, San Mateo, and Santa Clara apply similar strategies in ensuring their respective counties are consistently meeting the ODPHP’s 95% kindergarten immunization standards. These strategies are composed of either a unique program paired with strong community initiatives, or a mixture of both. These counties ultimately use a multi-prong approach to provide support and services directly or indirectly to the county’s immunization initiatives.

Unique programs, such as Alameda’s community immunity honor society, appear to add a distinct and encouraging touch in how schools approach their vaccination reporting and enforcement (C. Scott, personal communication, February 7, 2022). Schools are empowered to reach and consistently maintain vaccination goals with the added incentive of attaining a certificate from Alameda’s Public Health Department.
Another unique program with the added benefit of convenience for parents and children is Contra Costa’s robust school-based health clinics and mobile clinics. While some counties have dealt with reduced medical staff in schools due to limited funding, Contra Costa has focused on providing easy access and on-site immunizations at schools. Another county focused on accessibility is San Mateo through their health plan that targets low-income, undocumented, and underserved populations to ensure that they and their families have access to essential care and immunization services. These programs allow Contra Costa and San Mateo to be successful in reaching their multi-ethnic and racial populations that may traditionally not have consistent medical care, whether that be due to financial constraints or equitable barriers.

Lastly, Santa Clara relies on a variety of strategies focused on disseminating vital immunization information and providing overall support to key stakeholders, such as medical providers and school administrators through constant communication. Additionally, Santa Clara hosts an annual immunization event that provides training, certification, and resources to school administrators and nurses. The best performing counties all employ multiple techniques whether it be outreach, providing administrative support, and developing unique programs resulting in comprehensive and multi-tiered strategies and implementation for their populations.

Standards Met

Demographics

Much like the best performing counties, an analysis of demographic factors such as age range, race/ethnicity, median household income, and highest educational attainment is needed to assess whether there is a relationship between these factors and vaccination rates.
Table 14

Standards Met Bay Area Counties 0-9 Age Range

<table>
<thead>
<tr>
<th>County</th>
<th>Children 0-9 Years of Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marin</td>
<td>10%</td>
</tr>
<tr>
<td>Napa</td>
<td>10%</td>
</tr>
<tr>
<td>San Francisco</td>
<td>8%</td>
</tr>
</tbody>
</table>


As shown in Table 14, Marin and Napa have the same percentage of their population that belongs to the 0-9 age range group (Census Reporter, 2020c; Census Reporter 2020d). There is a notable difference between San Francisco’s 0-9 age range of 8% and the rest of Bay Area counties as seen in Figure 1 (p. 10) (Census Reporter, 2020e). Despite having the lowest percentage of its population that falls within this age range, San Francisco was still struggling to meet the ODPHP standards prior to 2016-2017. Best performing counties Contra Costa and Solano managed a much higher rate of this age group at 12%, and have been meeting the ODPHP standards since 2015, unlike the standards met counties. Based on these findings, it would appear that there is no discernable relationship between this population percentage and vaccination rates.
The majority of Marin and Napa’s populations identified as White (Census Reporter, 2020c; Census Reporter, 2020d). As previously mentioned, Marin had the highest rate of personal belief exemptions within the Bay Area (D. Hiser-Honda, personal communication, February 23, 2022). Scholars, such as Chatterjee (2013) have argued that “unvaccinated children tend to be white, have a married mother with a college degree, and live in a middle to upper-
middle income household…” (p. 130). In the case of Marin and Napa, there does seem to be a relationship between a majority white population, and lower vaccination rates. San Francisco’s racial and ethnic population mirrors that of some of the best performing counties in the fact that there is no majority racial population, and as such, it would appear there are other factors impacting their vaccination rates prior to 2016-2017 rather than their racial/ethnic population make-up.

Regarding median household income, as seen in Figure 3 (p. 16), Marin has a median household income of $110,843, which closely resembles the mean household income of all the Bay Area counties which is $110,436 (Census Reporter, 2020c). Napa falls below that amount at $92,769, while San Francisco is on the higher level of the spectrum at $123,859 (Census Reporter, 2020d; Census Reporter 2020e). Despite these differences, all three counties’ median household income in the standards met group fall between middle to upper-middle income.

Chatterjee (2013) assertion that primarily speaking, unvaccinated families tend to “…live in a middle to upper-middle income household…” (p. 130) appears to be true within this group, but when compared to the findings from the best performing counties, there does not appear to be a clear relationship between median household income and vaccination rates, since those counties also fall within middle, to upper-middle income household ranges.

Lastly, when examining the percentage of those who have attained a bachelor's degree or higher, as shown in Figure 4 (p. 17) all three counties fall within a wide range of educational attainment varying from the lowest of 36% from Napa, to 59.2% from San Francisco, to 59.7% for Marin (Census Reporter, 2020c; Census Reporter, 2020d; Census Reporter, 2020e). As previously mentioned, Marin and San Francisco had the highest percentage of educational
attainment of all Bay Area counties. Despite this, there does not appear to be a strong relationship between educational attainment and vaccination rates.

Although there is no clear relationship between educational attainment and vaccination rates by itself, there does appear to be a relationship when combined with income and racial identification, as is the case with Marin County. Chatterjee (2013) states unvaccinated children tend to “…be white, have a married mother with a college degree, and live in a middle to upper-middle income household…Families with similar attitudes and beliefs regarding vaccinations tend to cluster in particular communities” (p. 130). Marin County matches all three traits, with the additional insight that it had the highest rate of personal belief exemptions in the Bay Area (D. Hiser-Honda, personal communication, February 23, 2022), further emphasizing that parents matching these demographic features were present within this county. However, despite this, with the assistance of SB 277 and Marin County’s Department of Public Health, Marin has been able to maintain kindergarten immunization rates since 2016. Although San Francisco and Napa’s demographics do not perfectly fall in line with the description provided by Chatterjee (2013), there are certain factors to consider that are similar, such as Napa’s majority White population, and San Francisco’s high educational attainment rates.
Takeaways

Table 15

Standards Met Bay Area Counties

<table>
<thead>
<tr>
<th>County</th>
<th>Strongest strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marin</td>
<td>School outreach and kindergarten parent survey</td>
</tr>
<tr>
<td>Napa</td>
<td>Immunization clinics and vaccine awareness campaigns</td>
</tr>
<tr>
<td>San Francisco</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

The three counties identified as meeting the ODPHP standards are labeled as such due to their inability to reach the standard for all five required immunizations in 2015-2016, yet after this point, they were able to meet and maintain the standards for all five required immunizations. Marin and Napa, much like the best performing counties, employ a variety of strategies in ensuring they continue to meet the ODPHP’s kindergarten vaccination standards. These strategies mostly rely on outreach, whether that be reaching out directly to parents through surveys in Marin (D. Hiser-Honda, personal communication, February 23, 2022), to promoting and supporting immunization clinics and vaccine awareness campaigns in Napa (K. Relucio, personal communication, February 16, 2022).

However, the main factor both counties attributed to finally meeting the ODPHP standards, was the passage of SB 277. Having legal ramifications backing county health departments significantly assisted these counties that were struggling to meet the designated standards due to local anti-vax movements (D. Hiser-Honda, personal communication, February 23, 2022; K. Relucio, personal communication, February 16, 2022). As previously mentioned,
Marin faced the highest rates of personal belief exemptions in the Bay Area (D. Hiser-Honda, personal communication, February 23, 2022) and SB 277, paired with multiple channels of outreach, appears to have assisted the county in reaching and maintaining the ODPHP standards. As evidenced by Figure 7 (p. 34), Marin mainly attained rates of 90-93% for all five required kindergarten immunizations in 2015-2016, but once SB 277 went into effect in 2016, the rates increased to 95% or more for all five required immunizations (CDPH, n.d.-b). Napa, on the other hand, was less than a percentage point away in meeting the standards for DTaP, IPV, and MMR, and was meeting the standards for hepB and varicella in 2015-2016 (CDPH, n.d.-b). Once SB 277 passed, the county reached and, in some cases, surpassed, the standards for all five required vaccinations. For the standards met group, it is clear SB 277 assisted these counties in the final push needed to reach the ODPHP standards.

Standards Not Met

Demographics

As was the case with the best performing counties, and standards met counties, Sonoma County’s demographics consisting of age range, race/ethnicity, median household income, and highest educational attainment was analyzed to verify whether there is a relationship between these factors and vaccination rates.

As seen in Figure 1 (p. 13), Sonoma has a 10% proportion of their population that belongs to the 0-9 age range, which is the same as Marin and Napa and not as high as counties such as Contra Costa and Solano (Census Reporter, 2020i). There seems to be a lack of a strong relationship between the proportion of population that belongs to this age range and vaccination rates.
Much like Marin and Napa, Sonoma County does have a majority population who identify as White at 63% of the population, with the second highest group identifying as Hispanic at 27% (Census Reporter, 2020i). It would appear there is a relationship with low vaccination rates when the majority of a population identifies as White, when compared to counties that are multi-racial/multi-ethnic. Studies have found that unvaccinated children tend to be clustered in the same communities (Chatterjee, 2013; Smith et al., 2015), which falls in line with Sonoma’s difficulty in reaching and maintaining the ODPHP standards. Chatterjee (2013) distinguishes between under vaccinated and unvaccinated, citing that for the former, lack of vaccination opportunities plays a large role, whereas the latter is due to parents’ perceptions towards vaccination. Smith et al. (2015) further corroborates this in a study that showed among
the non-White participants, parent’s perceptions towards vaccinations did not play as large a role as other factors, such as missed vaccination opportunities. While there does appear to be a relationship between race/ethnic identity and vaccination rates, further analysis must be carried out to identify the root cause. In Sonoma County’s case, it is crucial to uncover whether this trend is occurring mainly due to the anti-vax movement or a lack of immunization opportunities.

As seen in Figure 3 (p. 16), Sonoma has a median household income of $92,759, and is neither the lowest reporting Bay Area county, nor the highest (Census Reporter, 2020i). By analyzing median household income alone, there does not appear to be a clear relationship between median household income and vaccination rates.

Lastly, as seen in Figure 4 (p. 17), Sonoma is the third lowest county when it comes to their populations attaining a bachelor’s degree or higher at 36.2%, with the lowest county being Solano at 28.9%, and second lowest Napa at 36% (Census Reporter, 2020i). Despite being the county with the lowest rates of their constituents attaining a bachelor’s degree or higher, Solano belongs to the best performing counties, and Napa to the standards met group, which indicates that there is no direct relationship between educational attainment and vaccination rates.
Takeaways

Table 16

Standards Not Met Sonoma County

<table>
<thead>
<tr>
<th>County</th>
<th>Setbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonoma</td>
<td>Anti-vax movement, limited staffing, limited resources</td>
</tr>
</tbody>
</table>

Much like Marin, Napa, and San Francisco, the most impactful push for Sonoma County has been the implementation of SB 277. However, unlike the standards met counties, Sonoma continues to struggle with maintaining the ODPHP’s vaccination standards for kindergarten immunizations. Despite using a multi-prong approach in addressing this situation, whether that be through community outreach in the form of a quarterly vaccine brochure or providing support to school administrators so they can correctly record vaccination information, Sonoma has not been able to consistently meet the standards (A.M, Zamora, personal communication, March 3, 2022). A reason for this is Sonoma has grappled with limited resources and staff within the immunization department, and contended with limited school nurses, which has impacted their ability to respond to the anti-vaccination movement and vaccine access (A.M, Zamora, personal communication, March 3, 2022). These two main issues have proven to be difficult to overcome, despite the additional legal support provided by SB 277. As shown in Figure 13 (p. 46) in 2016-2017, when SB 277 went into effect, all five required immunization standards ended up being reached, but then subsequently decreased to below the ODPHP standards in the following years (CDPH, n.d.-a; CDPH, n.d.-b; CDPH, n.d.-c; CDPH, n.d.-d; CDPH, n.d.-e; CDPH, n.d.-f). This indicates that legal backing can only go so far, and either requires additional support from the
state of California through additional legislation, or further support for the Sonoma’s Immunization Branch.

**Setbacks**

Sonoma County struggles in consistently meeting the ODPHP’s kindergarten immunization standards. Although the implementation of SB 277 assisted Sonoma in reaching the standards for all five required immunizations in 2016-2017, the support provided was not enough to maintain the ODPHP standards for the majority of kindergarten vaccination rates in the following years. Despite having similar racial majority demographics to Marin and Napa, Sonoma’s limited staffing for both its immunization department and school nurses have impacted Sonoma’s ability in implementing a variety of strategies and programs focused on immunization opportunities and in responding to the anti-vax movement.

Although SB 277 has been in effect since 2016, studies such as Gromis and Liu (2020) discovered that the areas with high rates of personal belief exemptions prior to 2016, shifted to having high rates of medical exemptions. With this in mind, it is important to note that in response to this, the state of California passed SB 276 which went into effect on January 1, 2021 and requires all medical exemptions be uploaded through the California Immunization Registry and is then reviewed by a group of experts to determine whether a medical exemption is accepted or rejected (C.A. Legis. Assem, 2019). Before, medical exemptions were granted by primary care physicians, who then passed on the exemption to often overwhelmed school administrators with no medical background (A.M, Zamora, personal communication, March 3, 2022). During the telephone survey, the representative from Sonoma County said it will be beneficial to review the data for 2020-2021 once it is released, to analyze whether the increased strictness on medical
exemptions has had an impact on vaccination rates (A.M, Zamora, personal communication, March 3, 2022).

Based on the telephone surveys of the best performing and standards met counties, it is crucial for immunization departments to be sufficiently staffed to carry out and monitor unique programs, community initiatives, and provide support to schools. While there is a certain degree of these initiatives deployed by Sonoma, these methods are not as robust and unique as the best performing counties. Staffing limitations may play a role in Sonoma’s inability to consistently meet the ODPHP’s kindergarten immunization standards for the majority of the required vaccinations despite their best intentions.

Best Practices

Table 17

Best Practices for Bay Area Counties

<table>
<thead>
<tr>
<th>Best Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Robust immunization department staffing</td>
</tr>
<tr>
<td>2) Wide range of community-based initiatives and outreach</td>
</tr>
<tr>
<td>3) School support</td>
</tr>
<tr>
<td>4) Development and implementation of unique immunization programs</td>
</tr>
</tbody>
</table>
CONCLUSION

Immunizations are crucial for communities to reach herd immunity for many communicable and deadly diseases. There can be a variety of reasons for low immunization numbers, whether that be vaccine accessibility and equity, the anti-vax movement, vaccine hesitancy, or vaccine misinformation. Public health departments play a key role in ensuring that their respective populations remain protected from serious communicable diseases.

This thesis-quality project specially examined kindergarten immunization rates for the nine Bay Area counties to determine whether these counties have met the ODPHP standards in the hopes of establishing best practices, while also learning from counties that have not met these standards. From 2015-2020, eight of the nine Bay Area Counties have met the ODPHP standards for kindergarten vaccinations. Sonoma County is the only county struggling to consistently reach 95% for all five required immunizations. While it is important to note that although Sonoma has not met these standards, their overall vaccination rates are still remarkably high, but for the purpose of this research project, Sonoma ultimately falls short of the prescribed ODPHP standards. Future research regarding the impact of COVID-19 on kindergarten vaccination rates in Bay Area counties needs to be carried out to determine whether the pandemic has caused a significant decrease, for any of the counties to move from meeting the ODPHP standards, to no longer meeting the ODPHP standards. Additionally, future research should analyze whether the implementation of SB 276 did indeed assist Sonoma in reaching the ODPHP standards, or whether there is another factor to consider. Due to unfortunate trends, whether it be the anti-vax movement or the impact of COVID-19, counties’ departments of public health must maintain an emphasis on vaccinations for the continued protection and health of their communities.
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APPENDIX A

ODPHP Standards Met Survey

Hello, my name is Janice Zelaya and I am currently a Master of Public Administration student at San Jose State University. I am reaching out to the nine Bay Area counties’ immunization departments to ask some questions regarding kindergarten vaccination rates for my thesis-quality research project.

1. From 2015-2020, your county has reached the standards established by the ODPHP for kindergarten immunizations. What programs does your county use to achieve this level of compliance?

2. Why have these programs helped your county to be consistent in meeting this standard?

3. What community-based initiatives has your county implemented to reach these goals?

4. Has your county been impacted by the anti-vaccination movement? If so, what strategies have been implemented to overcome this potential barrier to childhood vaccination?
APPENDIX B

ODPHP Standards Not Met Survey

Hello, my name is Janice Zelaya and I am currently a Master of Public Administration student at San Jose State University. I am reaching out to the nine Bay Area counties’ immunization departments to ask some questions regarding kindergarten vaccination rates for my thesis-quality research project.

1. From 2015-2020, your county has overall not reached the standards established by the ODPHP for kindergarten immunizations. What programs does your county use to encourage vaccination?
2. What programs have led to the greatest success with vaccination, and how could they be strengthened to be more successful?
3. What factors have contributed to your county struggling to meet the ODPHP standard for childhood vaccination?
4. What community-based initiatives has your county implemented to try and reach these goals?
5. Has your county been impacted by the anti-vaccination movement? If so, what strategies have been implemented to overcome this potential hurdle?
APPENDIX C

Now Meeting ODPHP Standards Survey

Hello, my name is Janice Zelaya. I am currently a Master of Public Administration student at San Jose State University. I am reaching out to the nine Bay Area counties’ immunization departments to ask some questions regarding kindergarten vaccination rates for my thesis-quality research project.

1. After 2015-2016, your county went from not meeting the standards established by the ODPHP for kindergarten immunizations, to meeting these standards. What programs does your county use to encourage vaccination?
2. What programs have led to the greatest success with vaccination, and how were they strengthened to be more successful?
3. What changes/factors have contributed to your county now meeting this standard?
4. What community-based initiatives has your county implemented to reach these goals?
5. Has your county been impacted by the anti-vaccination movement? If so, strategies have been implemented to overcome this potential hurdle?