

Vaccinations for Kindergarten Students in CA: Project Proposal

Motivation

In early 2015, the California Department of Public Health (CDPH) was notified of a measles case in an unvaccinated child who had recently been to the Disneyland theme parks. According to the Center for Disease Control and Prevention, there were a total of 125 measles cases that occurred from December 28 to February 8 in U.S. residents connected with the Disneyland outbreak (Zipprich, Winter et al., 2015).

The anti-vaccination movement has caused a lot of concern in the recent years, especially in California. An article released in April, 2019 in the LA Times states, “California health officials announced Thursday that 38 people had been infected with measles so far this year, a tally expected to rise.” There are clearly already societal repercussions due to the low percentage of vaccinations. An article published by the National Review has an exceptionally clear statement on the problem. “California has been the epicenter for anti-vaccine sentiment, and measles outbreaks, for the last several years. That’s not a coincidence; the former fuels the latter... for those too young or medically fragile to vaccinate, a vaccine-preventable illness could be absolutely catastrophic” (Mandel, 2019).

We believe calling the consequences of anti-vaccination catastrophic is not an exaggeration. Before measles vaccine was invented, 3 to 4 million people in the U.S. were affected by measles each year (CDC, 2018). No one would want to have their children affected by a vaccine preventable disease. Yet the presence of anti-vaccine sentiments has only grown stronger in recent years. We wonder what is causing such sentiments at the face of possible fatal diseases. We’ve chosen our dataset of vaccination rates among children in California schools because schools near Los Angeles, California are most notable for having an anti-vaccine population. We hope to use this dataset to identify what kind of people are more anti-vaccine, which counties are most at-risk of dipping below herd immunity for multiple vaccinations, and which vaccinations are the major concerns for anti-vaccinators.

Related Work

One reason for fewer children being vaccinated is concern surrounding a theory that the measles-mumps-rubella (MMR) immunization for young children causes an increase in the chance of autism. Over the course of time, the fear that vaccines could cause autism has become a part of anti-vaccination rhetoric despite there being no replicated studies that demonstrate causation, not just correlation. The concern that the MMR vaccination could somehow increase the rate of autism in children is addressed in Dales et al.’s paper, *Time Trends in Autism and in MMR Immunization Coverage in California*. Their analysis did not suggest any association between MMR immunization among young children and an increase in autism occurrence (Dales et al.).

Another very interesting paper on vaccination levels is *Improving MMR vaccination rates: herd immunity is a realistic goal* by Cockman et al. This paper looks at low vaccination rates in London, England and how effective different strategies were to increase those rates over time. They were successful in raising the percentage of vaccinated children in London, but their strategies primarily targeted health networks and not the concept that vaccinations cause harm (Cockman et al.). The paper discusses the importance of increasing vaccination rates and developing strategies to reach herd immunity to such deadly diseases.

The ideologies behind both papers mentioned above are shared with the United States Center for Disease Control and Prevention (CDC). Published on their website is a statement regarding the safety of vaccines and the findings that vaccinations have no true relationship with autism spectrum disorder (CDC Statement). There is also a CDC study and a review by the Institute of Medicine confirming the lack of relationship between the autism spectrum disorder and vaccinations (CDC Statement). The CDC emphasizes the importance of protecting children from such high-risk diseases when it's well-within our ability.

Data

Link to dataset here:

<https://www.kaggle.com/broach/california-kindergarten-immunization-rates#StudentData.csv>

Our data is presented in a 11 x 109008 table and is relatively clean. The table records the vaccination status of the new incoming kindergarten students in California each year from 2000 to 2015. A student's vaccination status can be *vaccinated (for MMR, DTP, Polio)*, *unvaccinated due to personal belief*, or *unvaccinated due to medical condition*. The rows are specific entry for each incoming students from 2000 to 2015. There are 11 columns in the table. They are *School Type (Public vs. Private)*, *Country Name*, *School Name*, *School Code*, *Number of incoming students*, *Number of incoming students vaccinated for MMR*, *Number of incoming students vaccinated for DTP*, *Number of incoming students vaccinated for Polio*, *Number of incoming students unvaccinated due to personal belief*, *Number of incoming students unvaccinated due to medical condition*, and *Year* in which the data is recorded.

Thus far, we have only found one project that referenced to this dataset on the internet. It is a R-project workshop that utilized this dataset as a means to demonstrate the geo-data processing of R. (http://rpubs.com/BJaafari/California_Immunizations) However, the workshop focuses on another geo-informatic file within the dataset and aims to use R to map out the result using coordinates provided by the geo file. We will focus on the numeric data table in the dataset and extend our concern of the anti-vaccine issue beyond just its geological distribution.

Questions

Our three top concerns about the anti-vaccine issue is who, where, and when. Who primarily makes up the most anti-vaccine population? Where in California is the anti-vaccine sentiment the most prominent, or does location (community) matter at all? When did the anti-vaccine movement pick up attraction?

First, in terms of who, we hope to utilize the school type data to look at the population by who chooses to send their children to a private school instead of a public school. It would be interesting to note if parents who did not agree with government vaccinations also did not agree with a traditional public education. Therefore, we are interested in verifying if this tendency in private-school families is stronger than in public-school families. Given the limited features our data possesses for identifying population, we will conclude either the richer family are or aren't more anti-vaccines. We will not be able to make further conclusion regarding the other income level families' sentiments towards anti-vaccine.

Second, in terms of where, we plan to utilize the data of counties to identify the geo-concentration of the anti-vaccine families. From previous research, we learned that many anti-vaccine sentiments stem from the rumors over the internet about the association of vaccination with autism. In addition, many anti-vaccine parents believe it is their right to choose not to vaccinate their children. (Hussain, Azhar et al., 2019) Since the anti-vaccine sentiments are spread across the internet and are distilled with a strong belief in individualism, it is interesting to know whether geological location ever matters in this issue: any parents can browse through the topics online irrespective of where they live. The individualism also implies that the anti-vaccine families care more about not vaccinating their own children than preventing other parents. Therefore, we wonder do anti-vaccine families cluster in any communities at all and if the County piece of data could help identify that.

Third, in terms of when, we look at the year data in the table and look for uprising trends in each school from 2000 to 2005. We can then find the school that has the earliest decline in vaccinated students and the other following schools along a timeline. Identifying the timeline is important because knowing the inception of this issue helps us to study what could possibly trigger such sentiment in that year. We could also see if this anti-vaccine movement is in its rise, at its peak, or is showing a declining trend. Besides from the three questions mentioned above, we will also analyze out of the three most fundamental vaccinations (MMR, DTP, Polio), which one has caused the most concern of the parents. This will be analyzed by the individual immunization report in the data.

Possible Findings and Implications

At this stage, we anticipate our three questions' answer would be the private-school families are more likely to be anti-vaccine than public-school families. We also believe that anti-vaccination trends will be distinct by county. We don't know about the inception year or which vaccine is more worrisome to the parents, but previous research seems to suggest that the MMR vaccine is the most concerning for anti-vaccinators. However, we think our final results will provide a valid ground for future researchers to ask better questions about this issue. Thus far, we provide answers to who, when, and where, but we do not know the why. Why exactly private vs. public, and what about different counties has fostered an anti-vaccine environment? The measles outbreak in 2015 in Disneyland clearly tells an alarming story about where we are heading the further that we dip below herd immunity (Zipprich, Winter et al., 2015). There are so many questions to be asked and analyzed based on our results, and this is the value we see in our project.

Citations

California measles cases reach 38, with outbreaks expected to keep growing. (2019, April 25). Retrieved from <https://www.latimes.com/local/california/la-me-ln-measles-increase-california-20190425-story.html>.

CDC Statement Regarding 2004 Pediatrics Article, 'Age at First Measles-Mumps-Rubella Vaccination in Children With Autism and School-Matched Control Subjects: A Population-Based Study in Metropolitan Atlanta' Autism | Concerns | Vaccine Safety | CDC. (n.d.). Retrieved from www.cdc.gov/vaccinesafety/concerns/autism/cdc2004pediatrics.html.

Cockman, P., Dawson, L., Mathur, R., & Hull, S. (2011, October 4). Improving MMR vaccination rates: herd immunity is a realistic goal. Retrieved from <https://www.bmj.com/content/343/bmj.d5703.full>.

Dales, L., Hammer, S. J., & Smith, N. J. (2001, March 7). Time Trends in Autism and in MMR Immunization Coverage in California. Retrieved from <https://jamanetwork.com/journals/jama/fullarticle/193604>.

Hussain, A., Ali, S., Ahmed, M., & Hussain, S. (2018, July 3). The Anti-vaccination Movement: A Regression in Modern Medicine. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6122668/>.

Mandel, B. (2019, September 24). California's Dangerous, Bipartisan Anti-Vaccine Movement. Retrieved from <https://www.nationalreview.com/2019/09/california-anti-vaccine-movement-bipartisan-dangerous/>.

Measles | History of Measles | CDC. (n.d.). Retrieved from <https://www.cdc.gov/measles/about/history.html>.

Zipprich, J., Winter, K., & Xia, D. (2015, February 20). Measles Outbreak - California, December 2014–February 2015. Retrieved from <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6406a5.htm>.