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### Vaccines: Personal Liberty Or Social Responsibility?

Vaccines are one of the greatest achievements in the history of public health, and their implementation across the globe has changed the entire landscape of the human race. They have entirely changed the scope of the leading causes of death from communicable diseases to chronic illness, lengthened life spans across the globe, and prevented millions from needless suffering of the diseases they immunize against. Using the human body's immune system combined with weakened viruses and bacteria from dozens of diseases, allowing for the immune system to create antibodies against the disease in the future, is a simple, yet remarkably effective concept that is considered by many to be the greatest public health achievement of the 19th and 20th centuries. However, this incredible scientific discovery that has saved millions is at risk of being decimated by the modern anti-vaccine movements, most concentrated in the last decade in North America and Europe.

In today's world, children in the United States receive as many as 12 different vaccines before the age of 2 (CDC, 2019). Without understanding the complex science behind the immune system's functionality or the stringent regulation in the ingredients of vaccines, this seems like a large number of shots for such a young child to be receiving in a short period of their lifetime. Add the large rise in neurological conditions like ADHD, autism, and anxiety diagnoses in children, and it is easy for parents to fall under the false pretense that vaccines are correlated with other health conditions in their children. Sharing these notions through social

media like Facebook, Instagram, and Twitter, all filled with access to countless anecdotes of harmful vaccine reactions from parents, creates an environment in present day where the safety and efficacy of vaccines comes into question.

This specter of doubt is detrimental to the success of vaccines' ability to protecting as many people as possible and allowing for the least spread of disease. Even still, critics of vaccines, whether scientific, religious, or otherwise, unite under the front that they should be an optional health intervention for the current and future children of world; it is up to individual decision to receive or abstain from receiving any and all shots. Vaccines, to those who oppose them and even some in favor of them, are believed to be a voluntary precaution that only affects the person making the decision. The flaw in this logic about how vaccines work in that it only affects individuals, is that at least 95% of the population must be vaccinated against a disease in order for it to be effective at controlling the spread of that disease. Vaccination is greater than a personal decision to be made based on assumptions of biases; it is the choice between life and death for ourselves and others, and the choice to not vaccinate has grave consequences far beyond the individual.

Immunization practices have been part of history for hundreds of years. Inflicting a wound with small amounts of snake venom to prevent death from snake bites was performed by Buddhist monks, and drinking small amounts of poison to build up immunity and prevent death through poisoning was practiced by wester monarchs and leaders. Edward Jenner, however, is said to be the founder of vaccinology in 1796, when he demonstrated that intentional cowpox (a less severe form of smallpox) infection created an immunity to smallpox in a 13 year-old boy. By 1798, the first smallpox vaccine was developed. Through the next 180 years, global smallpox

immunization lead to the eradication of the disease entirely from humans in 1979 (Immunisation Advisory Centre).

After Edward Jenner sent shockwaves through the scientific community with his smallpox prevention strategy, hundreds of scientists all over the world created dozens of new vaccines for diseases that had plagued the human race for thousands of years. Cholera, anthrax, the Black Plague, tetanus, just to name a few, are all vaccines that were created and implemented in the 19th and 20th centuries. As a result, life expectancy in all nations skyrocketed, deaths from communicable diseases staggered, and overall progress ensued, as these all-too-common but sometimes debilitating and deadly diseases weren't as much of a threat to humanity anymore (Immunisation Advisory Centre).

In contrast to all of this progress in the last 200 or so years, as long as vaccines have existed, so has opposition to them. Even Jenner's cure for smallpox, an extremely common disease in Europe that kills 1 in 3 of those infected, was met with resistance from parents, scientists, and clergy of certain faiths. While the reasons for opposition among individuals varied, there was broad fear and uncertainty about sanitation, scientific understanding, religious barriers, and political objections. Tensions in the United States specifically heightened when the Vaccination Act of 1853 was set into law, requiring infants up to 3 months of age to be vaccinated, and the Act of 1867 that increased that age requirement to 14 (History of Vaccines, 2018).

With these mandatory vaccine laws set in place for children, resistance was created in response in the form of anti-vaccine medical journals, the Anti Vaccination League and the Anti-Compulsory Vaccination League. They advocated for autonomy of their children's bodies,

and for the freedom to choose whether or not to vaccinate based on their decision, without the government's force. With enough lobbying and advocating for their cause, the Vaccination Act of 1898 removed penalties for parents that chose not to vaccinate, and contained a "conscientious" objection clause, so parents that believed their children would be better off without vaccines, no matter the reason, had a right to refusal (History of Vaccines, 2018).

Despite vaccines and their effectiveness in creating a world in where communicable disease is no longer the leading cause of death, there is still risk for reversal. Public health experts and scientists stress that vaccines require continuous and widespread public support in order for them to be most effective. This is because of an important phenomenon in vaccinology known as herd immunity. When a disease enters a population, the more people that are immune to it, the less hosts there are for it to infect. This is the tactic that eliminated smallpox from humanity entirely; there were so few non immune hosts for the disease to infect that it died off entirely. In addition, there are those that rely on herd immunity for protection from disease because of a weakened immune system. Whether it be from chronic illness, cancer treatment, or autoimmune diseases, some people cannot receive vaccines and rely on the population at large to be immune to these diseases so they don't spread around our country, and when they do, they die off quickly (CDC, 2018).

Even with the creation of new vaccines and guidelines, longitudinal studies about long-term effects of vaccines, and complete eradication of diseases in the U.S., these rights from the 1898 Act have remained upheld in a majority of states to the present day. While vaccine opposers have always been a persistent yet vocal minority since the time of Jenner, their overall effect on vaccination effectiveness has been dismal. So small, in fact, that vaccines lead us to a

reality where polio, measles, smallpox, and tetanus are so rare many don't even know what they are. In some ways, then, it can be interpreted that vaccines and their effectiveness have been the cause of their demise. We live in a country where these diseases are such a non-threat that these diseases don't even feel real or dangerous. It is easy to under-appreciate the importance of mass vaccination when the majority of our country today doesn't know what a non-vaccinated world looks like. However, one of the key players in understanding the modern rise in opposition to vaccines, and consequently may create a world where vaccines are no longer widely accepted, is Andrew Wakefield and his 1998 publication on the MMR vaccine and its correlation with autism in the British medical journal *The Lancet*.

Wakefield conducted research with 12 participants in a case study, and among its conclusions, suggested a link between the measles, mumps, and rubella (MMR) vaccination and increased onset of symptoms of autism spectrum disorders (ASD). This is the finding that is commonly cited as the beginning of the autism-vaccine controversy, and subsequent anti-vaccination movements in the 21st century. It was later discovered that Wakefield did not use sufficient study protocol, and cited 12 other authors on the article to gain credibility, all of them later testifying that he was the sole contributor. Wakefield was intending to get the specific conclusions that he found in the study, and distorted the study design and data to achieve these results (Kolodziejki, 2014). This unethical research practice has led to his excommunication from the medical community, and infamy amongst many people around the world.

Even though the article was later officially retracted by the journal, and Wakefield lost his medical license, the onset of this study's findings opened a world of conversation about the dangers of vaccines, which previously were widely accepted and understood in their importance.

Hundreds of scientific studies have been conducted in refutation to Wakefield's, but the damage was already done. Parents looking for answers about the causes of autism or lacked understanding about the science behind vaccines used this study as a means to confirm their own suspicions or unanswered medical questions. Wakefield's article also undermined the validity and trustworthiness of medical researchers and journal publications, casting doubt on traditional methods of scientific interpretation. Even if parents or those unrelated to the scientific research community didn't believe his findings to be true, it brought into question the passive acceptance or ignorance of most medical research and procedures that many practice. It also painted vaccines particularly in a bad light, an effect that lingers today (Kolodziejcki, 2014).

While it is clear to see some of the most sufficient causes of the modern questioning of vaccines, it is important to highlight the structures that are at play that leave individual parents deciding against them entirely. Parents most often rely on others they know or outside resources in deciding to conform to the recommended vaccine schedule. In a study by Emily K. Brunson, a social network analysis was conducted on 126 "conformers" and 70 "non-conformers", to investigate the differences in how outside factors determine the outcome. In the social networks (people networks and source networks) examined, the most predictive factor in nonconformity was people networks suggesting so. In other words, those that were anti-vaccine had a much higher level of influence from those in their social network that were anti-vaccine. Additionally, non-conformers were more likely to use the internet (social media, news articles, etc.) to assist in their decisions about vaccination, and less likely to rate their healthcare provider as a person of importance in making their decision (Brunson, 2013).

Through this analysis, it is concluded that the more people around an individual in their social groups that are anti-vaccine, the more likely it is they themselves will become anti-vaccine. This is detrimental, because this study also shows that those that are anti-vaccine are getting their information and source material from places that aren't always displaying the scientifically correct information. Through social networks that hold high levels of influence on parents and misinformation campaigns going viral across the internet, almost anyone is susceptible to being wary about vaccines. With access to many people and so much information, it is overwhelming for parents to make their decision, and it can feel easy to skip, delay, or spread out vaccines as a precautionary measure (Brunson, 2013). With the choice that parents make, there are other large components of identity that play a role besides their social network: affluence, education, and culture.

Acting as a lens through which our world is viewed, culture and identity are intertwined with our decision-making processes. Additionally, access to capital, education, and health insurance and a trusted physician all play critical parts in the decision-making process of parents in vaccinating their children. On trend with countless other social determinants of health, a study conducted by Geoboo Song in 2013, concluded that those with higher income, college education, and who rated highest levels of trust in their healthcare practitioner were the most likely to understand the risk-benefit ratio of vaccinating, and in turn more likely to have their children be fully immunized. To make matters worse, these factors are also strong predictors of other health outcomes like obesity rates, malnutrition levels, and risk of neurological diagnosis. It goes to show, therefore, that not only are the children that are negatively affected by other health risks and low incomes at a disadvantage to begin with, but they are more likely to be philosophically

exempt from vaccines by their parents, and subsequently at risk of getting ill from preventable diseases (Song, 2013).

Combining social network and socioeconomic status are major factors in parents deciding against vaccines, but geographical location in the United States is yet another important determining factor. While it is a federal mandate that all children attending public schools receive the recommended course of vaccines, there are exemptions that provide legal loopholes for parents to not vaccinate their kids. Each state has their own unique set of laws, but all have a medical exemption law, which protects children with autoimmune diseases, those receiving cancer treatment, or other extenuating circumstances. All but two states, West Virginia and Mississippi, have religious exemption laws that allow parents to forgo vaccines based on spiritual belief. The 20-odd states that have a “philosophical” or conscientious exemption for vaccines are where the largest issues lie, however. In a parent’s understanding the risk-benefit ratio of to vaccinate or not, states that have philosophical exemptions have much lower rates of universal vaccination, due to the legal tenants of their state (Song, 2013).

Adding insult to injury, parents that believe vaccines to be harmful to their children have a legal right to abstain, inferring through the justice system to these parents that their fears are not unfounded and their decision is based upon individual freedom, not public benefit. Citizens in a country with laws in place to protect them are naturally inclined to respect the intricacy and research behind the creation of these laws, and in states with philosophical exemptions, inferences about how or why these exemptions came to be leave room for interpretation about the possible danger of vaccines. In recent years, partially in response to public outcry over Wakefield’s article, lawmakers in many states have been pushing to reduce federal mandates for



children needing to receive their vaccines. This movement is so powerful, that in 2011, there was 17 states with philosophical exemptions, and by 2016, there were 21, four more additional states over the period of a few years (Samuel, 2018).

In a particular state example, an arc of events in California in recent years acts as a small scale model for our country and world of how vaccine policy shapes decision making. California, the most populous state in the country, had spikes of philosophical exemptions in the early 2010s, reaching a peak in 2013 with over 17,000 kindergarteners being philosophically exempt. The effects of this policy were reaching far beyond individuals that had their own reservations; also in 2013 in California, were major measles and pertussis outbreaks (both vaccine preventable) that killed dozens. Lawmakers ended up removing the policy of exemption based on philosophical belief, due to the outbreaks and deaths associated with children that were unvaccinated, and in 2017, immunization rates were higher than they had been for kindergarteners in the last decade (Samuel, 2018). California is the largest example to the rest of our country the harms and repercussions that can be made by abstaining vaccines when not medically necessary, and how law and policy about vaccines can change the outcomes of outbreaks and deaths. In future years, with the epidemic of anti-vaccination movements in full swing, history will vindicate California as being ahead of its time in relation to its vaccine policy.

The importance of universal vaccination of our population cannot be overstated. Anti-vaccine movements in the United States have already proven that their false and misleading messages can quickly have deadly implications. With the mistrust and/or lack of understanding in science and modern medicine, the surge in pseudoscience and the harmful claims it promotes, the widespread access to the internet and social media where these ideas can be spread, and lax

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vaccination laws in many states, all are key components in a culture in the United States that puts our population at risk of falling for these anti-vaccine movements. Unfounded in poorly executed and non-peer-reviewed science, the disconnect between the science community consensus on vaccines and their ability to relay complex information to laypeople is also a cause of disconnect. At our roots, Americans are also fundamental believers in the inalienable rights of personal liberty, and personal freedom in our individualistic culture often usurps our concern for the wellbeing of others.

How do we change the toxic environment then that breeds anti-vaccine culture in our country? The science is clear: vaccines have no link to autism, reactions are extremely rare, and the benefits heavily outweigh any cons. In order for optimal effectiveness, vaccines must have a very high percentage of implementation, and where there has been lacking support, the disease outbreaks have subsequently followed. Thousands of hours of work has been conducted in research studies to push back on Andrew Wakefield's debunked study, with millions of dollars spent in this pursuit. Public health interventions have sought to combat the misinformation that anti-vaccine groups spread among populations, instead providing scientifically accurate information in a nuanced way for parents to understand. Yet, there is still an active and growing movement for freedom to choose to not vaccinate and advocacy for its harms. Therefore, the solution lies in widespread public health education, policy change across dozens of states, and a fundamental change in the way that we view others in our culture: instead of with apathy and even disdain, we must change our individualistic goals in this area to a more utilitarian approach for the greater good of our country and our world.

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