

The Controversy of Vaccines - Protecting Our Herd

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Abstract

This literature review involves the controversy of vaccines and what causes this controversy. The research that linked autism to the measles, mumps, and rubella (MMR) vaccine is flawed and later deemed not credible, but it created a cultural phenomenon which influences herd immunity. The goal of this thesis is to answer the questions: Why do controversies of vaccines exist? Is there an association between vaccines and autism? Is there a cultural phenomenon that establishes this controversy, specifically with vaccines and autism? Based on the literature review of the research done behind this controversy, there is no scientific evidence that vaccines are harmful or are linked to autism. They are the most successful, medical phenomenon and based on one defective case study, the anti-vaccination movement developed. This movement needs to be eradicated by making the exemption clause harder in order to save herd immunity.

Introduction

Achievements of vaccines

Vaccines are considered the most cost-effective and successful medical phenomenon that was ever generated. “A recent publication from the US Centers for Disease Control and Prevention suggests that this distinction continues to hold, reporting that for children born in the United States during the period 1994–2013 vaccines will have prevented 322 million illnesses, 21 million hospitalizations, and 732,000 premature deaths, saving \$295 billion in direct medical costs and \$1.38 trillion in total societal costs” (Rappuoli, 2014). However despite these statistics, there is still a negative connotation with vaccines which affects herd immunity and can potentially cause outbreaks that lead to epidemics.

How do vaccines work?

Vaccines are made up of antigens. Antigens can be foreign bodies or are found within the body which creates the body’s immune system to produce antibodies. These antibodies fight off the disease. Vaccines introduce a weakened portion of a particular disease that the body can then adapt to fight off the disease. This creates the body to be immune to this disease because of the buildup of antibodies that the body produces when the vaccine is given. Vaccines are a safe way for children to be introduced to a disease without having the harmful effects of the disease (Center for Disease Control and Prevention, 2014).

The immune system can fight disease off to an extent. Vaccines are used to introduce a virus to the body; therefore the body’s immune system can create antibodies which then fight off the disease. There are four different concepts of immunity: immune specificity, immune memory, cellular immunity, and humoral immunity. These four concepts are a part of the body’s acquired immunity.

Immune specificity is when the body has an immune response to a specific strand of an infection. This means that the body can be immune to smallpox, but not chicken pox or vice versa. The body learns to fight off one strand of a disease, but if the disease mutates, the immune cells cannot recognize the virus. Because of immune specificity, the flu vaccine must be taken every year. The flu virus has the ability to change its form causing the body to not recognize it which means it takes longer to create the correct antibodies to fight the virus off (Link, 2005).

The second concept of acquired immunity is immune memory. The body recognizes a virus the second time it is introduced to it. This means that the body can fight off a virus faster the more times it has been infected by it. There is in fact a problem with immune memory. For instance, if antibiotics are used to treat an infection, the body cannot respond properly in order to create this memory of the infection. The antibiotics will treat the infection, but the body is more likely to be reinfected because it hasn't learned to fight it off competently (Link, 2005).

The third and fourth type of acquired immunity is cellular immunity and humoral immunity and is cohesive. In cellular immunity, the cells recognize that there is a foreign virus or infection in the body and therefore, the body creates antigens to attack the foreign bodies. Cellular immunity plays a vital role in the last concept of humoral immunity. When the cells identify a foreign body in cellular immunity, humoral immunity allows the antibodies to circulate in the blood to find the infection. It then coats the foreign body and attacks it, killing it (Link, 2005).

Benefits vs Risks

In the United States, there has recently been a resurgence of contagious diseases, such as pertussis, that can only be explained by the lack of vaccines administered to children. According

to Risk Analysis: An International Journal (2014), “In 2010, for instance, a total of 27,550 cases of pertussis, or whooping cough, were reported, which was a 250% increase from the 7,867 cases in 2000. The number decreased in 2011, with a total of 15,216 reported cases, along with some sporadic outbreaks in several states. However, in 2012 nearly 41,000 cases were reported to the Centers for Disease Control and Prevention (CDC), which made 2012 a record year for whooping cough in the United States” (Song, 2014). This outbreak of pertussis could have easily been decreased drastically or avoided completely by creating herd immunity within the population.

According to an interview with Elizabeth Miller, there are risks and benefits of vaccines. Miller’s current occupation is a Consultant Epidemiologist at the Immunisation Hepatitis and Blood Safety Department. She has also founded the World Health Organization (WHO) Global Advisory Committee on Vaccine Safety and served on the WHO Strategic Advisory Group of Experts for six years. In the 1970s, a massive decline in the United Kingdom of the vaccination for pertussis, also known as whooping cough, caused a major increase in the disease itself. This decline of the vaccination was because of the allegations that the vaccine caused neurological disorders and was inefficient in protecting against pertussis. The result of children not receiving the pertussis vaccination created an epidemic. Miller in turn conducted research over this epidemic that confirms the vaccine is safe and effective against pertussis creating a positive view on the vaccination once again (Miller, 2015).

Another outbreak that occurred, in the United States, is the measles outbreak. Song (2014) states, “In fact, during 2011 alone, a total of 222 measles cases and 17 measles outbreaks were reported to the CDC, compared with a median of 60 cases and four outbreaks reported annually from 2001 to 2010.” Again this outbreak could have been avoided by simply creating

herd immunity in the population. Herd immunity is when at least 95% of the population has been vaccinated against the disease which creates the disease from spreading. Herd immunity also protects unvaccinated individuals, which includes newborns, from a disease because the disease is controlled in a small portion of the community. Creating herd immunity may become a problem if and only if the virus mutates into a different strand that the body has not learned to fight off.

Policymaking in Vaccination Mandates and Vaccine Ethic

Even though the research behind vaccines' negative effects is very little, this idea can influence policy making. Based on Orenstein and Yang's research, policies should be based on evidence instead of personal opinion and politics. The mandatory vaccination laws for children have been the most successful at preventing epidemics from occurring. The mandatory vaccines are diphtheria, tetanus, pertussis, poliomyelitis, measles, mumps, rubella, hepatitis B, and varicella. The reason for this low incidence rate is that policymakers declare benefits from vaccines and identify vaccinations as the social norm. All 50 states require children to be vaccinated before attending school. However, some states have exemptions from this vaccination law which can be acquired based on religion, philosophical, and medical reasons. The goal of childhood vaccination laws is to create herd immunity and eliminate diseases completely (Orenstein and Yang, 2015). However, this mandatory vaccination law can become a problem if a child is homeschooled or if vaccines are deemed unethical by spiritual or physiological beliefs.

California is one of the states with the lowest vaccination population due to this anti-vaccination movement. This is due to parents' physiological or religious beliefs along with the belief that vaccines are unsafe for their children. A measles outbreak started at Disneyland in

California and because of the high rates of unvaccinated children, this caused measles to spread rapidly. The current mandatory laws put in place for all school aged children to be vaccinated are being taken advantage of because of the exemption clause included in the policy. Non-vaccinators choose to use this exemption clause as an excuse to not vaccinate their children therefore, lawmakers are responsible for revising or changing the mandatory vaccination laws to ensure public health and to stop the rapid spread of these diseases that vaccines prevent from occurring. According to the Boston College Law Review (2016), “Lawmakers must tighten the valve on compulsory vaccination requirements in order to prevent the deterioration of the nation’s health. Laws should reflect the need for diligence in vaccination practices and prevent unnecessary or unwarranted medical, religious, and philosophical exemptions” (Lobo, 2016). The laws need to be stricter and more difficult for the exemption of the mandatory vaccination law which will decrease the amount of parents deciding against vaccination.

Thesis/Problem Statement

In this thesis, I will investigate the basis and prevalence of the controversies surrounding vaccines and examine the data and claims based on this data that brings forth the controversy of vaccines. Specifically, I will address the following research questions. Why do controversies of vaccines exist? Is there an association between vaccines and autism? Is there a cultural phenomenon that establishes this controversy, specifically with vaccines and autism? Through these questions, the research that has been done shows that even through the successful eradication of diseases, there is an anti-vaccination movement that is harming herd immunity and increasing the incidence rate of these diseases. The anti-vaccination movement needs to be stopped by legislatures and public health professionals in order to protect herd immunity.

Literature Review

Why do controversies of vaccines exist?

Vaccines are the most controversial routine medical procedure. The opposing side does not see that vaccines are a preventative measure. When in fact, it is injecting an active vaccine that contains the weakened strand of disease it is trying to prevent. It is a scary thought. Why inject a healthy baby with a vaccine that could potentially harm them? It has the potential of a child contracting a mild form of the disease or to increase the child's immunity. With every pharmaceutical medication, vaccines do have side effects including convulsions, fever, rashes, nerve, and brain damage. Another potential problem with vaccines is the age shift. This means that natural infection (not receiving a vaccine) does lead to a lifelong immunity whereas vaccines tend to wear off after time which is why booster shots are recommended. That is one of the reasons why a person can become infected with a disease even though they have had a vaccine. It also could be that the disease has mutated in a way that the body cannot fight it off effectively (Link, 2005).

Vaccines are different than most medicines because they are strictly preventative to diseases that are no longer potentially a threat to society and the population is skeptical of this idea. Vaccines are more often given to babies or young children and the idea of harming a child with a vaccine that is, in the parent's eyes, no longer an issue. When people do not personally see the disease that vaccines prevent, the only element they do see are the side effects that can rarely occur. People who are suspicious of the idea of vaccines are often called 'anti-vaxxers'. Anti-vaxxers believe that the risk of a child contracting a disease naturally is better than the idea of 'overloading the immune system' which based on research does not actually exist. Anti-vaxxers are skeptical of the research done because they believe that the research is conducted by

pharmaceutical companies, therefore the research is bias because they believe the pharmaceutical companies main concern is to sell the vaccinations to make money. They also may strongly believe their child was or will be harmed due to a vaccine, therefore decide against any vaccinations (Gordon, 2015). Another reason for not receiving a vaccine is not being financially stable which means they cannot pay for themselves and/or their children to be vaccinated. With financial problems for vaccinations, it can include not being able to pay for the doctor's visit or even the transportation or time it takes for the vaccination (Hendrix, Sturm, Zimet, & Meslin, 2016). However, if the child does not receive the vaccine, it is more detrimental if they contract the disease later in their lifetime.

Other than personal beliefs, another element that may cause parents to decide against vaccination is the idea that herd immunity will save their children. According to the American Journal of Public Health (2016), "Some parents do invoke the herd immunity argument as a reason not to vaccinate, suggesting that it is unnecessary that they expose their child to the risk of side effects from vaccination if everyone else is vaccinated to a level that prevents the spread of illnesses" (Hendrix, Sturm, Zimet, & Meslin, 2016). This is much more complex than refusal of vaccination due to personal belief. The anti-vaccine movement in which herd immunity is believed to already be reached is called herd immunity commons. Being a 'free rider' of this movement creates harm for everyone in the community because there is a higher chance of disease outbreak. If a significant percentage of the population believes that herd immunity will result in their child not being affected by a disease then outbreaks have a higher chance of occurring (Hendrix, Sturm, Zimet, & Meslin, 2016).

Is there an association between vaccines and autism?

A negative connotation has been given to vaccines due to the allegation that vaccines cause autism. According to Elizabeth Miller, this scare between vaccines and autism started in the 1990s, when claims were made against the measles, mumps, and rubella (MMR) vaccine. When the safety of a vaccine is questioned or raises concerns, it is either due to statistical research or an increase in incidence rates that correlate with a vaccine. Specifically with the MMR vaccine and autism, the reported incidences, either ecological or temporal, did not show an increase in autism before this vaccine was introduced. However even though there was not a correlation between the two, the evidence of the controversy or lack thereof was not accepted in the population (Miller, 2015). The reason for this allegation between vaccines and autism is because autism symptoms usually start at the age when a child is going through their routine vaccines, making people believe that the vaccines caused the onset of autism (Link, 2005). When this negative connotation arises with a specific vaccine, the herd immunity percentage can drop because parents decide against their children being vaccinated. This in turn causes harm with the community because the likelihood of an outbreak increases.

The controversy initially started when Andrew Wakefield and his colleagues conducted research on eight children who showed signs of autism one month after receiving the MMR vaccine. “From these observations, Wakefield postulated that MMR vaccine caused intestinal inflammation that led to translocation of usually nonpermeable peptides to the bloodstream and, subsequently, to the brain, where they affected development” (Gerber and Offit, 2009). However, there were faults in the research conducted. Wakefield did not include a control group which means his findings could be coincidental or causal, but there is no evidence for either. Wakefield also did not conduct research over a large enough population in order to make

conclusions. In fact, in Wakefield's research, gastrointestinal symptoms did not exist in all cases of autism which means it could not have been the lone factor to cause autism (Gerber and Offit, 2009).

The study by Wakefield was flawed, but when he published his findings in the paper, *The Lancet*, parents took the information for granted and did not think twice about the research done causing a decrease in vaccinations given. This in turn caused epidemiologists to study vaccines and autism to calm the fears parents had about the MMR vaccine. Ecological, retrospective observational, and prospective observational studies were performed to clarify if there actually was a link between the MMR vaccine and autism. All of these studies concluded that there was in fact a rise in the numbers of autism cases in recent years; however, there was not an association between the MMR vaccine and autism (Gerber and Offit, 2009).

Thimerosal, an element found in vaccines that require multiple doses, also known as a booster shot, is also another factor that has been researched to indicate whether or not this compound is associated with autism. The MMR vaccine does require two doses which means it does contain thimerosal. Thimerosal contains mercury which brings researchers to ask the question if this rather toxic element could be the reason behind autism. When children are given vaccines, they are at the developing age where the immune system is more vulnerable to disease and infection. Vaccines containing thimerosal are a probable cause of developmental issues because of the mercury toxicity (Nelson and Bauman, 2003). However, there is not any statistical evidence that if one receives the MMR vaccination, developmental setbacks, such as autism, will emerge. This only means that the thimerosal contained in the MMR vaccine could be a factor that causes these setbacks.

As previously stated, some anti-vaxxers choose not to vaccinate their children due to this belief of ‘overloading the immune system’. By giving all of the recommended vaccinations to their children, anti-vaxxers believe that this will weaken their child’s immune system and therefore cause autism. Babies are born with an underdeveloped immune system that will progress as they age. This argument claims that because of this weakened immune system, babies are more likely to become ill and develop autism. This belief is irrational and doesn’t have any science based evidence to back it up, but some parents still have this belief. There are two simple solutions to this belief that needs to be known among the anti-vaxxer community. Even though a baby’s immune system is underdeveloped, it fights off thousands of antigens that could be potentially harmful. Also, autism is not an autoimmune disease which means it is not contracted when your immune system decides to attack the healthy cells in the body (Tolsma, 2015).

Mark A. Largent, a historian of science and medicine, wrote a book titled *Vaccine: The Debate of Modern America*. This book argues the debate about vaccines and autism. According to the book *Vaccine: The Debate of Modern America* (2012), “Even more troubling to the medical community will be Largent’s statistic that 40% of American parents have either delayed or refused vaccination for their children. Today, 17 states in the United States have adopted legislation that allows parents to refuse vaccination on philosophical grounds, a far broader category than the already existing medical and religious exemptions. Most of these parents are college educated, affluent, and comfortable challenging the authority of medical experts. And, because of the internet, they now have access to information from a variety of sources, both legitimate and illegitimate” (Largent, 2012). This alarming percentage should drive legislators

and public health professionals to eradicate this misperception that vaccines lead to autism. Herd immunity needs to be restored because without it, epidemics are bound to arise.

Is there a cultural phenomenon that establishes this controversy, specifically with vaccines and autism?

Another element that furthers this controversy of vaccines is today's culture relying on social media and unreliable sources and assuming they are credible. This cultural phenomenon that establishes this vaccine controversy has only recently occurred because of the readily available access to the internet and the misinterpretation of non-credible sources. Jenny McCarthy, an actress, model, television host, and author, had a son that was diagnosed with autism. Jenny McCarthy blamed this diagnosis on the side effects of not only the MMR vaccine but all of the routine vaccinations that children receive. McCarthy formulated this idea because she had seen an article in *Time Magazine* that there was a link between autism and the MMR vaccine. Because of Jenny McCarthy's celebrity status, she was in turn on the Oprah Winfrey show talking about her son developing autism after his routine vaccination shots. Oprah rewarded Jenny McCarthy for her bravery on believing in her motherly instinct that her son was diagnosed with autism after his routine vaccinations. According to White (2014), "The media portrayed Wakefield and McCarthy as "brave warriors against authority" and positioned them as crusaders against hard science." However, even after scientific evidence has been made to stop the controversy of the association between autism and vaccines, celebrities, newspapers, and even more credible media sources, like *60 Minutes* and *New York Times Magazine* still want to blame the increase in autism on vaccines (White, 2014). This creates a cultural phenomenon that establishes this vaccine controversy because as celebrities that people have a high opinion of and

admire, it has led to an increase in the disbelief of the positive aspects of creating herd immunity and previous research.

The most recent cultural phenomenon that created controversy between vaccines and autism is Wakefield's documentary, *Vaxxed: From Cover-Up to Catastrophe*. After Wakefield was discredited from his initial research on vaccines and autism, he lost his medical license. According to NBC Nightly News, Wakefield decided to portray his findings and create another uproar by producing this documentary about the so called 'possible link' between vaccines and autism. This documentary was supposed to be featured at the New York City's Tribeca Film Festival in April 2016. Robert De Niro, one of the founders of the Tribeca Film Festival, wanted to show this documentary because his son has autism and he wanted to start a conversation about it. Because the topic is threatening to herd immunity and could cause an even bigger controversy than before, Di Niro decided to retract this documentary from the film festival (Lesterholt, & Snow, 2016).

Conclusion

The controversy of vaccines is based on unreliable sources and cultural influences. There are not any reliable resources linking harmful effects such as autism to vaccines. This idea that routine vaccines lead to autism is based on Wakefield's research that he later lost his license because of his claims. The anti-vaccine movement is still a problem in today's society and threatens herd immunity. That is why outbreaks have been occurring more frequently than in the past. Lawmakers need to make the exemption clause harder for parents to utilize because at the rate of the anti-vaccination movement, the lack of herd immunity is putting society at danger. The creation of vaccines is one of the most successful medical marvels of its time and with the controversies continuing to arise, anti-vaxxers are ignoring the facts and research. According to

the book *Vaccine: The Debate of Modern America* (2014), “Two strands of research—one in the United States on the use of the mercury-based preservative thimerosal in vaccines, the other put forth by Andrew Wakefield in Britain on the possible link between the MMR (measles, mumps and rubella) vaccine, gastrointestinal diseases and autism—became entwined in public debate ten years ago, and those links have since been proven to be false. Members of the medical community will no doubt take issue with Largent’s evenhanded treatments of Wakefield and autism activist Jenny McCarthy [...]” (Largent, 2012). In order for this controversy to lighten, more research needs to be done to disclose the arguments that vaccines are linked to autism, along with vaccine activists to become heard over the anti-vaxxers.

References

- Gerber, J. S., & Offit, P.A. (2009). Vaccines and autism: a tale of shifting hypotheses. *Clinical Infectious Diseases: An Official Publication Of The Infectious Diseases Society of America*, 48(4), 456-461. doi:10.1086/596476
- Gordon, M. (2015). Public-Medicine Dissonance: Why in a World of Evidence-based Medicine?. *Rambam Maimonides Medical Journal*. 6(4), 1-9. doi:10.5041/RMMJ.10226
- Hendrix, K. S., Sturm, L. A., Zimet, G. D., & Meslin, E. M. (2016). Ethics and Childhood Vaccination Policy in the United States. *American Journal of Public Health*, 106(2), 273-278. doi:10.2105/AJPH.2015.302952
- Largent, M. A. (2012). *Vaccine : The Debate in Modern America*. Baltimore: Johns Hopkins University Press.
- Lesterholt, & Snow (2016). Actor Robert De Niro has reversed course in highly controversial documentary film. *NBC Nightly News*.
- Link, K. (2005). *The vaccine controversy: The history, use, and safety of vaccinations*. Westport, CT: Praeger.
- Lobo, J. (2016). Vindicating the Vaccine: Injecting Strength into Mandatory School Vaccination Requirments to Safeguard the Public Health. *Boston College Law Review*, 57(1), 261-296.
- Miller, E. (2015). Controversies and challenges of vaccination: an interview with Elizabeth Miller. *BMC Medicine*, 131-5. doi:10.1186/s12916-015-0508-z
- Nelson, K. B., & Bauman, M. L. (2003). Thimerosal and Autism?. *Pediatrics*, 111(3), 674.
- Orenstein, D. G., & Yang, Y. T. (2015). From Beginning to End: The Importance of Evidence-Based Policymaking in Vaccination Mandates. *Journal Of Law, Medicine & Ethics*, 4399-102 4p. doi: 10.1111/jlme.12228
- Rappuoli, R. (2014). Vaccines: Science, health, longevity, and wealth. *Proceedings of the National Accademy of Sciences of the United States of American*, 111(34), 12282. <http://doi.org/10.1073/pnas.1413559111>
- Song, G. (2014). Understanding Public Perceptions of Benefits and Risks of Childhood Vaccinations in the United States. *Risk Analysis: An International Journal*, 34(3), 541-555. doi:10.1111/risa.12114

- Tolsma, E. C. (2015). Protecting Our Herd: How a National Mandatory Vaccination Policy Protects Public Health by Ensuring Herd Immunity. *Journal Of Gender, Race & Justice*, 18(1), 313-339
- Vaccines and Immunizations. (2014, May 19). *Why are childhood vaccines so important?* Retrieved March 17, 2016, from <http://www.cdc.gov/vaccines/vac-gen/howvdpd.htm>
- White, E. (2014). Science, Pseudoscience, and the Frontline Practitioner: The Vaccination/Autism Debate. *Journal Of Evidence-Based Social Work*, 11(3), 269-274. doi:10.1080/15433714.2012.759470