

Kaylie-Anna Vallee

Professor Jim Fleming

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You and Others – Vaccines Doing More Good than Harm

There has been an ongoing controversy over the idea of whether or not people should vaccinate themselves and their children. Why is this? Are vaccines truly bad for us, or are they a prevention to what could be a much more severe epidemic reality? Vaccines have been present in medicine since the late 18th century, with it being mandatory to be vaccinated for certain diseases for a long period of time. However, this law is no longer enforced today, and instead some people are veering away from vaccinations in fear of the adverse effects that they cause. Recently there have been some instances where diseases like measles and mumps are increasing in case numbers. This is not caused by ineffective vaccines, but instead it's because more people are refusing to get the vaccine, leaving them more vulnerable to the disease, decreasing herd immunity, and therefore infecting more people around them (Blendon, Benson, and Hero). What is causing people to steer away from vaccination, and is their reasoning logical? Based on thorough research, arguments claiming that certain vaccines do more harm than protection are indeed insightful, however, there is strong evidence pointing towards the notion that vaccination is safer for the overall population.

A vaccine's purpose is to be administered into the body in the form of a dead or weakened virus, in hopes that the body's antibodies will react to the antigens and attack it (U.S. Department of Health and Human). The antibodies that are created to attack the antigens will remain in the immune system and prepare the body to fight the disease faster and more effectively, decreasing the strength and duration of the sickness caused by the disease (U.S. Department of Health and Human). What may appear to be a dangerous idea ended up becoming a very successful experiment, as done by Edward Jenner in 1796 when he used variolation as the first means of immunization for smallpox (Immunisation Advisory Care). Variolation was previously done by scraping off smallpox lesions from a blister of an infected individual and rubbing it into a scratch of someone uninfected. The hopes of this method were to create immunity to smallpox in the population because people can only contract this disease once. However, in 1796 Edward Jenner had developed a new type of immunization, variolation to create immunity against a disease using another disease. He discovered that using cowpox as the disease for the vaccine to protect against smallpox was a more successful way of creating immunity for people, since it results in less severe reactions with the same effect. This discovery marked the beginning of vaccines, leading to the discovery of many more ways to develop immunity to other diseases. However, ever since the idea of vaccines began, many people have been very skeptical about willingly injecting such a deadly virus into their bodies. One of the biggest reasons vaccines were rejected in the beginning was because people were forced to get vaccinated without having a choice. This was enforced by the Vaccination Act of 1853, ordering mandatory vaccination for infants up to 3 months old and later the Act of 1867 extended the age to up to 14 years old. If anyone refused to

get vaccinated there were penalties enforced such as parents being put in jail for prohibiting their children from getting vaccinated (Albert, Ostheimer, and Breman). Over time the government decided to overrule the enforcement of penalties due to vaccine refusal, but those who did not choose to pursue the vaccination path were looked down upon in the society. This is one reason people used to dislike vaccines, but recently there has been a growing increase in the number of people rejecting immunization for many different reasons.

Over time there have been many complications and negative effects resulting from vaccines. In the mid 20th century an inactivated polio vaccine was created and licensed in the United States. However shortly after this, it was discovered that the failure of the inactivated vaccine had caused 260 cases of poliomyelitis, which is a viral disease that attacks the central nervous system and can cause temporary paralysis in most cases (Baicus). This horrible incident also resulted in 10 deaths. This is a valid reason for people to want to refuse vaccines, in fear of the rare chance that either their children or themselves might encounter these side effects. However, the case that resulted in poliomyelitis occurred in the 1950s and was a result of the first batch of the vaccine to ever be administered. And while it may give some anxiety about the idea of contracting paralytic polio from the oral polio vaccine, there is an extremely low probability of that type of adverse event taking place. The number of paralytic polio cases have gone from about 350,000-400,000 cases per year in the 1980s to 22 total cases reported in 2017, decreasing by over 99% (World Health Organization). In the 1960s the likelihood of someone coming down with life-threatening reactions as a result of an adverse event of a vaccine is 15 per 1 million people vaccinated, and about 1-2 per million may die (“Vaccine Side Effects and Adverse Events | History of Vaccines”). While these numbers may be alarming, between 1994 and 2014 vaccines have also saved an estimated 732,000 American children from death and approximately 322 million cases of childhood illnesses were prevented (“Vaccines ProCon.org”). So, we as a population have a decision to make: would we rather risk being one of the 15 per one million people that could be affected, or should we refuse to vaccinate our children and risk creating the projected 732,000 gravestones for those that would have otherwise been protected?

Yes, it is a known and a proven fact that vaccines can have adverse effects. However, what type of drug does not? There are warning labels on the bottles of commonly used medicines, like ibuprofen, that state the potential side effects such as liver damage, kidney damage, vision problems, increased risk of heart attack or stroke, and bleeding or ulcers in the stomach or intestines (Truven Health Analytics). A drug that is taken by many to cure headaches, muscle aches, or arthritis can have very serious adverse effects, yet many people still choose to take the risk in hopes of feeling better. What makes ibuprofen so much better than vaccines? I can agree that it is intimidating to think about putting a dead or weakened virus of a very dangerous disease into your body. However, if all goes well and you are not among the very few people to be negatively affected by the vaccine, then you have now increased your immunity against that certain disease, protecting both yourself and those around you. The adverse effects of vaccines are not much different from those posed by medicine you can get from the drug store. They also vary according to the type, but the general mild side effects are pain, swelling, or redness or pain in the shoulder where the shot was given, mild fever, chills, feeling tired, headache, muscle and joint aches (“Vaccine Side Effects - NHS.UK”). The pain in the shoulder could be due to SIRVA (shoulder injury related to vaccine administration) which is when the shot may not have been injected in the right area, potentially resulting in swelling and pain of the shoulder. More severe

problems that could occur after receiving a vaccine may be things such as fainting or an severe allergic reaction (National Center for Immunization and Respiratory Diseases). Although it is unfavorable, fainting is an event that can happen after almost any medical procedure, which includes receiving a vaccine. However, one of the most severe side effects that could be caused by a vaccine would be an anaphylactic reaction, where the person issued the vaccine has an allergic reaction to a chemical present in the drug. Despite the fact that this is a serious side effect that could result in many complications, there is a very small chance that it could happen, only occurring in less than 1 in every one million cases (National Center for Immunization and Respiratory Diseases). Although these side effects can be harmful, scientists are continuously researching new and better ways to reduce the number of adverse events that may occur due to vaccinations.

Through out the years, the government has invented many programs to help continue the positive progression of developing vaccines. VAERS (Vaccine Adverse Event Reporting System) is a program that accepts and analyzes reports of adverse events after someone has received a vaccination (Centers for Disease Control and Prevention, Food and Drug Administration, and U.S. Department of Health and Human Services). It's best used as a national early warning system to detect possible problems in the vaccines administered in the United States, trying to ensure protection and safety to those who get or have gotten vaccinated. This reporting system relies on individuals to send in reports to the CDC or the FDA if they experience any adverse events, but it does not help determine if a vaccine caused a health problem. However, The National Vaccine Injury Compensation Program (VICP) does help determine this. This program helps provide financial compensation to individuals who file a petition and are found to have been injured by a vaccine covered by the program ("National Vaccine Injury Compensation Program | Official Web Site of the U.S. Health Resources & Services Administration"). VICP is a no-fault alternative to the legal system that resolves vaccine injury petitions and provides assistance to those that may need it due to any health setbacks caused by a vaccine. An additional program is The Vaccine Safety Datalink (VSD), which is a collaboration between the Centers for Disease Control (CDC) and other healthcare organizations to quickly study and compare data to find out if reported side effects are linked to a vaccine (Centers for Disease Control and Prevention). However, these programs are only a few examples of how the government is continuously trying to improve vaccinations and take care of those who may have developed a side effect from the vaccine.

Despite all of this evidence supporting vaccines, many people are still veering away from getting vaccinated. Why? Many people bring up the idea that vaccines can cause chronic illnesses and can delay mental growth. One of the greatest studies that many parents are known to hold onto is that done by British Doctor Andrew Wakefield in 1998. Wakefield studied the MMR (measles, mumps, rubella) vaccine and its relationship to autism (Albert, Ostheimer, and Breman). He had concluded that there may be a correlation between the vaccine and children being diagnosed with autism, while also stating that the MMR vaccine wasn't properly tested before being distributed (Albert, Ostheimer, and Breman). His work alarmed many people and began the movement of parents refusing vaccines for their children. However, it was later determined that all of Andrew Wakefield's work was false, and he was simply acting on a drive to get paid, driven by a law board pushing him to determine if there was any evidence to support a case by parents who believed that their children were harmed by the vaccine (Albert, Ostheimer, and Breman).

Andrew Wakefield is no longer permitted to be a doctor, and his work was the only of its kind, the only piece showing any correlation between autism and vaccines. Aside from this one study, all of the numerous other studies have conducted experiments and research to try and link any correlation to autism and vaccines, but none has been found. When the MMR vaccination was first introduced, the occurrence of autism cases by year of birth had no sudden increase or change in the trend line aside from what was already taking place (Taylor et al.). Studies found that there was no difference in age at diagnosis between cases of children vaccinated before or after 18 months, along with those who have never been vaccinated (Taylor et al.). People are still refusing to vaccinate their children or get vaccinated in fear of this assumption being true. However, the idea that autism can be caused by vaccinations is false and will remain so until scientific evidence is provided.

When their reason to refuse vaccinations could not be supported by a correlation between vaccines and a chronic illness, people had to look for another, so they came up with the idea that vaccines can cause mercury poisoning. Starting in the 1970s people began to become worried about the thimerosal in vaccines, which had a form of mercury called ethylmercury, causing mercury poisoning (U.S. Department of Health and Human Services, "Vaccines.gov"). Case studies reported that when given in large amounts, much larger than the tiny amount found in vaccines, there is a possibility that thimerosal could cause neurotoxicity (U.S. Department of Health and Human Services, "Vaccines.gov"). At the time, only the DTP (diphtheria-tetanus-pertussis) vaccine contained thimerosal, and it had such small amounts that there would be no reason for any type of neurotoxicity to occur due to the mercury (Baker), making this another unsupported reason for people to refuse getting vaccinated.

Although there could be severe adverse events as a result of some vaccinations, the chance of them happening to the majority of the population is very small and is not worth the risk of potentially catching the real disease or spreading it to others. The only valid reasons a person could give to not get vaccinated would be if they are pregnant (or thinking about it), already sick, too old or too young for a certain vaccine, have severe allergies relevant to ingredients of certain vaccine, or if they have an autoimmune disease where their immune system is too weak to handle the vaccine adverse effects ("Who Should Not Get Vaccinated | CDC").

What other reasons are vaccines good for you, other than those previously stated? Although children receive many vaccinations between the ages of 0 and 6 (29 doses of 9 vaccines), this is due to the fact that this is the most vulnerable age for the immune system, therefore the best age to develop resistance to diseases. The vaccines will form antibodies that will protect the children from diseases and will be carried along with them throughout their life (U.S. Department of Health and Human Services 2017). This concept also helps support herd immunity, which is when the vast majority of a population is to be vaccinated, helping protect the individuals that can't due to certain health restrictions. Herd immunity is very effective in a situation where if most of the population is vaccinated for a certain disease and it is introduced to the environment, there is a very small chance that there would be an epidemic, since most people would be able to fight off the disease and the contagious disease would be contained, only drastically affecting those that aren't vaccinated (U.S. Department of Health and Human Services 2017). This form of indirect protection shows that when someone decides to refuse a vaccine, they are not only choosing to put themselves at risk, but also those around them that are not able to get the vaccine

due to health restrictions. It's not all about that extremely small chance of you attaining a side effect from a vaccine, but rather it's about how your decisions also affect your community and any person near you wherever you go.

Not only are vaccines a way to protect both you and your neighbors, but they are also a much cheaper option. Would you rather pay the small fee to get a vaccine, or pay the medical bills and doctor visits when you contract the disease that was protected by that vaccine? In 2005 a study was conducted to research the economic impact of routine childhood immunization in the United States. The results from this study showed that the vaccination program ended up saving about \$5 in direct costs for every dollar spent and \$11 in additional costs to society (National Institute of Allergy and Infectious Diseases). In another study it was discovered that "the routine childhood program in one birth cohort saved about \$13.6 billion in direct costs." To put all of these random numbers in an example, in Colorado it took \$29.2 million to treat 538 children with vaccine-preventable diseases in one year (Colorado Children's Immunization Coalition). That's a lot of time and money those families could have saved if they did not decide to refuse vaccination.

Over time and thanks to programs like VAERS and VCIP, scientists have developed vaccines and improved them drastically over the years, decreasing the number of cases by huge amounts while also eradicating some like smallpox, polio, and malaria (National Institute of Allergy and Infectious Diseases). But, if certain diseases have been eradicated by vaccines and there has been a huge decrease in the number of cases for each disease, why are some starting to come back? The director of CDC, Dr. Tom Frieden, believes that even though the occurrence of certain diseases in the U.S. is rare, that does not mean that people should stop getting vaccinated, nor should we believe that eradicated diseases can never return to our country. He brings up the fact that people travel quite a bit around the world, potentially to ones that still contain diseases we have eradicated. In an interview he stated, "current outbreaks of measles in the U.S. serve as a reminder that these diseases are only a plane ride away, borders can't stop measles, but vaccination can" (Omer et al.). His last two phrases reiterate the notion that the only way to eradicate diseases or to stop them from returning to America is to get vaccinated. When there are increasing numbers of people traveling outside the United States, there is a greater risk of them contracting a disease and bringing it back to infect all of those around them not vaccinated. The recent return of certain diseases isn't due to ineffective vaccines, instead, it's caused by the increasing number of people refusing immunization. The diseases were not present because the vaccines were effective at developing herd immunity.

Despite the numerous arguments that people pose about why they don't want to get vaccinated, there are only a select few that are factual. The potential of vaccines having some drastic side effects are real, but the likelihood of them happening are extremely rare, similar to the likelihood of someone having a side effect from a drug like ibuprofen. The idea of autism and mercury poisoning being caused by MMR has never been proven to be true, and therefore would not be logical reasoning to use in an argument for why people refuse to get vaccinated. The scientific and developmental process for vaccines is continuously improving thanks to the government programs that offer services such as supporting patients and providing recent statistics to researchers to continue decreasing any negative side effects caused by vaccines. The best way to

protect both yourself and those around you that you love is to get vaccinated, it will increase the herd immunity in your population and raise the likelihood of more diseases becoming eradicated.

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