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The American Misconceptions About the HPV Vaccine

For centuries, society has struggled to combat numerous diseases due to the lack of scientific discoveries. In the past, the symptoms and mortality rates of infectious diseases evoked fear in populations throughout the world. Preventative methods, such as vaccines, have provided humanity with a successful approach to mitigate infection and mortality rates of worldwide diseases. Through Edward Jenner's introduction of vaccination, numerous diseases have been able to be eliminated from populations worldwide. However, there are many speculations regarding the efficacy and safety of vaccines as well as the motives of the healthcare system that have caused Americans to refuse vaccination. In modern day America, the human papillomavirus vaccine is stigmatized as harmful as there are many reported effects. Despite the social stigma and medical injustices, the HPV vaccine is an efficient method of preventing many cancers in both men and women, at a mitigated risk. With physician recommendations and public health campaigns, medical professionals can increase the rate of children that receive the HPV vaccine in order to decrease the burden of HPV-related diseases.

Vaccines were first introduced into society in the 1790s by Edward Jenner to confront the smallpox pandemic (Stern and Markel). "Smallpox was a highly virulent, easily transmittable disease with a mortality rate of thirty percent" (Stewart and Devlin). In the 1770s, Edward Jenner focused on natural history and animal biology to understand the anatomy of a human virus and

disease transmission. Jenner used his knowledge about variolation, a technique practiced in Asia for centuries, to further develop the vaccination process. Variolation was a method that infected a non-immune individual with fluid from a smallpox pustule, more commonly known as a blister (Stewart and Devlin). Physicians expected that inoculated individuals would develop a mild infection that would prevent against future illness. As a result of variolation, the mortality rate of smallpox was found to decrease in populations, however, there were many risks associated with the technique (Stewart and Devlin).

Edward Jenner observed that the milkmaids on a small farm in England that engaged with cowpox appeared to have blisters on their forearms and were ultimately immune to the smallpox outbreaks in the area. He further hypothesized that the blisters must have contained a structure so minuscule, yet important to the immunity of smallpox (Stern and Markel). With this, Jenner began one of the world's first clinal trials, which resulted in the production of the first man-made vaccine. Taking the risks of variolation into account, Edward Jenner took a sample of liquid from a milkmaid's cowpox blister and injected it into an eight-year-old boy (Stern and Markel). After several weeks, Jenner variolated two sites on the boy's arm with smallpox in order to test for infection. The boy remained unaffected, which concluded that the vaccination technique developed by Edward Jenner demonstrated immunity to the smallpox virus (Stern and Markel). The physician repeated this experiment on multiple subjects and published a book that claimed that cowpox protected humans against the infection of smallpox, which in turn, provided a foundation for modern vaccinology.

Due to the impact smallpox had on populations globally, smallpox vaccinations were highly encouraged in many countries by the government. It was speculated that almost every individual had contracted smallpox in their lifetime and would transmit the virus to three to six

people while infected (Stewart and Devlin). Many countries promoted vaccination by providing free services, which ultimately turned to mandatory vaccination. As a result of mass vaccination, the infection rate of smallpox was seen to decrease in certain countries. For example, a report in London for a week in 1853 reported that of almost five hundred deaths, only three were attributed to smallpox (Stewart and Devlin). Due to compulsory vaccination, smallpox was able to be eradicated within the human population. With every vaccine, there are risks and side effects associated with inoculation, however, they can be outweighed by the efficacy of the vaccine.

In modern terminology, a vaccine is a substance "that prepares the immune system to fight a disease-causing germ or other pathogen by imitating infection" (Konkel). By injecting a dead or weakened pathogen into an individual's body, their immune system is able to remember the germ by producing antibodies to be able to fight it in the future. This is simply because the human immune system has B cells that generate antibodies that are able to bind to specific antigens on pathogens to inhibit the progression of infection (Konkel). If a vaccinated individual were to come in contact with the same virus, they would not get sick. This being said, there are two ways to build immunity against a disease; infection and vaccination. An individual that is exposed to a virus itself and has a strong enough immune response to fight the disease, will produce antibodies to prevent against future infection. In this case, it can be very dangerous as many diseases have been found to have serious effects and can lead to death (Konkel). However, through a vaccination process, the individual will never show symptoms of the disease as the individual is not exposed to a functional germ. Instead, the individual is able to produce antibodies for the specific disease in order to prevent against subsequent infection (Konkel).

Although there have been countless studies that demonstrate the positive aspects of vaccination, many individuals still refuse to receive vaccines today. Refusal can be attributed to

lack of knowledge and necessity, reported adverse effects, distrust in the government and misinformation from the media. Without the promotion of vaccines in society, there is no possible way to obtain herd immunity, which puts populations at risk (Konkel). This being said, choosing to obtain a vaccine comes down to simply the amount of confidence one has in a vaccine itself, and the system in which produces them. As social media has become one of the most popular and efficient ways of sharing thoughts and opinions, individuals are easily misinformed. Even more so, parents are deprived of the proper knowledge needed to formulate an opinion about vaccination from primary care physicians. As the efficacy of vaccines has been clinically proved, it comes down to the encouragement of health providers to ensure that the public is educated in order to increase vaccine uptake. It is important that in the near future a new informative system is created that will link the public to accurate information regarding vaccines. This connection will allow for the government and health organizations to reach as many people as possible, as information is always changing to adapt to novel advancements.

In the United States, a collaborative effort must be made between pharmaceutical companies, the healthcare system and proper government agencies in order to produce a vaccine (Jamison et al.). As medical research continuously confirms the safety and efficacy of vaccination, researchers still observe “vaccine hesitancy” from the public (Jamison et al.). The foundation of administering a vaccine that is accepted by the public mainly relies on confidence and trust. Individuals must believe that vaccines are safe, trust physicians and researchers, and have confidence that the motivations of policy-makers promote the well-being of society. There has been speculation that minorities may be “less trusting of institutions that are involved in vaccine production and promotion” (Jamison et al.). A study conducted from 2012 to 2014 analyzed one hundred and nineteen African American and White adults’ perspectives on influenza vaccination.

It was concluded that "African Americans are significantly less likely to be immunized than Whites" (Jamison et al.). In both ethnic groups, the individuals that did not receive the yearly vaccine expressed concerns regarding the for-profit principles and ulterior motives of the healthcare industry. Respondents argued that "the healthcare industry valued profit over the needs of the public" and used vaccines as a way of generating revenue (Jamison et al.). This mindset gave rise to widespread of speculations about the true motives of pharmaceutical companies, which ultimately steered individuals away from vaccination.

Differently, African Americans were more likely to "introduce the topic of government distrust", while White respondents rarely expressed concern (Jamison et al.). Many African Americans expressed that the deep-rooted racial injustice in the public health system has provided a foundation for distrust, which had led to decreased vaccine acceptance. These respondents described numerous accounts of medical racism, especially referring to the infamous Tuskegee Syphilis Study. This study involved six hundred African American males in Alabama in 1932 in order to understand syphilis (Brandt). Of the initial six hundred, only three hundred and ninety-nine men were diagnosed with latent syphilis, while the remainder were monitored as a control (Brandt). Blood samples were collected from these individuals for years without proper consent to further examine the disease. Researchers informed participants of the study that they would be treated for "bad blood", which was a common term to describe medical conditions such as anemia, fatigue and syphilis (Brandt). As penicillin became an effective and safe treatment for individuals with the disease, physicians were authorized to deny participants access to the drug (Brandt). The participants remained untreated until 1972 when the study was deemed "ethically unjustified" (Brandt). In response to the Tuskegee Syphilis Study, many African Americans involved in the influenza vaccination study pointed out that many "medical abuses" have occurred to cause the

massive distrust in medical advancements (Jamison et al.). This study highlighted the effect discrimination has had on the American healthcare system to instilled fear and distrust in many minorities. This being said, historical injustices contribute to the denial of vaccination in specific ethnic groups in the United States.

There are also many speculations about the human papillomavirus vaccine in the United States. HPV is a sexually transmitted infection that has been connected to the development of cervical, anal, oropharyngeal and vaginal cancers (*HPV Vaccine Safety and Effectiveness Data)*. Currently, there are three HPV vaccines including Gardasil® 9, Gardasil®, and Cervarix® that are FDA approved (*HPV Vaccine Safety and Effectiveness Data)*. However, as of 2020, Gardasil® 9 is the only HPV vaccine readily available to the United States public (*HPV Vaccine Safety and Effectiveness Data*). In order to prevent against cancer-causing infections, precancers and genital warts, HPV vaccination is recommended by physicians for children between the ages of nine and twelve. A study conducted by researchers at Johns Hopkins examined trends in the contemporary reasons that parents did not intend to vaccinate their children against HPV (Beavis et al.). As this specific vaccine prevents against the "sexual transmission of HPV types that cause cervical cancer", some parents refused as they believe the vaccine would promote promiscuity (Beavis et al.). After analyzing survey data, researchers concluded the most common reason parents decided not to immunize their children were perceived lack of safety, necessity and knowledge. Many parents expressed that they were not educated thoroughly about the vaccine by health professionals, which led to their decision to decline. Researchers noted that one in five boys reported a lack of recommendation from their pediatrician, as opposed to one in ten girls (Beavis et al.). However, a larger number of parents highlighted that safety concerns regarding the adverse effects of the HPV vaccine influenced their decision. In 2016, of almost four thousand parents,

issues concerning the safety of the vaccine were expressed by twenty-two percent of parents of girls, and fourteen percent of parents of boys (Beavis et al.). A study conducted in Japan concluded that the human papillomavirus is responsible for many serious adverse events and is not safe for public use (Beppu et al.). The most frequently reported symptoms following HPV vaccination were immediate pain and swelling at the injection site followed by headaches, fever and fatigue among many others. Researchers in Japan highlighted that there is no evidence supporting the vaccine's safety on individuals that have autoimmune diseases (Beppu et al.). This being said, the case study concluded that in order for immunization to be successful, there must be a high antibody level for a prolonged time period. It has been speculated that initial research did not take the inflammatory reaction that is associated with infection to cause autoimmune diseases into account. Japanese physicians have stopped recommending HPV vaccination to patients on the basis that "long time antigen stimulation with HPV vaccines might also induce complex autoimmune reactions via a mechanism similar to that seen with prolonged infection" (Beppu et al.). As a result, the inoculation rate for the vaccine has decreased at a rapid rate from eighty percent to less than one percent in Japan (Beppu et al.). Due to research carried out on the adverse effects of Japanese citizens, US parents have stressed the perceived safety and risks of the human papillomavirus vaccine.

The media has also influenced HPV vaccination acceptance as thoughts and opinions are easily shared without having evidence from an expert. Individuals are able to post false information that ultimately can affect another individual's perspective on a prominent issue. A study was conducted to analyze the effect fake news has on the anti-vaccination movement and found that "nearly 60% of adults in the US have searched for health information online in the past year" (Chiou and Tucker). As Facebook is one of the largest social media platforms in the United

States, approximately two-thirds of adults report that they obtain most of their healthcare information from the site (Chiou and Tucker). In doing so, many individuals do not check the credibility of their sources, especially on the topic of vaccination. This has a profound effect on the dependability and efficacy of vaccines as the Internet serves as a free and easily accessible way of sharing information. The study found that the "dissemination of misinformation and anecdotal reports of alleged vaccine reactions by the media, the Internet and anti-vaccination groups leads parents to question the need for immunization" (Chiou and Tucker). In doing so, vaccines are often stigmatized as harmful and ultimately leads to the rejection of a vaccine. Considering many individuals fail to inspect the credibility of their sources, they allow for misinformation to determine their perspectives on public health. Chiou and Tucker claim that an additional cause for the declination of the HPV vaccine uptake is due to false stories about the risks and effects of vaccination (Chiou and Tucker). As modern society has become reliant on technology, the media able to claim information without scientific evidence as a way of manipulating perspectives. The exposure to negative attitudes regarding vaccines can cause parents' attitudes to shift, leading to a decreased vaccination rate seen in American society.

Considering HPV is the most common sexually transmitted infection in the United States, the health of the public relies on scientific discoveries (Torre et al.). Human papillomaviruses are responsible for causing many types of cancers and genital warts. Research has suggested that "in the USA about 75% of individuals from 15 to 50 years of age are infected with genital HPV during their lifetime" (Torre et al.). Although there is no treatment for those infected with the virus, scientists suggest that prophylactic vaccines are able to lower the risks of infection and decrease the development of various cancers in the body. Despite the perceived risks associated with the human papillomavirus vaccine, researchers have proved the efficacy of the vaccine. Gardasil®, a

quadrivalent HPV vaccine, was first introduced to the public to prevent against HPV 16 and HPV 18. An investigation carried out in 2007 found that DNA of these specific papillomaviruses were detected in seventy prevent of cervical cancers (Torre et al.). With this taken into account, the efficacy of Gardasil® was tested based on the prevention of cervical precancers and carcinomas due to the infection of HPV 16 and 18. Research confirmed that the vaccines "pooled efficacy is 87% and 78% in preventing cervical persistent infections from HPV 16 and HPV 18, respectively" (Torre et al.). A recent study also concluded that the number of HPV 16 and 18 infections decreased significantly among vaccinated females (White). While comparing data regarding viral prevalence between time periods prior to HPV vaccination and after HPV vaccination was implemented into healthcare, there was an overall fifty-percent decrease (White). Additionally, there was a "significant decline in the diagnosis of genital warts during this time frame" as well (White). Despite the objections of the HPV vaccine, research has shown that the benefits of vaccination outweigh the risks and potential side effects. Individuals that are vaccinated are protected against the development of precancerous and malignant diseases caused by the human papillomavirus.

Regarding parental concerns about the safety of HPV vaccination, scientists have geared research towards addressing the adverse effects reported by patients. An adverse event is a compliance of health issues that occur simply after receiving a vaccine but cannot automatically be assumed to be side effects of inoculation (*HPV Vaccine Safety and Effectiveness Data*). From 2006 to 2017, over eighty million doses of Gardasil® were distributed in the United States by physicians. As a result, there were only about thirty-six thousand reports of adverse effects, with ninety-three percent being classified as non-serious symptoms (*HPV Vaccine Safety and Effectiveness Data*). As HPV vaccinations have closely monitored, The Center for Disease Control

and Prevention claims that studies "have not found any association between HPV vaccination and autoimmune conditions" (*HPV Vaccine Safety and Effectiveness Data*). It has been clinically proven that HPV vaccines that have been available to the public are safe and effective as the benefits of decreasing the risk of cancers outweigh the risks of adverse effects. Medical researchers have concluded that the preventative aspects of vaccination outweigh the risks and possible side effects related to the administration of Gardasil®.

Although evidence demonstrates the impact vaccination has on decreasing the level of HPV associated cancers, lack of information and recommendation from physicians has a detrimental effect on public health. In order to combat this issue and increase vaccine uptake in the United States, physicians must gear recommendations towards parents (Beavis et al.). As safety remains a persistent concern among parents of young adolescents, physicians must properly educate parents about the scientific literature promoting the safety of vaccination. Health campaigns must be put in place to inform the public about the substantial effect HPV vaccination has on decreasing the risks of developing certain cancers in both girls and boys. A study focusing on the importance of a physician's recommendation found that the "strength of the physician's recommendation played a significant role in the decision to be vaccinated, resulting in a 4-fold greater likelihood of vaccination" (Rosenthal et al.). This being said, physicians have an important role in promoting vaccination and the overall goal of increasing HPV vaccination. Instead of addressing sexuality and gender on the topic of HPV vaccination, physicians should focus on properly educating parents about safety and necessity of inoculation. Another study focused on the effectiveness of placing restrictions on social media regarding the advertisement of fake news about vaccines (Chiou and Tucker). Experimental conclusions were found that "exposure to online information that is critical of vaccination leads to stronger anti-vaccine beliefs" (Chiou and

Tucker). In this case, Facebook banned ads that promoted false information that would influence parents' decisions to vaccinate their children. The ban led to an overall decline of Facebook shares by seventy-five percent (Chiou and Tucker). In doing so, the spread of false information has been limited in order to urge individuals to educate themselves on health issues, rather than conforming to the latest social media trends.

The issues seen with the HPV vaccine are extremely prevalent in society today as medical researchers are currently searching for a COVID-19 vaccine. As the pandemic has posed a threat to public health and placed restrictions on daily activities, researchers have been designing a vaccine to restore American lives. However, many individuals have their own doubts and suspicions about the process of creating the COVID-19 vaccine. Research reports that the amount of U.S citizens "who would *definitely* get a coronavirus vaccine now stands at just 21% – half the share that said this four months ago" (Tyson et al.). This reaction is observed mainly due to the widespread public concern about the pace of the process and possible side effects. Similar to the HPV vaccine, "concerns about side effects and uncertainty around the effectiveness of a vaccine are widely cited as reasons by those who would not get a COVID-19 vaccine if one were available today" (Tyson et al.). As seen in most scientific studies regarding vaccination, some individuals are hesitant due to mistrust in research and pharmaceutical companies. In order to combat this issue, the scientific community will target their campaigns toward instilling confidence within public by proving the safety and efficacy of the COVID-19 vaccine.

For decades, vaccines have protected the health of individuals as well as society as a whole by limiting the spread of diseases. Countless studies have continuously shown that when the HPV vaccine is introduced into a population, the rate of cancers caused by human papillomavirus substantially decreases. However, due to predispositions and the power of the media, the HPV

vaccine has suffered in society. The fate of a vaccine ultimately lies within the trust between the healthcare industry and the public. In order to combat this issue, it is the duty of physicians to educate patients about the public health benefits and importance of the HPV vaccination. In doing so, human papillomavirus, along with many others, can be eradicated from the human population.

Annotated Bibliography

Beavis, Anna, et al. "Reasons for Lack of HPV Vaccine Initiation in NIS-Teen Over Time: Shifting the Focus From Gender and Sexuality to Necessity and Safety." *Journal of Adolescent Health*, vol. 63, no. 5, 2018, pp. 652–656., doi:10.1016/j.jadohealth.2018.06.024.

This study explored the reasons in which parents choose not to vaccinate their children against HPV. The researchers found that the leading cause was due to lack of necessity, knowledge and recommendation by a primary care provider. Research also concluded that a small cause was due to the concern of supporting sexual activity at a young age. The study also discusses the protective features of the HPV for both males and females.

Beppu, Hirokuni, et al. "Lessons Learnt in Japan from Adverse Reactions to the HPV Vaccine: A Medical Ethics Perspective." *Indian Journal of Medical Ethics*, vol. 2, no. 2, 2017, pp. 82–88., doi:10.20529/ijme.2017.021.

Beppu and colleagues report the numerous adverse reactions of the human papillomavirus in Japan. The study shared observations about the safety and limitations of the vaccine. There is also speculation that the vaccine is based on commercial interests rather than public health necessity. Additionally, Japanese researchers point out the flaws the vaccine may have on autoimmune diseases which has led to a rapid decline of HPV vaccine uptake.

Brandt, Allan M. "Racism and Research: The Case of the Tuskegee Syphilis Study." *The Hastings Center*, vol. 8, no. 6, 1978, pp. 21–29., doi:10.2307/3561468.

Brandt discusses the ethics of the Tuskegee Syphilis study in Alabama in 1932. Blood samples were collected from African American's to further examine syphilis without proper consent. Although a drug was created in order to treat the disease, the individuals in the study did not receive the proper treatment leading to distrust in the government and scientific studies from certain groups.

Chiou, Lesley, and Catherine Tucker. "FAKE NEWS AND ADVERTISING ON SOCIAL MEDIA: A STUDY OF THE ANTI-VACCINATION MOVEMENT." *National Bureau of Economic Research Working Paper Series*, vol. 25223, 2018, doi:10.3386/w25223.

Researchers aimed to explain the trends seen between the spread of false data and information on the acceptability of vaccines. This study examined the proportion of American adults that obtain their medical news from social media platforms, more specifically Facebook. It was concluded that individuals exposed to negative and misinformation about vaccination, had a negative outlook on the process.

"HPV Vaccine Safety and Effectiveness Data." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 15 Nov. 2019, www.cdc.gov/hpv/hcp/vaccine-safety-data.html.

The CDC reports the efficacy and safety of the three HPV vaccines. In doing so, research has tied the human papillomavirus to cervical, anal, oropharyngeal and vaginal cancers in both men and women when applicable. The CDC has also provided evidence indicating that over ninety percent of adverse effects of the HPV vaccine are deemed as non-serious which further supports that the risks of vaccination are minimal.

Konkel, Lindsey. *Explainer: What Is a Vaccine?* 22 Apr. 2020, www.sciencenewsforstudents.org/article/explainer-what-vaccine.

Lindsey Konkel simply describes the basis of a vaccine and the scientific explanation as to how vaccines provide immunity. Konkel also supports the implementation of mandated vaccine programs as a way of promoting herd immunity. Trends have shown that populations with a greater rate of vaccine uptake allows for the spread of diseases to be suppressed.

Jamison, Amelia M et al. ""You don't trust a government vaccine": Narratives of institutional trust and influenza vaccination among African American and white adults." *Social science & medicine (1982)* vol. 221 (2019): 87-94. doi:10.1016/j.socscimed.2018.12.020

Jamison and researchers interviewed African American and White adults on their viewpoint on influenza vaccination. As a result, they found that African Americans were more likely to be hesitant towards vaccinations due to historical medical injustices.

Rosenthal, S.l., et al. "Predictors of HPV Vaccine Uptake among Women Aged 19–26: Importance of a Physician's Recommendation." *Vaccine*, vol. 29, no. 5, 2011, pp. 890–895., doi:10.1016/j.vaccine.2009.12.063.

Researchers have found that a physician's recommendation is one of the most important factors of promoting a vaccine. The public relies on the opinions of professional care providers as a way of determining what is best for their health. Rosenthal and researchers claim that physicians have an important role in promoting vaccination in American society.

Stern, Alexandra M, and Howard Markel. "The History Of Vaccines And Immunization: Familiar Patterns, New Challenges." *Health Affairs*, vol. 24, no. 3, 2005, pp. 611–621., doi:10.1377/hlthaff.24.3.611.

Stern and Markel explore the history of vaccines beginning with the first man made vaccine against smallpox. The analysis also focuses on the scientific discoveries and implementation of vaccination in society. Additionally, Stern and Markel explain the response of the public, especially protestors.

Stewart, Alexandra J, and Phillip M Devlin. "The history of the smallpox vaccine." *The Journal of infection* vol. 52,5 (2006): 329-34. doi:10.1016/j.jinf.2005.07.021

Stewart and Delvin explain the history of the smallpox vaccine and the perpetual impact it has had on the world. In doing so, researchers claim that vaccines are one of the most prominent scientific discoveries.

Torre, G. La, et al. "HPV Vaccine Efficacy in Preventing Persistent Cervical HPV Infection: A Systematic Review and Meta-Analysis." *Vaccine*, vol. 25, no. 50, 2007, pp. 8352–8358., doi:10.1016/j.vaccine.2007.09.027.

Researchers have shown that HPV affects 75% of individuals from 15 to 50 years of age in their lifetime. Additionally, Torre demonstrates how common HPV 16 and 18 are genetically sequences from precancers and carcinomas related to HPV. The study conducted demonstrates how Gardasil® targets HPV 16 and 18 to prevent cancer.

Tyson, Alec, et al. "U.S. Public Now Divided Over Whether To Get COVID-19 Vaccine." *Pew Research Center Science & Society*, Pew Research Center, 18 Sept. 2020, www.pewresearch.org/science/2020/09/17/u-s-public-now-divided-over-whether-to-get-covid-19-vaccine/.

As America is confronted with the COVID-19 pandemic, researchers interviewed Americans about their thoughts on receiving a vaccine to prevent against coronavirus. Initially almost 50% believed they would receive the vaccine, however, only 21% of Americans still feel this way. The scientific community will now have the battle with the common misconceptions about vaccines for the sake of public health.

White MD. Pros, cons, and ethics of HPV vaccine in teens-Why such controversy?. *Transl Androl Urol*. 2014;3(4):429-434. doi:10.3978/j.issn.2223-4683.2014.11.02

The main purpose of this study was to examine the efficacy of the HPV vaccine on preventing HPV infections, anogenital warts and cervical cancers in women. The study that the HPV vaccine had a substantial impact on both males and females and the development of HPV infections and related cancers. The study also concluded that the benefits of vaccination outweighed all risks and potential side effects.