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Introduction

Vaccine hesitancy is defined by the World Health Organization as delay in making a decision to accept or reject a vaccine, despite the vaccine's availability (WHO, 2019). It has also been declared one of the top 10 threats to public health (Szilyagi et al, 2020). There are many factors that come into play when a patient is choosing whether or not to get vaccinated. Minors are represented by a guardian who typically makes the decision on vaccines and other health outcomes. Vaccine hesitancy is seen both in patients as they make their own health decisions and in parents as they decide for their child. Many factors can contribute to hesitancy or readiness to make these choices, such as values, education, and potential effects of the vaccine. Today, with the rise of social media, it is even easier to spread these myths and harder to distinguish fact from fiction. This review will discuss the human papillomavirus (HPV) vaccine and its association with vaccine hesitancy.

While autonomy is an important part of the healthcare process, the decision to reject vaccines can have adverse effects. Vaccine hesitancy not only effects the patient in question, but the whole community around them. Today, populations are able to live without fear of many vaccine-preventable diseases. Even if an individual is not vaccinated, for whatever reason, the number of vaccinated individuals in their community keeps them mostly protected. This concept is called herd immunity, and it is important because it protects the people who cannot be vaccinated due to medical conditions or age. When you add to that number the patients who choose to reject a vaccine, the significant numbers of unvaccinated individuals means that this safeguard is not there.

The human papillomavirus (HPV) vaccine is administered to adolescents in a series of two shots, beginning around age 11. This age is recommended because at this point in a child's life, they are less likely to have been exposed to the virus (CDC, 2019). Human papillomavirus is very common, so common that it is expected that almost everyone will be exposed at some point in their life. The infection itself is not as much of a concern as the cancers it can cause affected individuals

later in life. Every year, over 25,000 cases of HPV-associated cancers are reported, and thousands of these cases result in deaths (Luisi, 2020). HPV can lead to cancer of the throat, anus, and genital areas of both men and women. A person becomes infected after skin-to-skin contact or by having oral, anal, or vaginal sex with someone who is infected (CDC, 2019). Despite these concerns, a study done in 2018 found that only 54% of girls and 49% of boys in the United States had completed the HPV vaccine series (Szilyagi et al., 2020).

Factors That Contribute to Vaccine Hesitancy

Vaccine hesitancy is a very complex issue. Patients and guardians must evaluate their vaccine options against many aspects in their life. In some places, policies are in place that eliminate the need for the decision process. Certain vaccines are required by employers, groups, or for children to begin school. While controversial, these policies increase vaccine uptake. When a vaccine is optional, there are many factors that go into the decision-making process.

Knowledge is a key factor when making vaccine decisions. Researching side effects, efficacy, and safety of a vaccine is important rather than basing a decision on what is expected. Studies have shown that parents who reject certain vaccines have typically done more research on the topic than those who accept them. Parents who refuse a vaccine on behalf of their children, overall, have been found to have more knowledge and interest in health issues. Knowledge and perceptions of susceptibility and severity also play a role. Perceived susceptibility refers to how likely someone believes they are to contract the vaccine-preventable illness. The more susceptible they believe themselves to be, the more likely they are to become vaccinated. Perceived severity is what an individual believes will be their outcome if they do contract the disease, and how severe they believe that to be. Again, the more severe they believe it to be, the more likely they are to accept the vaccine (Dube et al., 2013). Comprehensive sex education and clear, open communication with healthcare

providers can help increase knowledge and understanding of the risks associated with sexually transmitted infections, such as HPV.

Beliefs and social influences also play a major role in vaccine hesitancy. Having family members or peers who are vaccinated and vaccinate their children increases the likelihood that an individual will do the same. Moral beliefs and values also may play a role. Some cultures and religions have strong ties to traditional medicine and may prefer traditional preventive methods over vaccines. Religious groups, such as the Amish in the United States, also express an opposition to vaccines that contradict their belief systems (Dube et al., 2013).

The HPV vaccine has its own unique set of challenges. First of all, because it is a series, patients must be willing and able to get two doses, something that can be challenging. Not only must they be able to access and afford a second dose, but they must also understand the importance of the second dose. Receiving both doses within a certain time period is also important, which can be a potential barrier. Another important consideration is the fact that human papillomavirus is a sexually transmitted infection. This can bring on hesitancy in that parents may fear that by vaccinating their children, they are sending a message that it is now okay to become sexually active. This can become a substantial barrier among groups who see sex as a taboo or otherwise may fear judgment (Bonanni et al., 2017). A final consideration is that with modern medical interventions, women have pap smears and other preventive care that they may mistakenly believe is sufficient for cancer prevention (Bednarczyk, 2019).

Common Myths Regarding the HPV Vaccine

A large contributor to vaccine hesitancy is the presence and spread of myths and other false information. There are many myths and misunderstandings regarding the human papillomavirus vaccine, in particular, due to its relation to sexual activity and the age at which it is administered. One myth is that the HPV vaccine itself is not safe. This myth is based on reports of individual

deaths that occurred sometime after receiving the HPV vaccine. After being reported to the CDC, these deaths were investigated, and no evidence was found connecting the vaccine to the deaths. Another concern is that being vaccinated will lead to autoimmune disease or cause ovarian failure. Regarding both concerns, studies showed that neither issue is not caused by the vaccine, and there was no connection found at all to autoimmune disease development. Other concerns have been raised regarding insufficient testing of the vaccine before its approval. Upon the US approval of the HPV vaccine in 2006, there had been many clinical trials done to test safety and effectiveness. Following this, there continue to be many studies published confirming the safety of the vaccine (Bednarczyk, 2019).

Others assert that the vaccine is not effective or is not necessary. When first developing the HPV vaccine, clinical trials were done to monitor subjects for pre-cancers only. This was done because the cancers that can result from human papillomavirus take years, sometimes even decades, to develop. This study design led to hesitancy among those who believed that the vaccine had not actually been shown to prevent cancer. While not proven immediately, with continued monitoring, researchers have seen the prevalence of HPV-related cancers decrease in those who received the vaccine. Because the HPV vaccine is linked to prevention of cervical cancers, some hesitant parents feel that early detection through a pap smear is sufficient, so therefore the vaccine is not necessary. While it is true that regular pap smears are important for early detection of cervical cancer, they do not assess for other cancers, such as those of the throat and anus, that can be caused by human papillomavirus (Bednarczyk, 2019).

A third belief among hesitant parents is that 11 or 12 years of age is too young to vaccinate. People may believe this for various reasons, but it is commonly asserted that the vaccine could "wear off" or that getting a child vaccinated sends a message that it is okay to be sexually active at their age. There has been research done on both of these viewpoints. In clinical trials, researchers

found that when vaccinated at age 15, teens did not have as great of an immune response as their younger counterparts. This led to the recommended age being lowered, in 2016 (Bednarczyk, 2019). A study done on 26 girls, ages 11 and 12, focused on the importance of education for preventing risky sexual behaviors. When first interviewed, many of the girls had a fairly good understanding of HPV, recognizing that HPV is a sexually transmitted infection and that the vaccine can prevent certain cancers. Half of the girls studied, however, demonstrated low or inconsistent knowledge about HPV and the vaccine. Common misconceptions were identified regarding the type of cancer that is prevented and how HPV is spread. Overall, knowledge and understanding of HPV and its vaccine increased as the study continued, mainly due to education from a parent or in a school setting. Girls who had open communication with their mothers about sex and safety had more knowledge about HPV and other STIs, as well as more accurate risk perception. Most of the girls interviewed (19 out of 26) had not initiated sexual activity at the time of the second interview (30 months after the first). Of these, 20 reported feeling safer if they were to have sex, but 18 of those 20 agreed that using protection, such as a condom, would still be necessary (Mullins et al., 2015). This study helps illustrate the point that building a good understanding of safe sexual behaviors with adolescents is related to safer sex practices and receiving the HPV vaccine does not suddenly cause urges to partake in risky sexual behaviors.

The Role of Social Media

Social media has been shown to play a crucial role in vaccine hesitancy. A 2016 study analyzed over 6,000 Facebook posts written since the FDA approval of the HPV vaccine in 2006. Researchers used search terms such as "HPV vaccine" and "Gardasil" (a brand name for the HPV vaccine) to search Facebook for posts relating to human papillomavirus and the vaccine. The posts were sorted by search term used and the year it was posted, then were assessed to determine the source (individual profile vs. group or public page) and the audience size (number of shares,

reactions, comments). The majority of posts were found to be negative in nature, encouraging the refusal of HPV vaccines. One page that was discovered, called "CancerTruth," was responsible for numerous anti-vaccine posts and had a significant following. One post from the page, written on March 6, 2014, asserted that 1 of every 912 children who received Gardasil subsequently died. It went on to say that when compared to the death rate of cervical cancer, 1 out of every 40,000, young girls are more likely to live if they refuse the vaccine. It contains a link to an article called "The Murdering of our Daughters." This post was found to be the most engaging in the study, with over 6,000 comments, 11,000 likes, and 329,000 shares (Luisi, 2020). As of December 31, 2008, VAERS (Vaccine Adverse Event Reporting System) had received 32 reports of deaths in individuals who had received the Gardasil vaccine. There was nothing found in any of these cases to suggest that Gardasil had caused the deaths (FDA, 2009). It has been made clear that this post does not contain totally factual information, but the message was still spread and likely contributed to vaccine refusal for many girls.

The study done by Luisi was one of many that reviewed social media posts and their contribution to vaccine hesitancy. The study found that the more popular posts (those with more shares, likes, and comments) contained anti-vaccine messages or otherwise negative tones. HPV vaccine benefits were mentioned in less than 20% of the posts analyzed. It was found that most of these pro-vaccine posts were made by organizations and group pages, and most of the others were written by individuals (Luisi, 2020). With a platform such as Facebook, with billions of users who can post almost anything (there are some guidelines and restrictions, which it is important to note have developed and increased over the years), it is easy to see how false information can be spread and get the attention of the masses. Many people will believe statements made by different individuals or groups without checking their sources or critically analyzing their claims. This plays a

huge role in vaccine hesitancy, as the drastic claims lead people astray, but also promote distrust of true professionals and experts in the community.

In February 2019, the Western Cape Department of Health in South Africa announced, via Facebook, their plans to implement a school-based program that would administer the first dose of the HPV vaccine to 9 year old girls in their public school system. The post received a flood of reactions. "Hesitant" comments made up 33% of the total responses. These comments ranged from statements like "I will be sure to keep my children away from that" to more aggressive comments such as "'Omg. . . Agenda 21 in full effect. . . come close to my child with this I will hurt you." "Agenda 21" was a phenomenon that asserted that the HPV vaccine was part of an attempt to reduce the population. The more positive, pro-vaccine comments addressed the severity of HPV related cancers and benefits of being vaccinated (Wiyeh et al., 2019).

There are many ways to quickly spread false information, but with the rise of social media, it is easier than ever. Studies like these show the spectrum of claims and information that is readily available on social media. It is important to address these myths and educate the public on them, but also educate about the importance of critically analyzing sources to discern between fact and fiction.

Interventions

Interventions designed to address HPV vaccine hesitancy have been implemented both in the vaccine recipient community (girls and parents) and among providers and medical students. Both are important populations to target, because each has a distinct role in the vaccine decision process. In fact, physician recommendation has been found to be a contributor to vaccine uptake, as lack of recommendation has been associated with refusal (Holman et al., 2014).

A study done in Italy assessed overall HPV knowledge and potential sources of both hesitancy and confidence in the vaccine. Participants were divided into two groups- an intervention group, who received a questionnaire, and a control group, who did not. The questionnaires were

conducted over the phone, and asked parents and guardians of the girls about human papillomavirus, the HPV vaccine, and cancers associated with HPV. Among parents surveyed, 31.7% said they trusted the vaccine, and 28% were still hesitant. The majority, 62.3%, reported that most of their education on the topic came from a healthcare provider, and of those, 44.5% still believed that they had an inadequate amount of information provided to them. A year after the questionnaire was administered, a follow-up was done to see how many of the girls had completed the entire vaccine series. In the control group, 10.3% completed the series, compared to 27.1% in the intervention group (Palmeri et al., 2017). Despite the low percentage of vaccine uptake in both groups, the percentage doubles between the control and intervention groups. This study cites patient-provider communication and overall education as important ways to prevent vaccine hesitancy.

Another program done regarding patient-provider communication was implemented with medical students. Because provider recommendation plays such a role in vaccine acceptance or refusal, the curriculum was designed to provide students with the tools they will need to address the vaccine in their future practice. A survey done prior to the intervention found that adolescents who had the HPV vaccine recommended to them by their provider were 5 times as likely to take the vaccine (Schnaith et al., 2018). When asked, providers reported having low levels of self-efficacy in addressing the concerns of vaccine-hesitant parents. This intervention, done with 132 medical students at the University of Minnesota, consisted of a presentation from a physician, a video about communication strategies, and role-playing simulations (Schnaith et al., 2018). The effectiveness of the intervention was assessed using pre and post surveys. The results included an increase in overall feelings of comfort and confidence in speaking with vaccine hesitant parents. There was also an increase in knowledge of the benefits of HPV vaccination and increased likelihood of recommending the vaccine to children of both sexes. Prior to the intervention, medical students

reported that they would be more likely to recommend the vaccine to female patients than males, which illustrates the common misconception that the vaccine is not equally as necessary for males and females. On top of these findings, the study discovered that key elements of vaccine uptake included recommendation and strong endorsement by the provider, educational messages about cancers and prevention, followed by same day vaccination (Schnaith et al., 2018). Both interventions attempted to increase knowledge relating to the HPV vaccine, in order to reduce hesitancy.

There are many factors that come into play when a patient or guardian chooses to accept or refuse a vaccine. These include cultural differences, belief systems, socioeconomic status, education level, insurance status, accessibility, and many more. The most common determinant to be addressed in interventions was general knowledge relating to the HPV vaccine. The above interventions used an educational approach, but with two different populations. It has been found that having both patients and providers who are informed and confident in their knowledge increases confidence in the vaccine, and vaccine uptake.

Discussion

Hesitancy is seen for all vaccines, but the HPV vaccine has a unique set of challenges that contribute. First, it requires a series of doses over time. Accessibility and perceptions of finishing the series can prevent it from happening, leaving the patient with a decreased immunity to the virus. Second, because HPV is commonly sexually transmitted, the vaccine may not be seen as necessary. Some may believe that the recommended age is too low, or that it will encourage their children to begin sexual experimentation. Both are false notions, as stated above.

Along with these, there are many myths that have been spread that also contribute to HPV vaccine hesitancy. Some believe that the vaccine is not safe or effective, others are more concerned with the age at which the vaccine is administered and the message that they could be sending by having their child vaccinated.

The interventions assessed here focused on education as a tool to combat vaccine hesitancy. These two studies tackled the issue from different perspectives, as one was implemented with medical students who are soon to become providers, and the other with parents of adolescents who are eligible to receive the vaccine. It is important to acknowledge the connection between these two target populations. In the study done by Palmeri, 45% of parents reported that, prior to the intervention, they had received little to no information about HPV and its vaccine from a healthcare provider (Palmeri et al., 2017). Schnaith found, through the survey of medical students, there was a lack of knowledge on their part as well. When paired with a lack of understanding about how to communicate effectively with hesitant parents, many felt that they would not be likely to recommend the vaccine or would not provide much information to those who seemed to have already made their vaccine decision. After receiving education and going through simulations, the medical students felt more confident recommending the HPV vaccine (Schnaith et al., 2018). These studies demonstrate the importance of education for both providers and patients.

Conclusion

Vaccines are important tools in disease prevention. They have helped to eradicate diseases that once were major threats to entire populations. When a high percentage of a population is vaccinated, and therefore immune, their immunity can protect those who are unable to be vaccinated. This concept, called herd immunity, relies on those who can become vaccinated. When those who can access and receive a vaccine still choose to refuse it, this threatens the immunity of the population. It is for this reason that the increasing prevalence of vaccine hesitancy is being considered one of today's greatest threats to public health (Szilyagi et al., 2020).

Human papillomavirus is a very common virus. It is estimated that everyone will encounter it at some point in their lifetime. By becoming vaccinated, not only does a person avoid being infected, but they also avoid certain cancers that can occur later in life because of the infection

(CDC, 2019). The HPV vaccine is met with hesitancy for a variety of reasons. On top of concerns about accessibility and safety, the fact that HPV is often sexually transmitted leads to conflict with religious and moral beliefs about sex. These combined with the current state of social media and spread of false information contribute to hesitancy in a large percentage of the population who should be receiving the vaccine. There are many ways to address this, but one of the most effective ways is education. Educating patients and providers and fostering communication about the HPV vaccine can increase uptake. Now, more than ever, vaccine hesitancy is an issue, and by increasing awareness and eliminating stigmas, we can combat hesitancy surrounding the HPV vaccine and save lives.

Resources

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