

Assessing Human Papillomavirus Knowledge and Vaccination Intentions Following a Virtual Educational Intervention for Parents and Guardians

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ABSTRACT

Introduction: Human papillomavirus (HPV) is the most common sexually transmitted infection globally, with high-risk strains contributing to cancers of the cervix, penis, anus, vulva, vagina, and oropharynx. Despite the availability of an effective vaccine (Gardasil-9) and broad support from public health organizations, vaccination rates remain suboptimal due to parental hesitancy and misinformation. This study assessed the impact of an educational intervention on HPV knowledge and vaccination intent among parents and guardians of children aged 8 to 17 years.

Methods: Pharmacy students conducted virtual educational sessions via Zoom for parents of children aged 8 to 17 years. Sessions covered HPV transmission, associated risks, and benefits of Gardasil-9. Participants completed presession and postsession surveys assessing knowledge and willingness to vaccinate.

Results: A total of 50 participants attended the sessions; 48 completed the presurvey and 39 completed the postsurvey. Knowledge improved significantly following the intervention (53% vs 90% correct; $P < .001$). Willingness to vaccinate daughters increased from 68% to 89% reporting “very willing,” while willingness to vaccinate sons increased from 70% to 91%. Parents were 1.2 times more likely to report being “very willing” to vaccinate their children against HPV after the intervention.

Conclusions: A virtual educational intervention significantly improved parental knowledge and positively influenced their intent to vaccinate against HPV. Addressing vaccine hesitancy through structured, accessible educational programs may help increase HPV vaccination rates and reduce the burden of HPV-related cancers.

INTRODUCTION

Human papillomavirus (HPV) is the most common sexually transmitted infection among individuals in their late teens and early 20s worldwide.¹ HPV is a group of more than 200 related viruses that infect cells on the skin surface and moist inner linings of body

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cavities. Low-risk HPV types may affect the skin, throat, and genital area, leading to abnormal tissue growth, including cutaneous and genital warts. If left untreated, high-risk HPV can lead to 6 types of cancer. HPV accounts for approximately 90% of cervical and anal cancers, 70% of vaginal and vulvar cancers, 60% of penile cancers, and 70% of oropharyngeal cancers. It is transmitted through intimate skin-to-skin contact including vaginal, anal, and oral sex. Importantly, asymptomatic individuals can unknowingly transmit HPV.²

The prevalence of HPV in the United States is substantial, with more than 42 million Americans currently infected and approximately 13 million new cases annually.³ In 2022, HPV accounted for approximately 660 000 new cases of cervical cancer and 350 000 cancer-related deaths worldwide. It is the fourth-leading cause of cervical cancer and cancer-related deaths among women worldwide.⁴ Approximately 36 000 new cases of HPV-

related cancers are diagnosed annually among men and women in the United States, with an estimated 4000 cervical cancer-related deaths among women each year.^{3,5} The highest incidence and mortality rates from cervical cancer occur in low- and middle-income countries. During 2004-2007, the estimated annual medical cost in the United States amounted to \$9.36 billion for cervical cancer screening and follow-up, treatment of HPV-related cancers and anogenital warts, and recurrent respiratory papillomatosis.⁶ This burden underscores the need for improved awareness of and access to the HPV vaccine.

Protection against HPV is achieved by completing a 2- or

3-dose series of Gardasil-9 prior to exposure. Gardasil-9 is a non-infectious, recombinant vaccine.⁷ More than 15 years of research confirm that the vaccine is well tolerated and effective in preventing HPV-related cancers.⁸ The most common adverse effects include injection-site reactions (pain, swelling, redness) and headache, each with a reported incidence greater than 10%.⁹ Rare but more serious side effects include autoimmune conditions (approximately 2%) and oropharyngeal pain (1%-3%).⁹ The Centers for Disease Control and Prevention (CDC) recommends initiation of the Gardasil-9 series at ages 11 to 12 years; however, vaccination can be initiated as early as age 9 years.¹⁰ “Within 12 years of vaccine introduction, Gardasil-9 reduced infections by 88% in females aged 14 to 19 years,” according to the CDC.¹¹ Additionally, the percentage of cervical lesions caused by HPV decreased by 40% among vaccinated women since the vaccine’s introduction,¹¹ and one study found that vaccination reduced the prevalence of genital lesions by 60.2% in males aged 16 to 26 years.¹² These findings support early vaccination to maximize protection against HPV.

The American Academy of Pediatrics recommends HPV vaccination as early as 9 years of age.¹³ Initiating vaccination at age 9 enables timely completion of the series within 6 to 12 months before potential exposure.¹³ Additionally, children mount a stronger immune response when vaccinated at younger ages.¹⁴ A previous trial found that clinical staff were more willing to recommend vaccination at the earliest eligible age compared with ages 11 to 12 years. Parents were more likely to vaccinate their children when vaccination was recommended at age 9 versus 11 to 12 years.¹⁵ Early vaccination reduces the risk of HPV-related cancers and diseases later in life and represents an important step in safeguarding long-term health.

Vaccine hesitancy is a global challenge driven primarily by concerns about safety. However, studies have identified and refuted common misconceptions associated with HPV vaccination. A 2023 study found that 65% of parents were hesitant to initiate HPV vaccination due to perceptions that it was unnecessary, concerns about safety or adverse effects, lack of knowledge, belief that their child was not sexually active, or lack of a health care provider recommendation. Between 2013–2014 and 2019–2020, hesitancy related to reasons such as “not needed or necessary,” “not recommended,” “lack of knowledge,” and “not sexually active” declined among parents of unvaccinated adolescents.¹⁶ This change may reflect increased public health efforts, greater awareness of HPV and vaccine benefits, and provider recommendations. It is important to recognize public uncertainty and provide education to distinguish opinions from evidence-based findings.

In a 2024 study, a lack of knowledge about the HPV vaccine was the most cited reason minority patients reported little interest in vaccinating themselves or their children. Among unvaccinated adults unwilling to receive the vaccine, common factors included low perceived risk of HPV infection, limited awareness of the vaccine, and doubts about its benefit. Providing education about

HPV and its consequences to minority populations may help address a major barrier to vaccination. Efforts to improve access, convenience, and health literacy may increase uptake among underserved populations.¹⁷

Although support for the HPV vaccine is high among numerous health organizations including the CDC and the American Cancer Society, a 2023 study found that limited knowledge of HPV and Gardasil-9 significantly influences parental decision-making.² To address this knowledge gap, we designed a study to assess changes in parents’ knowledge and willingness to vaccinate their children against HPV before and after an educational intervention. We hypothesized that the intervention would increase both parents’ knowledge of HPV and willingness to vaccinate.

METHODS

Study Design

The study involved parents or guardians of children ages 8 to 17 years old. Parents of children outside this age group and children who had already received the HPV vaccine were excluded. Participants were recruited through flyers distributed at a local community health fair and social media. As an incentive, 1 participant was randomly selected to receive a \$50 Visa gift card. Third-year pharmacy students conducted 28 Zoom sessions covering HPV, complications of untreated infection, and vaccine benefits. Each session consisted of a presurvey, a 10-minute educational presentation, and a postsurvey. Participants accessed the presurvey via a QR code and were encouraged to complete it within 10 minutes of joining the session. Surveys assessed parents’ knowledge of HPV and willingness to vaccinate before and after the presentation. The study was approved by the Wingate University Institutional Review Board, and all participants provided written informed consent.

Educational Intervention

A 10-minute virtual slideshow was delivered via Zoom. The presentation included an overview of HPV, modes of transmission, and symptoms associated with low- and high-risk strains, as well as a comparison of these strains. Education on Gardasil-9 included dosing schedule, benefits, potential adverse effects, and common myths and facts. Participants were informed that the vaccine protects against 9 HPV types, including those most strongly associated with cancer.

Presurvey and Postsurvey

Participants completed online surveys via Qualtrics (Qualtrics, LLC) before and after the presentation. The presurvey contained 4 demographic questions, 5 knowledge-based questions, and 2 questions assessing willingness to vaccinate sons and/or daughters. Demographic questions included parents’ gender, race, and children’s ages. The postsurvey repeated the knowledge and willingness questions. Each knowledge question had only 1 correct

Table 1. Parent Demographics (N=48)

Characteristics	n (%)
Gender	
Male	17 (35)
Female	28 (58)
Prefer not to answer	3 (6)
Race/ethnicity	
African American	23 (48)
White	19 (40)
Hispanic/Latino	4 (8)
Asian	1 (2)
Native American	1 (2)

Table 2. Performance on HPV Knowledge Questions

Question	Presurvey Correct n (%)	Postsurvey Correct n (%)
What is human papillomavirus (HPV)?	21 (44)	35 (90)
How is HPV transmitted?	25 (52)	34 (87)
What are the benefits of the HPV vaccine?	32 (67)	36 (92)
What are the adverse effects of the HPV vaccine?	24 (50)	32 (82)
Untreated HPV can cause which of the following?	26 (54)	38 (97)

$P<.001$

response, and the percentage of correct answers per participant was calculated. Willingness was measured on a 4-point Likert scale (1 = not willing; 4 = very willing). Participants could optionally enter a drawing for the \$50 Visa gift card.

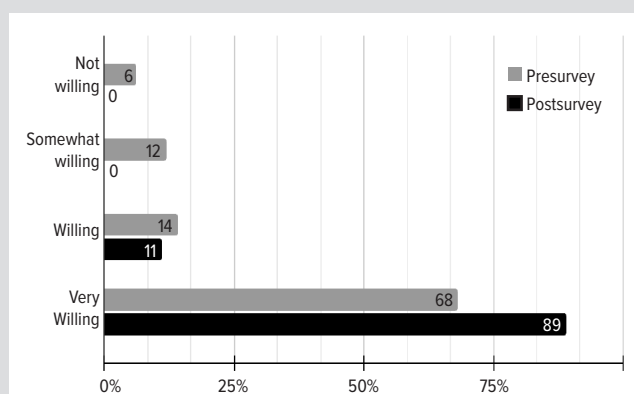
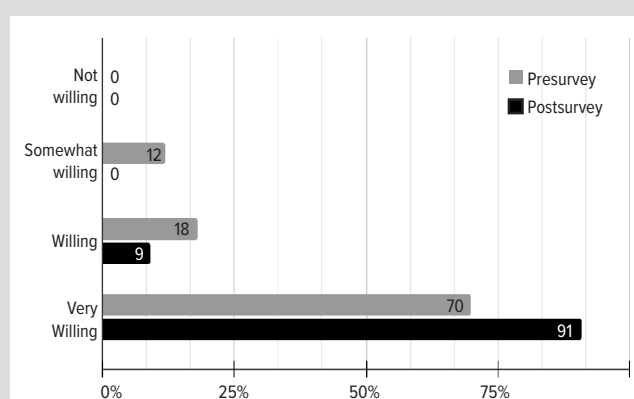
Data Analysis

Data collected via Qualtrics were exported to Microsoft Excel (Microsoft Corp). Survey responses were deidentified. Descriptive statistics were used for demographic data, and a t test assessed changes in knowledge and willingness between presurveys and postsurveys.

RESULTS

A total of 50 participants attended Zoom-based educational sessions. Of these, 48 completed the presurvey and 39 completed the postsurvey. Forty-eight percent were African American and 58% were female (Table 1). Two presurveys and 11 postsurveys were excluded due to duplication or incomplete responses, as their inclusion would have introduced potential outliers and reduced the overall statistical integrity of the results.

Knowledge scores improved significantly from presurvey to postsurvey (53% vs 90% correct; $P<.001$) (Table 2). The proportion of participants reporting they were “very willing” to vaccinate their daughters increased from 68% at baseline to 89% postintervention (Figure 1). For sons, this increased from 70% to 91% (Figure 2). Overall, participants were 1.2 times more likely to report being “very willing” to vaccinate their children against HPV after the intervention.

Figure 1. Parental Willingness to Vaccinate Daughters**Figure 2.** Parental Willingness to Vaccinate Sons

DISCUSSION

Parental vaccine hesitancy is associated with lower childhood vaccination rates.¹⁸ Hesitancy often stems from misconceptions about HPV and the Gardasil-9 vaccine. This study sought to address potential barriers to early HPV vaccination, including limited access to education and stigma surrounding vaccination. Addressing these barriers may improve health literacy and reduce vaccine hesitancy.

Survey data demonstrated that knowledge improved significantly (53% vs 90%, $P<.001$), reinforcing the impact of education on parental attitudes. Additionally, willingness to vaccinate both daughters and sons increased following the intervention, underscoring the role of health literacy in parents' vaccination decisions.

A 2012 study found that mothers were less willing to vaccinate sons than daughters, largely due to lower perceived risk of HPV among males.¹⁹ In contrast, our study found similar willingness to vaccinate both sons and daughters. This may be due to the intervention's educational emphasis on HPV risk in males: that they have a threefold higher prevalence of HPV than females and greater than 5 times the rate of oropharyngeal cancer.²⁰

Many participants demonstrated baseline willingness to vacci-

nate their children against HPV, possibly reflecting increased public awareness, expanded vaccine recommendations, increased research on vaccine safety and effectiveness, and a growing acknowledgment of HPV as a public health issue. Following the intervention, parents were 1.2 times more willing to vaccinate their children and no participants remained unwilling to vaccinate. Many participants also had high presurvey knowledge scores, which may reflect the use of external resources, such as online search engines, during online survey completion.

Our findings are consistent with prior research demonstrating that earlier recommendation (eg, age 9 years) by clinicians improves vaccination uptake and series completion.¹⁴ In this study, “very willing” responses increased by 21% for daughters and 9% for sons.

Research indicates that HPV vaccination rates are lower in minority populations due to lack of awareness and knowledge.¹⁶ This study included a diverse patient population, with substantial minority representation (48% African American, 8% Hispanic/Latino, 2% Asian, and 2% Native American). As awareness among minority communities increases, more individuals may choose to get vaccinated, ultimately contributing to community-wide immunity by reducing the overall risk of infection.

Additionally, the use of Zoom as an educational platform eliminated transportation and in-person attendance requirements, enhancing accessibility and scheduling flexibility, as various dates and times were offered. The intervention required minimal time and no specialized equipment or infrastructure. Costs for materials and personnel were modest relative to the long-term costs if HPV-related disease. Despite its low cost, the intervention significantly improved knowledge and vaccination intent, demonstrating strong potential public health value.

Study Limitations

Several limitations were identified. Recruitment challenges and lack of reminder emails or text messages may have reduced participation. Eligibility criteria limited participation to parents and guardians of children aged 8 to 17 years. Survey responses were analyzed at the group level, potentially reducing generalizability. Technological barriers, including lack of technological proficiency (eg, scanning QR codes, joining Zoom sessions, navigating computer systems) and limited internet access, also may have restricted participation. Additionally, parents may have chosen not to participate due to a bias toward pharmacy students, preferring to receive information from licensed health professionals.

Future research should examine differences between maternal and paternal attitudes, address racial and ethnic disparities, and evaluate optimal timing and messenger (eg, clinicians vs students) for education. This study lacked long-term follow-up, limiting assessment of actual vaccination uptake. Future studies should include objective behavioral outcomes to evaluate sustained impact.

CONCLUSIONS

The Gardasil-9 vaccine provides well-tolerated, effective protection against cancers linked to HPV infection. Addressing barriers, misconceptions, and variability in vaccination across genders and age groups is critical to addressing this public health issue. This intervention employed virtual education sessions delivered via Zoom as a strategy to overcome persistent barriers to HPV vaccination. This format improved accessibility and convenience while maintaining educational quality.

As global vaccination efforts expand, the potential to save lives, lower health care costs, and decrease the burden on health systems increases. The impact of HPV vaccination on reducing cervical cancer incidence and mortality is greatest among women with limited access to regular screening or comprehensive health care services. Although the vaccine benefits all populations, its overall public health impact may be lessened among women who already receive high-quality preventive care, such as routine Papanicolaou (Pap) testing and HPV screening, which reduce baseline risk through early detection. Continued advocacy, education, and equitable access to vaccination are essential to maximize its benefits and improve population health outcomes worldwide.

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