The impact of the HPV vaccine on cervical cancer

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Acknowledgements

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# Table of Contents

Introduction to the Human Papillomavirus ................................................................. 1
Efficacy of the HPV Vaccine .......................................................................................... 6
Acceptability among Young Women .............................................................................. 10
Acceptability among Healthcare Providers ................................................................. 12
Acceptability among Parents ....................................................................................... 14
Estimated Cost/Benefit of the HPV Vaccine ................................................................. 17
Impact of the Vaccine on the Physician Assistant Profession ..................................... 19
References ..................................................................................................................... 20
Abstract ....................................................................................................................... 27
List of Figures

Figure 1. Common HPV types associated with Benign and Malignant Disease .......................24
Figure 2. Risk Factors for HPV Infections .................................................................................25
Figure 3. Factors Contributing to Development of Cervical Cancer .........................................26
Introduction to the Human Papillomavirus

This literature review discusses the impact of the human papillomavirus (HPV) vaccine in women’s health. The vaccine is a new medical breakthrough that has the potential to reduce HPV infection by 70%, and therefore to reduce cost of treatment for HPV disease and cervical cancer deaths. This discussion includes an explanation of human papillomavirus infection, efficacy of the vaccine, acceptance of the vaccine by young women, the healthcare community, and parents, cost effectiveness of the vaccine, and how the vaccine will impact the physician assistant profession.

In this review, the impact is focused on women for two reasons. First, women are directly affected by cervical cancer and this vaccine can reduce the number of infections. Second, men have not been extensively studied, therefore the medical community can only theorize about how men will benefit from the vaccine. The Advisory Committee on Immunization Practices (ACIP) of the Center for Disease Control recommends routine vaccination of females at 11 to 12 years of age (Zimmerman, 2007). This recommendation is very controversial considering the vaccine is to protect against a sexually transmitted infection and this paper discusses how the medical community and the public reacted to this recommendation.

The human papillomavirus (HPV) is a very common sexually transmitted virus with a prevalence rate of 20-40% in sexually active women over 20 years of age (Lowy & Schiller, 2006). In the general population, men were infected at a rate of 33%. The lifetime risk of HPV infection for sexually active men and women is approximately 50% (Villa, 2005). Several studies have shown a wide range of infection percentage in men, 6.9%- 50%, with most studies agreeing with greater than 20% HPV infection among men (Dunne, Nielson, Stone, Markowitz,
& Giuliano, 2006). The prevalence of high risks types peaks at 30-50% for young women in their second and third decades of life (Bosch, 2006). Of the women infected with HPV, those infected with high risk types HPV16 and HPV18 are at the highest risk for developing cervical cancer. HPV types 16 and 18 account for 50% and 20% of cervical cancer, respectively (Lowy & Schiller, 2006).

HPV is a very small virus that must enter the host by microscopic tears in the mucus membrane. Once inside a female host, genital HPV targets the squamous epithelial cell of the cervix (Greenblatt, 2005). The cervix is covered by both columnar epithelium and squamous epithelial cells. In one area of the cervix, called the transformation zone, both of the cell types come together and form the squamo-columnar junction. This junction is a highly dangerous area for dysplasia to occur because of the cellular remodeling of squamous and columnar epithelium. When the virus invades, the squamous epithelial cell does not die as a result of the HPV replication, assembly, or viral particle release because the cell is destined for apoptosis. The virus evades the immune system by hiding in the cervical cells (Stanely, 2005). Because the viral invasion is not accompanied by cytokine release, there is no signal to cell-mediated immunity and the virus is able to persist without resolution (Stanely, 2005). While the high risk types of HPV are active in the squamous epithethium, they are able to produce proteins that block or inactivate tumor suppressor genes, TP53 and RB1, and activate cell cycle related genes, permitting uncontrolled cellular proliferation (Kumar, Cotran, & Robbins, 2003). As the cellular proliferation progresses, cervical epithelial lesions develop at the squamo-columnar junction (Stanely, 2005). These lesions are classified as cervical intraepithelial lesions, CIN 1, CIN 2, and CIN 3 based on the response to viral invasion.
In addition to inactivating the tumor suppressing gene, TP53, the high-risk HPV types produce proteins E6 and E7 which cause considerable malfunction of the cervical cell deoxyribonucleic acid (DNA). The expression of E6 and E7 are critical to transforming a persistent HPV infection into a cancerous process. The protein E6 binds and inactivates tumor suppressor gene p53. Without the p53 gene, the cell does not undergo apoptosis and infection is able to persist, therefore cells accumulate leading to cervical dysplasia. The protein E7 binds and inactivates retinoblastoma protein, Rb the product of another tumor suppressor gene. When the Rb gene is not expressed, the HPV infected cells are able to replicate and eventually release newly formed human papillomavirus (Greenblatt, 2005, (Kumar et al., 2003). Without these suppressor genes in place, the virus maintains its presence in the host.

The reasoning behind the HPV vaccine is to create a successful immune response with protection against specific types of HPV by causing seroconversion after exposing patients to the HPV protein. Stanley and colleagues have shown that HPV infection followed by local cell-mediated immunity is associated with lesion regression and protection against further infection of the same type of HPV (Stanley, 2006). The main goal of prophylactic immunity is to mimic an HPV infection, to cause a cell-mediated immune response, and to protect the host against further infection by HPV.

The HPV vaccine is administered by three serial intramuscular injections. By delivering the vaccine through an injection, the virus-like particles infiltrate the lymphatic system and small vessels systemically, therefore offering an intense immune response to the vaccine (Stanley 2006). This systemic reaction helps to account for the high antibody response seen during clinical trials. Koutsky and colleagues show that seroconversion occurs at a rate of 98% for the targeted HPV types (Koutsky, 2006). After a time of eighteen months, the antibody levels seen
in vaccinated women is equal to or higher than women naturally infected with HPV (Koutsky, 2006).

The HPV vaccine developed by the pharmaceutical company Merck called Gardasil is a quadrivalent, recombinant vaccine offering protection from HPV types 6, 11, 16, and 18 (See Gardasil insert). Types 6 and 11 cause 90% of genital warts and as noted types 16 and 18 cause approximately 70% of cervical cancers. The vaccine is developed by culturing the HPV L1 major capsid protein in recombinant yeast and these particles self assemble into virus like particles (VLPs) (See Gardasil insert). The VLPs do not contain any live virus, therefore they have no oncogenic potential (Ault, 2006). The vaccine is a three series intramuscular shot to be given in a 6-month time frame. The private-sector retail cost of Gardasil is $120 per shot, totaling $360. The Vaccines for Children Program offers free vaccines to children who are uninsured and Medicaid-insured (Zimmerman, 2007).

The HPV vaccine was approved June 2006 based on results of four placebo-controlled phase 2 and 3 clinical studies testing 20,541 HPV naïve women. The results showed the vaccine to be 100% effective at preventing HPV types 6, 11, 16, and 18 related lesions and cervical cancers. It also prevented 99% of genital warts (Zarbock, 2006). The Food and Drug Administration (FDA) approved the vaccine for girls and women aged 9 to 26 years. The Center for Disease Control’s Advisory Committee on Immunization Practices recommended the vaccine for girls aged 11-12 (Control, 2007).

A second vaccine for HPV types 16 and 18 has been developed by GlaxoSmithKline. The bivalent vaccine, called Cervarix, is also a series of three intramuscular injections. GlaxoSmithKline released a media statement announcing the Cervarix submission for US FDA approval in March 2007. GSK formulated the vaccine with a proprietary adjuvant system called
ASO4, which contains aluminum hydroxide and monophosphoryl lipid A. GSK claims that when the virus-like particles are combined with the ASO4 system, the immune response is longer than when combined with the traditional aluminum hydroxide adjuvant (GSK press release 2006).
Efficacy of the HPV vaccine

Clinical trial data show the human papillomavirus vaccine is 100% effective in causing seroconversion against type specific HPV. The Gardasil vaccine is effective against types 6, 11, 16, and 18 and the Cervarix vaccine is 100% effective against types 16, and 18. HPV types 16 and 18 cause 70% of all cervical cancer, therefore the vaccine has a significant potential to reduce the morbidity and mortality of HPV related cervical cancer. Three randomized, placebo controlled studies have shown the efficacy of the quadrivalent HPV vaccine to be very successful. The methods and results of the three studies led by Fife, Villa, and Harper are discussed further (Fife, Wheeler, & Koutsky, 2004; Harper, Franco, & Wheeler, 2006; Villa, Costa, & Petta, 2005).

In a 2004 randomized, double-blind, placebo controlled dose-escalation trials of HPV 11 and 16 vaccines, Fife and colleagues showed that the vaccine is highly immunogenic. In the study of the type 11 HPV vaccine, four doses of 10, 20, 50, and 100 micrograms of the vaccine were injected intramuscularly at months 0, 2, 6, and for the highest dose at month 12. In the study of the type 16 HPV candidate vaccine, dose formulations of 10, 40, and 80 micrograms of the vaccine were injected intramuscularly at months 0, 2, and 6. The study participants were healthy women between the ages of 18-25 who had neither a history of an abnormal Pap smear or genital warts (Fife et al., 2004).

The cut-off value for the serological response was defined as the lowest mMU/ml concentration that could be distinguished from a panel of presumed negative samples. The cut point for type 11 HPV candidate vaccine was 10mMU/ml and the cut point for type 16 HPV candidate vaccine was 6mMU/ml. The seroconversion was measured using competitive
radioimmunoassay (cRIA). In both studies, HPV antibodies were detected in cerviovaginal lavage fluid at month 7 following the beginning of the study (Fife et al., 2004).

With the criterion that immunized participants should develop a type-specific antibody above the cut point of the assay, 100% of participants at each dose in both studies developed antibody at month 7. The HPV type 11 vaccine doses of 20, 50, and 200 micrograms met the cut point for acceptable antibody levels however the lowest 10 microgram dose did not meet the criterion. The HPV type 16 doses of 40 and 80 micrograms met the cut point for antibody levels and the lowest 10-microgram dose did not. In both studies, the antibodies persisted through month 36 following the beginning of the study. In conclusion, all the participants who received active vaccine were seropositive for the respected HPV type vaccine (Fife et al., 2004).

Regarding vaccine safety and adverse reactions, the vaccines were well tolerated. Injection site reactions, including erythema, pain, pruritis, and swelling were reported, yet none of these reactions were so severe to cause any participant to withdrawal from the study. As the vaccine is distributed among adolescent girls, the medical community will need to be aware of further adverse reactions to the vaccine not discovered during clinical trial.

In a separate study conducted by Villa and colleagues, the quadrivalent human papillomavirus vaccine was studied in a randomized double-blind, placebo-controlled efficacy trial (Villa et al., 2005). The study enrolled healthy, nonpregnant females between the ages of 16-23. The quadrivalent vaccine consisted of virus like particles for types 6, 11, 16, and 18 that were purified and adsorbed onto amorphous aluminum hydroxyphosphate sulfate adjuvant. The vaccine or placebo was given at 0.5 mL by intramuscular injection at day 1, month 2, and month 6. Testing for the virus occurred at day 1 and months 7, 12, 18, 24, 30, and 36 post-injection (Villa et al., 2005).
For the Villa study, 2005, the seroconversion cut off point was determined by selecting the lowest possible point at which the virus can be detected. The cut off points were 20 MU/L for type 6, 16 MU/L for type 11, 20 MU/L for type 16, and 24 MU/L for type 18. If participants tested positive for atypical squamous cells at any point during the study, they underwent colposcopy and further treatment. Colposcopy is an in-office procedure to detect dysplastic cervical cells by treating them with different agents.

A total of 552 eligible participants were enrolled in the efficacy trial. Two hundred seventy-seven women were randomly assigned to the vaccine and 275 women were assigned to the placebo. In the vaccine group, four women were infected with HPV type 16 and HPV type 18. In the placebo group, 36 women were infected with HPV. Thirteen were infected with HPV type 6, three were infected with type 11, twenty-one women were infected with type 16, and nine were infected with type 18. With a confidence interval of 95%, the efficacy of the vaccine was 89%.

Over the 30 months follow-up vaccination, the incidence of persistent HPV type 6, 11, 16, or 18 infection decreased by 90% in the vaccine group compared with incidence of HPV infection in the placebo group (Villa et al., 2005). The results showed that the vaccine induced detectable antibody responses in all women who received the vaccine. The antibody levels were significantly higher in women who were vaccinated compared with women with a natural infection of HPV. At month 36, the antibody levels of the vaccinated women remained at or above the antibody levels of women who had a natural immune response. As in the previous study, the vaccine was well tolerated, with no related serious adverse reactions. Overall, the study proved that a quadrivalent vaccine for types 6, 11, 16, and 18 was well tolerated, induced
significant antibody levels for seroconversion, and effectively prevented natural infection of HPV (Villa et al., 2005).

The third study to be explored was developed by Harper and colleagues was a follow-up of a double-blind, randomized, placebo-controlled trial from 2004. The study enrolled healthy women from the USA, Canada and Brazil. Seroconversion was defined at an antibody level at or above 8 U/mL for HPV type 16 and 7 U/mL for HPV type 18. The researchers found that after month 12 and 18, 98% of vaccinated women were seroconverted for types 16 and 18. In the extended follow-up study, vaccine efficacy remained positive for 48 months after vaccination. This study indicated that the vaccine against type 16 and 18 is effective for 4 years after vaccination with no signs of decreasing antibody levels (Harper et al., 2006).
Acceptability of the HPV vaccine in Young Women

The acceptance of the HPV vaccine will be determined by educational, social, and religious factors. Young women, physicians, and parents all need to understand the value of the HPV vaccine and its efficacy for cervical cancer prevention, but specific concerns should be addressed with each audience. Studies repeatedly show that women have a poor understanding of HPV, specifically how the virus is transmitted and resulting dysplasia and cervical cancer (Dell, Chen, Ahmad, & Stewart, 2000). Young women are unable to differentiate low-risk and high-risk types of HPV, were confused about the sequela of HPV infection to cervical cancer and that HPV is both curable and persistent (Sherris et al., 2006).

Knowledge gaps also exist with HPV and the role of Papanicolaou (Pap) smear testing. While women generally understand the Pap smears are diagnostic of dysplasia, communication about the HPV vaccine will need to be clear to ensure that women continue to receive annual Pap smears (Giles & Garland, 2006). The type-16 and type-18 HPV vaccine will protect women from 70% of cervical intraepithelial neoplasms, however other identified high-risk types are not included in the vaccine; therefore healthcare practioners must be diligent in educating women about continuing with cervical cancer screening (Wiley & Masongsong, 2006). Other high-risk types of HPV that have been identified are 31, 33, 45, 52, and 58 are oncogenic (Hymel, 2006).

In a study conducted by Kahn and colleagues 2003, researchers studied women’s knowledge of HPV and their intent to receive the HPV vaccine. After explanation of HPV and the human papillomavirus vaccine, eighty-nine per cent of the participants agreed that receiving the vaccine is a good idea for themselves and their daughters. The participants believed the vaccine was safe and effective in preventing future infections with HPV and subsequent cervical cancer. In an attempt to ascertain the women’s attitudes about sex after receiving the vaccine,
researchers asked if the women would feel safe having more sexual partners or use condoms less often (Kahn, Rosenthal, Hamann, & Bernstein, 2003). The majority of women in the study stated that they would not begin practicing riskier sexual behavior due to receiving the HPV vaccine.

The quadrivalent HPV vaccine protects against two high-risk types of human papillomavirus that cause cervical cancer and two low-risk types of human papillomavirus that cause genital warts. One obstacle in addressing the vaccine for young women will be the possible embarrassment of needing a sexually transmitted infection vaccine. One study found that the acceptability of the vaccine was not reduced by the sexually transmitted infection factor (Zimet, Liddon, Rosenthal, Lazcano-Ponce, & Allen, 2006). Gerend and colleagues found that among underserved women, the majority of participants had strong intentions to receive the HPV vaccine. These intentions correlated with several predictors to accepting the vaccine; perceived safety of the vaccine, perceived encouragement from physician, and having received an HIV test (Gerend, Lee, & Shepherd, 2006). The increasing awareness and publicity of the safety and efficacy of the vaccine should positively influence the acceptability of the HPV vaccine.

Healthcare providers will be the main credible source of information for young women. When providing patient education, clinicians should continue to encourage protective sexual practices, such as abstinence, limiting the number of sexual partners, and condom use (Moore & Seybold, 2007). While controversy surrounds administering the HPV vaccine to adolescent girls, clinical trials have proven that the vaccine will decrease HPV-related disease and cervical cancer dramatically in the United States (Moore & Seybold, 2007).
Acceptability among Healthcare Providers

Primary care physicians, pediatricians, and gynecologists also have knowledge gaps about HPV natural history and types, the management, treatment, and prevention of HPV disease (Sherris et al., 2006). As with the general public, physicians were confused about how much reduction in risk a condom provided against HPV. Providers were also confused about the link between genital warts and cervical cancer. Providers uniformly requested HPV clinical training information, clinical decision support tools, and patient education materials (Sherris et al., 2006).

Results from studies assessing the intention of pediatricians, gynecologists, and family practice physicians have noted several trends consistent within the medical community. The majority of practitioners are somewhat or extremely likely to recommend the HPV vaccine to adolescents. Physicians have stated that endorsement from associations will be a major positive influence persuading them to vaccinate adolescent girls (Zimet et al., 2006). To determine the overall acceptability of the vaccine, if practitioners are positively endorsing the vaccine, then young women will be more likely to accept the vaccine as well (Kahn et al., 2003).

The three major studies published also show that physicians are more acceptable of a vaccine targeted toward an older adolescent population, preferably girls over the age of 14 (Kahn, Zimet, & Bernstein, 2005; Raley, Followwill, Zimet, & Ault, 2004; Riedesel et al., 2005). Pediatricians stated that they discussed sexual activity to over 40% of their adolescent patients, but also admitted that they felt uncomfortable doing so (Kahn et al., 2003). Efficacy trials and The Center for Disease Control and Prevention (CDC) agree the most effective vaccination time for young girls is before sexual debut (Woodman, Collins, & Winter, 2001). Almost half of 15-19 year old young women who participated in a recent study were HPV-positive within 3 years of sexual initiation (Woodman et al., 2001).
The most influential factors towards vaccine acceptability were The American College of Obstetricians and Gynecologists (ACOG) approval, vaccine efficacy, age of vaccination, and type of vaccine (quadrivalent or bivalent) (Raley et al., 2004). Gynecologists will be more likely to provide the HPV vaccine if it is endorsed by the American College of Obstetricians and Gynecologists. These physicians would accept a vaccine protecting young women against both genital warts and cervical cancer. In agreement with pediatricians, the gynecologists surveyed prefer vaccinating young women between the ages of 17-22 and if the vaccine covered both low-risk and high-risk types of HPV (Raley et al., 2004).

Family physicians had similar attitudes about the vaccine regarding professional endorsement and age of vaccine (Riedesel et al., 2005). The physicians surveyed reported that the major barriers to vaccinating adolescents would be related to parental refusal. The top five reasons against recommending the vaccine depended on if the parent accepted the vaccine. Over 73% of practioners stated that parental concern about the safety of the vaccine, parental refusal due to their child receiving too many vaccines, and parental concern that a sexually transmitted infection vaccine will encourage riskier sexual behavior (Riedesel et al., 2005). In this study, practioners stated that they felt comfortable discussing sexual issues with adolescents and this was not a significant barrier to recommending the vaccine. Therefore, family physicians will recommend the vaccine provided that long lasting immunity is proven, the vaccine will not lead to adverse side effects, and the vaccine will protect against cervical cancer and genital warts (Riedesel et al., 2005).
Acceptability among Parents

The Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention recommends the administration of vaccines to children and adults (Control, 2007). The ACIP has recommended the HPV to be administered to all 11- to 12-year old girls. The vaccine is FDA-approved for women aged 6-26 (Zardock, 2006). It is estimated that 24% of 15-year-old girls, 38% of 16-year-old girls, and 62% of 18-year old girls have engaged in sexual intercourse (Abma & Sonenstein, 2001). The prevalence of HPV is highest in young women, after their sexual debut (Trottier & Franco, 2006). While the majority of parents agree to vaccinate their daughters, parents express several concerns about vaccinating a young population against a sexually transmitted infection.

Several factors positively affect whether a parent will vaccinate their child. HPV knowledge of transmission and sequelae increased some parents’ acceptance of the vaccine. In a study reviewing acceptance among parents of children aged 10- to 15-years old reported that after reading information about the prevalence of HPV, its mode of transmission, and severity of sequelae, the percentage of parents agreeing to the vaccine rose from 55% to 75% (Zimet, 2005). This study shows how vital public education will be to the acceptance of the HPV vaccine. It also reiterates that health care providers will be a strong influence on parents accepting the vaccine as beneficial to their children’s protection against HPV.

An association is found between parents who discuss the human Papillomavirus with their children and the likelihood of accepting the vaccine. In a survey conducted by Brabin and colleagues (2006), parents who discussed HPV with their child were more likely to support the vaccine. This report shows that parents who discuss sex and STDs are more willing to accept a vaccine that will protect their child from a sexually transmitted infection (Brabin, Roberts,
Farzaneh, & Kitchener, 2006). Women who accept the vaccine for themselves are more willing to accept the vaccine for their children. Also, women who believe their daughter is at a higher risk for acquiring HPV are more willing to accept the HPV vaccine (Slomovitz et al., 2006).

Resistance to vaccination comes in several forms. The parents that broadly resist vaccinating their children in general are not going to accept the HPV vaccine (Clogrove, 2006). Although this is a small category of people, this resistance will affect the outcome of decreasing incidence and prevalence of HPV. Also, parents with strong religious and cultural views are not likely to accept the vaccine (Brabin et al., 2006). Some religious groups state that administering a vaccine for a sexually transmitted disease will challenge abstinence based programs (Clogrove, 2006). Parents argue against the vaccine because they believe it may condone sexual promiscuity (Melo-Martin, 2006).

In a study conducted by Monk and colleagues (2006), adolescents were surveyed to determine why they practiced abstinence. The three most cited reasons for maintaining their abstinence were; premarital sex is against their religion, to prevent pregnancy, and they have not found the right person (Monk & Wiley, 2006). Conclusion from this survey infer that parents can be a dominant influence on adolescents regarding sexual decision making by educating teens about sexual relations and the possible consequences. Also, since teens did not cite any sexually transmitted diseases as one of their reasons for maintaining abstinence, then the human papillomavirus as a sexually transmitted infection plays a very small determinant in adolescents’ decision to engage in sex.

Recent studies also present evidence regarding parent’s attitudes about vaccinating young boys as well (Olshen, Woods, Austin, Luskin, & Baucher, 2005; Zimet, 2005). Studies have not been published that show the HPV vaccine efficacy in boys (Olshen et al., 2005). If the vaccine
is efficacious, vaccinating men will be an important step in protecting women from HPV as men are the vector in transmission of the virus. (Zimet, 2005) In a study presented by Slomovitz and colleagues, 66% of the participants showed intention to vaccinating their son if the vaccine was available. However, the reason for the remaining participants feelings against the vaccine is that the male children would not directly benefit from the vaccine (Slomovitz et al., 2006). In a separate study conducted by Olshen et al, the parents agreed to vaccinate boys because immunizing boys against HPV was important to protect future partners and to reduce disease transmission (Olshen et al., 2005). Public education will be important in ensuring herd immunity for both men and women (Dempsey & Davis, 2006). Herd immunity is a type of immunity that occurs when a large segment of the population is vaccinated against a disease, and this provides protection to unvaccinated members of the population. The quadrivalent vaccine developed by Merck offers protection from high-risk types of HPV and low-risk types of HPV that cause 90% of genitals warts. Perhaps parental education regarding the sequelae of low-risk types of HPV will positively influence parents to consent to vaccination of male children.
Cost-effective prevention of gynecologic infection and cancer in women is a significant public health priority. Considering the escalating costs of cervical cancer screening and treatment, a HPV vaccine to reduce the number of cervical intraepithelial lesions and cervical cancer would reduce the associated health care costs. Based on data from 2002, the United States population spent $350 million for treatment of cervical cancer, $450 million for treatment it CIN 2-3 lesions, $150 million for CIN 1 lesions, and 2.1 billion in routine screening (Hymel, 2006).

In a mathematical model analysis conducted by Sanders and colleagues (2003), the researchers tested the cost-effectiveness of the HPV vaccine against the current standard of care for HPV related infections. For the study, developers modeled that 70% of all 12 year-old girls would be vaccinated against high-risk types of HPV. This percentage was used based upon data from HBV vaccine administration. The developers also assumed that a booster shot, at a cost of $100, was needed every ten years. In this vaccination circumstance, more than 272,740 cases of HPV infection, 174,208 cases of cervical intraepithelial lesions, 7,992 cases of cervical cancer, and 3,093 deaths from cervical cancer would be prevented. Through rigorous sensitivity analyses, Sanders found that the vaccine was cost effective compared to current practice and further testing demonstrated that if the vaccine efficacy was as low as 40%, the vaccine would still be cost effective compared to current standard of care (Sanders & Taira, 2003).

Kulasingam and Myers used the State Transition Model to determine the cost-effectiveness of the HPV vaccine versus the current medical treatment of human papillomavirus infection (Newall, Beutels, Wood, Edmunds, & MacIntyre, 2007). In this model, the vaccine was given to girls aged twelve, with 100% compliance and a booster shot given every ten years.
With the assumption that the variables the researchers used are accurate (i.e. HPV incidence, disease progression), the model indicated that the HPV vaccine would be cost effective compared with current practice (Newall et al., 2007).
Impact of Vaccine on Physician Assistant Profession

The new HPV vaccine will be beneficial and challenging for PAs practicing in many areas of medicine. Practitioners in Family Medicine, Gynecology, and Pediatrics all serve the patient population that is approved for vaccination. With the recommendation to vaccinate girls between the ages of eleven and twelve, practitioners will have the opportunity for many educational moments. An important point will be to discuss safer sexual behavior, including contraception, abuse, and gynecologic care. Both the young girls and their parents will need to understand exactly how the vaccine protects women from human papillomavirus but that protection against other sexually transmitted diseases are not covered, therefore consistent barrier method contraception is needed during sexual intercourse.

Besides the rather controversial nature of the HPV vaccine, practical issues are challenging for Physician Assistants. The CDC has incorporated the vaccine into the Immunization Schedule and one difficulty is administering the vaccine to all eligible girls. Public health policy will need to offer financial assistance and education to ensure implementation of the CDC’s recommendation. If government standards are issued and Medicare is able to cover the cost of the vaccine, then more adolescents will likely be able to comply with the costly three series vaccine. Another issue surrounding the vaccine is compliance to complete the three serial intramuscular injections. Maintaining the vaccine schedule is important in ensuring complete seroconversion. Studies have not shown how effective the vaccine can be against HPV based on incomplete treatment of the vaccine. Overall, the HPV vaccine will enable PAs to educate young girls about safer sex practices and to offer them an effective means of preventing harmful sequelae of HPV infection.
References


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<thead>
<tr>
<th>Group</th>
<th>HPV Types</th>
<th>Manifestations</th>
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</thead>
<tbody>
<tr>
<td>High-Risk</td>
<td>16, 18 31,33,35,39,45,51,52,</td>
<td>Low-grade cervical changes</td>
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<tr>
<td></td>
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<td>High-grade cervical changes</td>
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<tr>
<td></td>
<td></td>
<td>Cervical Cancer</td>
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<tr>
<td></td>
<td></td>
<td>Anogenital and other cancers</td>
</tr>
<tr>
<td>Low-Risk</td>
<td>6,11 26,42,43,44,53,54,55,</td>
<td>Benign low-grade cervical changes</td>
</tr>
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<td></td>
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<td>Condylomata acuminata</td>
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Figure 1. Common HPV types associated with Benign and Malignant Disease

Mayeaux, E
Prophylactic HPV vaccines
Women’s Health in Primary Care
July-August 2006
22-29
Risk Factors for HPV Infection in Girls and Women

<table>
<thead>
<tr>
<th>Risk Factor</th>
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<tbody>
<tr>
<td>Age Younger than 25</td>
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<tr>
<td>Increased number of sexual partners</td>
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<tr>
<td>First sexual intercourse at 16 or younger</td>
</tr>
<tr>
<td>Sex with a male who has had multiple sex partners</td>
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Figure 2
Risk Factors for HPV Infections

Moore, Shelly and Seybold, Virginia
HPV Vaccine
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36-41
<table>
<thead>
<tr>
<th>Risk Factor</th>
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<tr>
<td>Cigarette Smoking</td>
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<tr>
<td>Few or no screenings for cervical cancer</td>
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<td>Multiple Sex Partners</td>
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<td>Immunosuppressed State</td>
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<tr>
<td>Long-term oral contraceptive use (&gt;2 years)</td>
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<tr>
<td>Co-infection with another STI</td>
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<tr>
<td>Pregnancy</td>
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<tr>
<td>Nutritional deficiencies</td>
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<tr>
<td>Early onset of sexual activity</td>
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Figure 3

Factors Contributing to Development of Cervical Cancer

Moore, Shelly and Seybold, Virginia
HPV Vaccine
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Abstract

**Objective:** To examine and discuss the current literature about the human papillomavirus vaccine impact on future cases of cervical cancer. **Method:** Searches of MEDLINE, PubMed, and CINAHL for all literature related to human papillomavirus, vaccine, and cervical cancer. **Results:** The human papillomavirus can potentially reduce HPV infection by 70%, therefore reducing medical expenses for cervical dysplasia and cervical cancer. The ACIP of the CDC recommends vaccinating girls between ages 11-12. The vaccine is administered by three intramuscular injections. Acceptability of the vaccine depends on young women, parents, and healthcare providers. Two studies have predicted that the HPV vaccine will be cost-effective compared to current standards of care. **Conclusion:** The HPV vaccine can successfully prevent HPV infection. All eligible females should be vaccinated. Physician Assistants will be able to educate girls about safer sex practices and offer an effective protection against HPV.