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Cancer Prevention: HPV Vaccination

Tami L. Thomas, PhD, RN, FAANP, FAAN [Associate Dean of Academic Affairs and Associate Professor]

Nicole Wertheim College of Nursing and Health Sciences, Florida International University, 11200 SW 8th Street, AHC -3, Miami, Florida 33199

Tami L. Thomas: tthomas@fiu.edu

Abstract

Objectives—To provide an overview of Human Papillomavirus (HPV) vaccination as cancer prevention with current strategies that nurses can use to help patients and parents overcome barriers to HPV vaccination.

Data Sources—Peer reviewed literature, presentation abstracts, and current immunization recommendations from the Advisory Council on Immunization Practice (ACIP).

Conclusion—Nurses can help prevent cancer by encouraging HPV vaccination during routine immunization and make HPV vaccination normal and routine.

Implications for Nursing Practice—A vaccine to reduce/eliminate HPV related cancers enables nurses' at all educational levels to advocate for cancer prevention through initiation and completion of the HPV vaccine series.

Keywords

Cancer; prevention; nursing practice HPV vaccination; oncology nursing

A number such as 3.7 billion dollars can be terrifying, and rightly so – but this gigantic number is the healthcare costs of cervical cancer. In addition, a staggering $252 million is spent on a yearly basis to manage and treat Human Papillomavirus (HPV)-related cancers and infections endured by both women and men.[1,2] HPV infections are associated with large percentages of various types of cancer: 96%–99% of cervical cancers, 90%–93% of anal cancers, 12%–63% of oropharyngeal cancers, 36%–40% of penile cancers, 40% of vaginal cancers[3–6] and 40%–51% of vulvar cancers.[3–7]

The two most common cancer causing DNA subtypes types of HPV are 16 and 18 and their distribution varies substantially, constituting approximately 79% of carcinomas in North America and 68% of carcinomas in Africa.[8] The pervasiveness of these kinds of infections in U.S. males over the age of 19 living in high risk populations is thought to be

approximately 65%–93%, with the nationwide prevalence for women estimated to be about 45% for ages 14–59 as of the year 2015.[9]

Pathophysiological mechanisms of HPV Infection and Vaccine-Induced Protection against Cancer

As a result of its unique mechanisms of infection, contact with high-risk HPV types 16 and 18 most often lead to cancer development.[10,11] These papillomaviruses are the only known viral infections that self-initiate, interacting with the cell surface when it attacks. After that, it takes a mere 24 hours for HPV to fully assimilate the basal cell's nuclear DNA with its own. As a result, the transcription and translation of the infectious genetic material leads to the production of viral proteins that process the disease. Types 16 and 18 express proteins (L1 and L2) not found in low-risk HPV types that are diametrically linked to oncogenesis (cancer cell production) and the promotions of invaded skin cell growth.[12,13,14]. L1 and L2 contribute to HPV's "outer cap layer" or "capsid layer" binding to the basal membrane, the basal cells of future hosts, and the base of the tongue and oral pharynx as with cervical cells.[10]

Cervarix and Gardasil vaccines were used to prompt the recognition of and the antibody protection of a person's natural immunity toward the L1 capsid protein. However, in accordance with the varied expressions of L1, defense is limited by the diminishing amount of cross-type protection from these kinds of vaccines.[15] Cervarix and Gardasil only induce immunity against types 16 and 18 and types 6, 11, 16, and 18 respectively.[16] Their antibody responses plateau 12–18 days after injection and decline until the subsequent injection in the series.[17]

With the help of statistical models, it is predicted that the immune response to L1 antibodies have sufficient memory to recognize and therefore respond to future HPV challenges for 32 years, saving boys and men from the ravages of cancer long after the vaccination series is completed.[18] Current evidence even suggests that the immune memory of L1 induced by the vaccine remains strong enough up to 7 years afterward that it can reliably respond to new forms of HPV.[19] Figure 1 demonstrates the difference between noninfectious and infectious HPV.

While 16 and 18 may be the most commonly occurring HPV genotypes, international distribution varies greatly, accounting for 79% of carcinomas in North America and 68% of carcinomas in Africa.[8] As such, a second generation of HPV vaccines, including Gardasil 9 (described below), are currently being developed with the intent of providing broader cross-type immunity, targeting L2 as it is more highly conserved (providing coverage) across HPV types, and most of all to cover more than just HPV types 6, 11, 16, and 18.[1520]

Research experts, including those from the Centers for Disease Control (CDC), have reported that HPV infections are increasing across cancer sites but remain hopeful in light of the supported increase for vaccination efforts.[21–23] With HPV-related cancer on the rise, it becomes more and more apparent that preventing these cancers through the completion of the prophylactic HPV vaccination series is vital, especially for adolescent boys and girls.

Description of the Vaccine and Current Utilization

Because it is such an effective method of prevention, the HPV vaccine will always be a crucial health promotion element for both boys and girls alike.[24] A simple series of 3 injections over a period of 6 months is an essential step towards reducing HPV-related cancer.[24] Unfortunately, rates of vaccination completion continue to be low, 40% nationwide for girls ages 13 to 17 with Florida having the lowest rate completion rate for both boys (17%) and girls (28%) in the nation,.[23–26] With those kinds of figures, a simple series of 3 injections over a period of 6 months is an essential step towards reducing HPV-related cancer.

Vaccination has been approved by the Advisory Council on Immunization Practices (ACIP),[2] and the CDC to prevent HPV-related cancers including head, neck, throat, cervical, and other cancers caused by HPV types 6, 11, 16, and 18 (subtypes responsible for approximately 99% of cervical cancers and 90% of genital warts)[18,19] is recommended for girls and boys ages 9 to 17.[3,17] In 2009, the HPV vaccine was approved by the Food and Drug Administration (FDA) for use in males ages 9 to 26.[26,27] Two years later, ACIP and the CDC recommended using quadrivalent vaccines in boys aged 11–12, catch-up vaccines in boys ages 13–21, and males ages 22–26 (recommendation for routine use not given).[16]

In February 2015, a 9-valent HPV vaccine called Gardasil 9 was approved for use in both males and females by the FDA.[20,28] Licensed for use in males ages 9–15 and females 9–26, this new vaccine was designed to guard against types 6, 11, 16, and 18 with additional protections against types 31, 33, 45, 52, and 58.[20] Gardasil 9 not only received full committee approval from ACIP but it was agreed its 97% efficacy rate and ability to protect against HPV-related cancers was superior to Gardasil for both males and females.[29] And yet, with no cited preferences for one vaccine or the other it is certain that HPV vaccinations will be a conversation between healthcare providers and their patients.

Even with all of its recommendations and the demonstrated safety and efficacy, HPV uptake remains low.[30] HPV immunization completion rates stay well below projected figures in males (less than 21%), females (less than 60%).[31, 32] These low vaccine rates translate to 79 million people currently infected and another 14 million more people newly infected every year in the U.S.[8] While such alarming rates of cancer continue to rise, completing the prophylactic HPV vaccine series is direly important, especially concerning adolescents in areas of poverty, low literacy, and limited access to primary care and prevention services.[33] Luckily, the concern over mounting HPV-related cancer rates is becoming the subject of more and more studies and even the President's Cancer Panel (PCP) in 2014 made the issue a priority of focus and concern for 2015.[3435] See Table 1, which provides the historical perspective of HPV vaccine approval, utilization and updated recommendations from the Food and Drug Administration and the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention.

Evidenced Based Research Findings for Nursing Practice

Research on the subject of HPV vaccine has shown that there are a variety of reasons that influence its acceptance, which include the place of residence, personal culture, and general economics. Other factors that influence uptake include perceived susceptibility to HPV transmission, personal understanding of vaccine benefits, and barriers to completing the vaccination series.[36]

Recent research indicates that the decision to vaccinate a child is a complex one for a parent to make and is based on many factors including culturally competent interventions to ultimately expand acceptance and receivership of the HPV vaccine. As such, the best approach to this kind of important health discussion should begin with and focus on preventing possible future cancers.[37,38] In 2013, Cochrane collaborations released a systematic review of randomized trials to examine the efficacy of vaccine education through face-to-face interventions and found that they lacked some rigor in regard to measurement tools for knowledge and that more studies are needed.[39] Concordantly, Fuand colleagues[40] also conducted a systematic review which evaluated educational interventions to improve acceptance of HPV vaccine, they also found that more studies are needed to determine the true potential of culturally competent interventions and the ability to reach diverse populations.

Parents have cited lack of access to appropriate facilities, excessive travelling distances, economics, the absence of local healthcare providers, and reduction in the hours of operation at local health departments as some of the major barriers to HPV vaccine completion.[37,41] As most underserved communities operate with close-knit social groups, such populations have significant influence when adopting health promotion activities, therefore making it incredibly important to establish communication and rapport between caregivers and healthcare providers.[42–44] But with an inherent mistrust of healthcare providers and innovations like the HPV vaccine, low vaccination rates persist in underserved populations.[45]

Researchers have gathered data that shows most parents, especially in isolated and underserved communities, are misinformed about reproductive health issues like HPV and are often filled with doubt and anxiety, complicating their decision on the HPV vaccine and leading to vaccination disparities.[46] Poor geographic location can compound problems including poor access to care, lack of academic achievement, and poverty. In areas such as these, suspicion of outsiders is very common and people generally resist healthcare innovations like the HPV vaccine.[47] The parents and caregivers gaining the appropriate knowledge about important healthcare issues is the key to increasing the uptake of the HPV vaccine.

One of the leanest areas of knowledge concerning HPV is the heightened prevalence of infection rates among males. Research shows there is a lack of education among men and fathers on the subject and those without HPV knowledge are shown to have greater shame regarding infection and are not as likely to get involved in preventive actions like receiving vaccination, as HPV vaccination completion rates are still below 40% nationally.[48]

Perceptions of inconvenience that include cost, self-efficacy, and perceived sociocultural norms are associated with lack of vaccine uptake in men.[49] It is possible that the acceptance of the HPV vaccine are even lower in males of adolescent and preadolescent age groups who belong to vulnerable populations.[50]

Current research shows that health disparities concerning HPV are often the result parents neither trusting nor understanding cancer prevention information, a phenomenon of growing concern in underserved communities.[45,51,52,53] Fortunately, strategies for community engagement have proven to give the flexibility required to address diversity and overcome behaviors to affect change.[54,55,56] Research that examines the stages of HPV vaccine adoption in women show that social norms are reliable predictors of vaccine uptake but do not encourage vaccination like proper education materials.[57,58]

Through research, gaps have been identified concerning parents' and caregivers' knowledge of vaccines and HPV-related cancers. Parents possess enthusiasm for cancer prevention education and communities have great willingness to find ways to overcome vaccination barriers.[20–22] A parent's decision to not vaccinate against HPV is frequently thought to be influenced by the fear that their children will engage in early sexual activity and they prefer to have their child wait until they reach a sexually active age.[59] However, data from a 2010 study shows that parents have positive attitudes toward the HPV vaccine especially in rural areas where healthcare providers are scarce[60]; those with conservative religious beliefs, for example, are very likely to provide their children with the HPV vaccine.[61]

In 2013, a study of over 500 parents showed that knowledge of the HPV vaccine was very low, less than 10%t, in underserved populations and that very few grasped the connection between HPV and cancer or knew that boys could be vaccinated.[49, 52] Research suggests that multifaceted approaches and strategies that respect spiritual beliefs and culture are vitally important in crafting effective interventions like increasing knowledge of HPV and how it often leads to cancer.[32,49,53] If parents do not understand the correlations between HPV and cancer, they will underestimate vulnerability to the infection, its severity, and perceived benefits of the vaccine.[53–55,62]

Nursing's Role in Preventing Cancer through HPV Vaccination

The first step towards furthering parents' knowledge of the HPV vaccine is for nurses to use family-centered strategies, sharing information such as the immunization guidelines set forth by ACIP and the CDC and the climbing rates of cancer causing HPV infections. Educating parents from low-income settings on cancer prevention has proven to be challenging for healthcare professionals; the attitudes of parents and caregivers in underserved areas stemming from low knowledge or inaccurate perception, are notorious barriers to HPV vaccination where there is little to no healthcare.[63] But being inclusive of parents and other community members in cancer prevention education and identifying strategies to surmount perceived healthcare barriers is essential to decreasing HPV-related cancer rates. Underserved populations are particularly concerning as their economic, cultural, and geographic disparities tend to govern the decisions of parents planning on vaccinating their

children against HPV. For example, the misperception that the HPV vaccine condones sexual activity needs to be addressed.

An important part of the nursing practice is acknowledging the roles of family, ethnicity, and parental gender. Nurses working with all kinds of diversities have to consider a much broader definition of family when providing parents and caregivers with information on the HPV vaccine. When making these considerations, it is important for healthcare providers to take into account the variety of reasons that dictate parents' child rearing views such as low income, low education level, lack of social support, and varying work schedules.[64]

When a nurse discusses subjects concerning HPV, it is important to communicate knowledge and talk over vaccination intentions, but it is equally important to address the gender gap that occurs during this kind of education, meaning fathers as well as mothers need to participate in the discussions.[60] Most men do not know that HPV is not merely a "woman's disease" and that vaccinating their sons is just as significant as vaccinating their daughters. In focus groups, men and fathers said they believed the HPV vaccine was permission to indulge in promiscuous sexual activities and was therefore worth abstaining from on behalf on their children.[62] Research has shown that this important health measure can be viewed as it is – solely a cancer prevention method – by equally including both male and female roles in HPV health discussions and citing the relevant material like the research of Liddon et al.[65]

See Figure 2 depicts a Stepwise progression of strategies to increase HPV vaccine series completion based on current research and evidenced based practice.

Conclusion and Future Directions

Future research and testing of interventions should focus on increasing HPV education and overcoming the barriers to vaccination by using collaborative learning ideas. With the current and pertinent information in hand, nurses can be a great resource for health promotion and HPV-related cancer prevention.[66]

Before discussions on health and cancer begin, healthcare professionals must take the most crucial first step of building a relationship of respect. The initiation of these links to patients with deference and courtesy, especially with ethnic minorities in underserved areas, must come before discussing vaccination in order to prevent misinformation.[65,66]

With cornerstones of good communication in place, the preeminent focus should be to ensure that parents understand the need of initiation and timing of the vaccine. By beginning the series in boys and girls ages 9 to 11, the body's burgeoning immune response can better protect against HPV-related cancers.[66] Completion of the HPV vaccine series should thus be strongly encouraged, with nurses making it clear to patients and their parents or caregivers that returning within the recommended windows (6 weeks and 6 months, respectively) helps to ensure the vaccine's future effectiveness.[67]

Vaccination is one of the most routine health promotions activities there are, no different than brushing your teeth, getting a flu shot, or committing to regular physical exercise. Like the Hepatitis B or Meningococcal vaccines, the HPV vaccine is also a routine series of

injections intended to encourage a person's health. With hard work and a little dedication, nurses can relay these important facts not only to their patients but to each other as well, starting a chain of discussions that will ultimately lead to more healthy bodies and much happier people. The CDC web site (http://www.cdc.gov/hpv/hcp/commit-cause.html) provides a list of downloadable handouts and resources.

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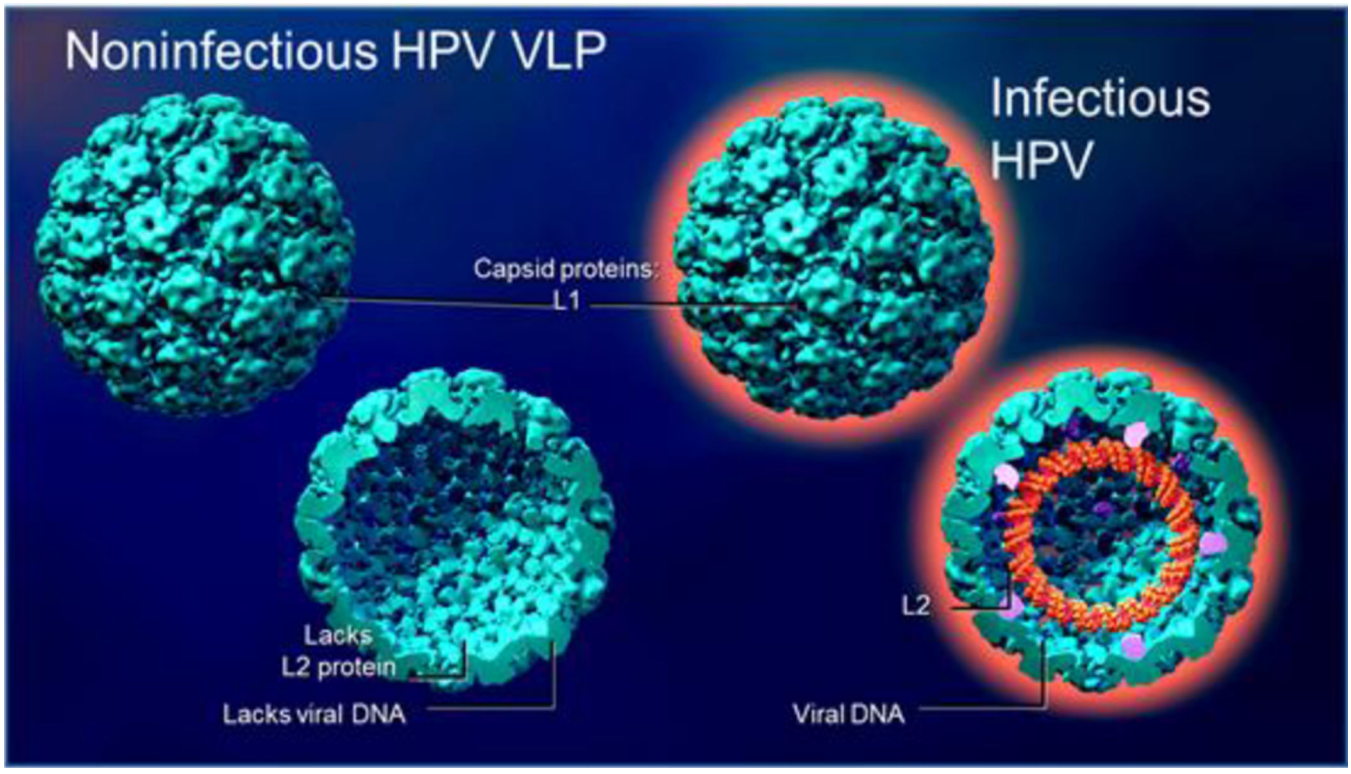

Figure 1. Noninfectious HPV VLP (vaccine) versus Infectious HPV Virus

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Timothy S. Baker, Professor

Departments of Chemistry & Biochemistry and Molecular Biology

University of California, San Diego

HPV – Human Papillomavirus

HPV VLP – HPV Virus Like Particles – resembles HPV but is non-infectious

Viral DNA – deoxyribonucleic acid: a main component of chromosomes and the material that transfers genetic characteristics, in this case the DNA of HPV

L2, L2 protein – protein expressed by HPV subtypes 16 and 18 that are linked to cancer cell production

Capsid Proteins - outer cap layer of the HPV also known as viral structural proteins which can result in the self-assembly of VPLs or Virus Like Particles

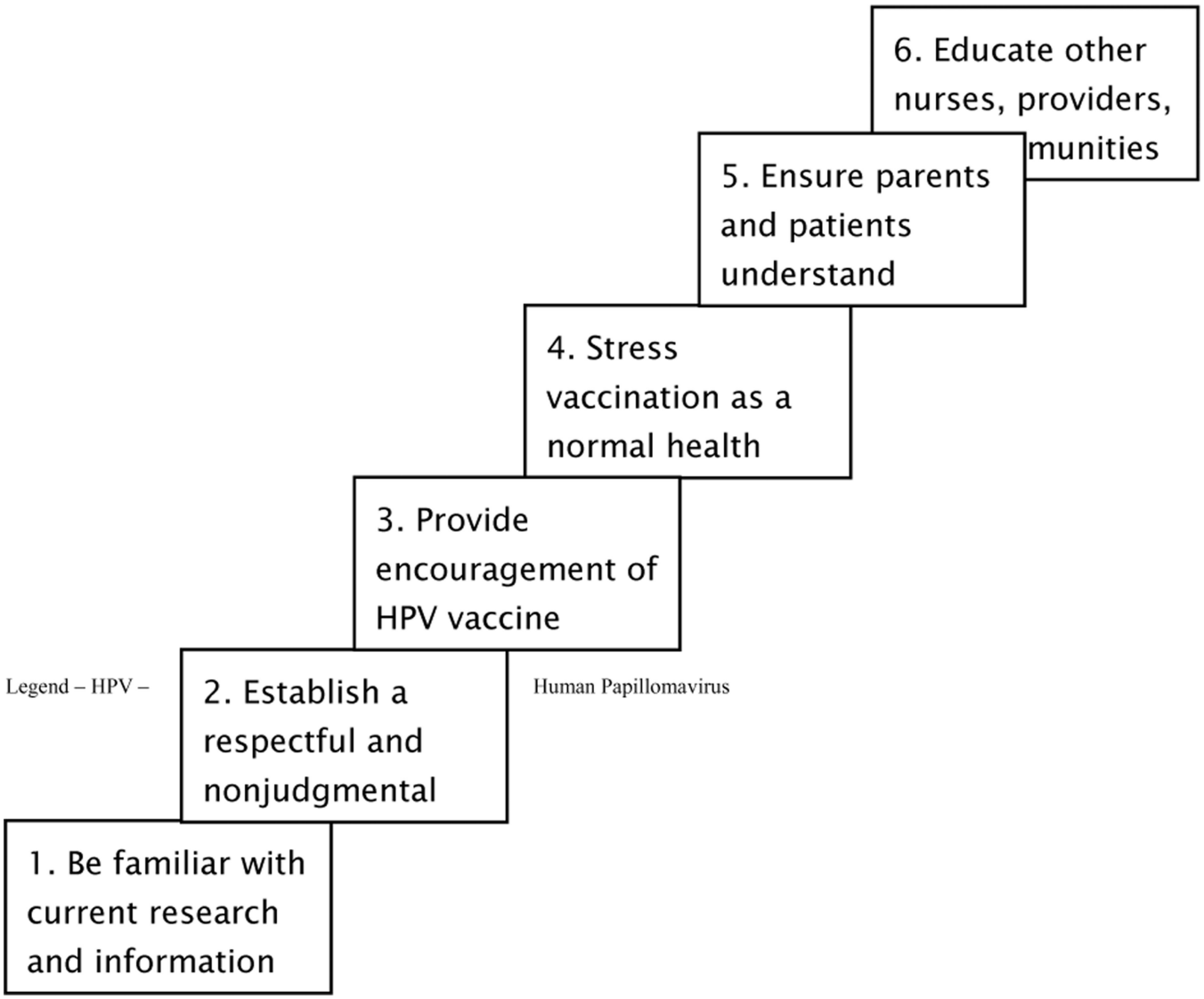

Figure 2.
Suggested progressive steps to overcoming barriers to HPV vaccination series completion

Table 1

Progression of human papillomavirus (HPV) vaccine approval, utilization and development from 2006 to 2016

Date	Description
June 2006	Quadrivalent HPV vaccine, Gardasil, which prevents HPV types 6, 11, 16, and 18, was approved by Food and Drug Administration (FDA). Vaccine is approved for females 9 through 26 years of age.
October 2009	FDA approved use of HPV vaccine in males 9 to 26 years of age.
October 2011	Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC) amended 2009 endorsement of HPV vaccine in order to recommend routine use of vaccine in boys ages 11–12 and catch-up vaccinations in boys ages 13–21. ACIP and CDC further stated that boys 9–10 years of age and 22–26 years of age may also receive quadrivalent HPV vaccine.
February 2015	9-valent HPV vaccine known as Gardasil 9 approved by FDA and recommended for use in both males and females. Gardasil 9 provides same protection against HPV 6, 11, 16 & 18 with additional protection against HPV 31, 33, 45, 52 and 58.
2006-present	HPV immunization completion has remained well below the projected rates for both males (less than 21%) and females (less than 60%), with lower than predicted HPV vaccine completion rates among ethnic minority groups.

Note: Data from references 17, 21, 26–28, 31, 32, 34, 35.