

Human Papillomavirus: The Who, What, When, Where and Why of Vaccination

Faith Brown, PharmD Candidate 2018

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Home Study Monograph



Human Papillomavirus: The Who, What, When, Where and Why of Vaccination

ACTIVITY DESCRIPTION

This program reviews what human papillomavirus is, how it is spread and the pathophysiology behind cervical cancer. The current HPV vaccine available in the United States is discussed in detail, including its storage, handling, administration and disposal. The updated 2017 CDC immunization recommendations are listed in this program along with the analysis of two clinical trials supporting the guideline change. Additionally, this program discusses barriers to vaccination and a list of commonly encountered questions by pharmacists regarding the vaccine. Lastly, the program reviews the pharmacist's role in the vaccination process and the pharmacist's impact on patients to improve compliance with completing the vaccine series

TARGET AUDIENCE

The target audience for this activity is **pharmacists, pharmacy technicians and nurses** in hospital, community, and retail pharmacy settings.

LEARNING OBJECTIVES

After completing this activity, the **pharmacist and nurse** will be able to:

- Identify the clinical significance of HPV and how it is spread
- Analyze literature specific to the rationale for administering two doses of HPV vaccine
- Describe the barriers and challenges to HPV vaccination along with potential remedies.

After completing this activity, the **pharmacy technician** will be able to:

- Identify the clinical significance of HPV and how it is spread
- Recognize the appropriate patient population eligible to receive the HPV vaccine
- Identify barriers to receiving the HPV vaccine and ways to overcome these challenges

ACCREDITATION

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Human Papillomavirus: Background

The Human Papillomavirus (HPV) is the most common sexually transmitted infection in the United States. Over 200 strains of HPV have been identified and can be spread via sexual contact, skin-skin contact and mucosal contact. Greater than forty strains are transmitted via direct sexual contact. Various HPV strains have been linked to cancer, genital and non-genital warts. Because the virus may be spread via multiple methods, condoms do not completely protect against the spread of HPV.¹

HPV has been linked to a variety of cancers, including cervical, anal, oropharyngeal, vaginal, vulvar and penile. The predominant strain resulting in these particular cancers is HPV-16. As expressed in [Table 1](#), HPV-16 is responsible for 35-70% of specific cancers. The rate of oropharyngeal cancer is increasing and predominantly affecting the male population. There is an increased number of male patients being diagnosed with oropharyngeal cancer secondary to oral sex with infected female partners. While the overall risk remains low, it is speculated that males who have greater than five sexual partners and smoke are at increased risk for developing oropharyngeal cancer. According to a 2017 study published in *Annals of Oncology*, the prevalence of oropharyngeal cancer in males at highest risk (>5 sexual partners and smokes) was 14.9%, whereas males classified as medium risk (having either 2-4 sexual partners or smokes) had a prevalence of 7.3%.²

Type of Cancer	Percentage	Most Common HPV Strain(s)
Cervical	Almost 100% total (70% specifically)	16, 18
Anal	95% total	16
Oropharyngeal	70% total (~50% specifically)	16
Vaginal	65% total	16
Vulvar	50% total	16
Penile	35% total	16

Table 1: HPV Derived Cancers

Pathophysiology of Human Papillomavirus

HPV derived cervical cancer is one of the most observable examples of viral induced malignancy. The origin by which HPV infections lead to cervical cancer is well understood. The virus infects the replicating basal epithelial cell layer of the cervix.^{3,4} Other cell types within the cervix are not as easily invaded and are thought to have a form of resistance to the infection.⁴ Once the virus has infected the active cell, it produces proteins which interfere with the cell's ability to control replication. E6 and E7 proteins produced by HPV can disrupt the cell's tumor suppressor gene, p53. By inactivating the tumor

suppressor gene, p53, the cell is no longer able to control the cell cycle, induce apoptosis or perform DNA repair.⁵ The virus is then able to induce rapid cell proliferation, which may lead to cancerous growths. The progression of the growth into an invasive cancer usually occurs over a period of 10-20 years; however, some lesions develop into cancer more rapidly, in as little as two years.⁵

The overall risk of a HPV infection developing into an invasive cancer remains low, despite a large number of women being infected with the virus. In the majority of cases, the body's immune system recognizes the virus as foreign and will induce apoptosis prior to developing into cancer. Approximately 90% of HPV infections clear within 12-36 months and do not develop into cancerous growths.⁵ The ability to clear an infection is dependent on the body's immune system. Certain patient populations are speculated to be at increased risk for infections developing into cancer compared to others. Immunocompromised individuals have a more difficult time clearing the infection secondary to their suppressed immune response. Individuals with Human Immunodeficiency Virus (HIV) and suboptimal CD4 counts, history of bone marrow or organ transplantations, inherited immunodeficiencies or autoimmune disorders are at increased risk of infection with HPV.⁶ The chronic immunosuppression hinders the body's ability to mount an immune response to clear the virus.⁶

Screening Guidelines

The Centers for Disease Control and Prevention (CDC) recommends that all women between the ages 21-65 years old get a Pap smear every three years. The Pap smear evaluates the cells of the cervix under a microscope looking for abnormalities. Women over the age of 30 years are recommended to additionally receive a HPV Co-test in addition to the Pap smear every 5 years. Of note, it is no longer recommended by the CDC to perform annual Pap smears or to screen women under the age of 21 years old.⁷

Vaccines Available

The available vaccines in the United States changed this year. Historically, Cervarix, Gardasil, and Gardasil-9 were available for injection in the United States (US). Gardasil-9 is now the only available HPV vaccine available in the US. Cervarix and Gardasil still may be available in other countries outside of the US. Gardasil was the first HPV vaccine approved by the FDA in the US. Gardasil gained approval in 2006 and includes coverage for HPV-16, HPV-18, HPV-11 and HPV-6. Gardasil is indicated for both males and females and includes coverage for strains of HPV responsible for causing genital warts.⁸ Cervarix gained FDA approval in 2009 for females, and includes coverage for HPV-16 and HPV-18, the two strains most responsible for causing cervical cancer.⁹ GlaxoSmithKline (GSK) made the decision in 2016 to stop producing the vaccine, Cervarix, secondary to a low market demand for the vaccine.¹⁰ Gardasil-9 is the most recent HPV vaccine to gain FDA approval in 2014.¹¹ In December 2016, the CDC issued a statement explaining that Gardasil will no longer be available in the United States after the last doses expired May 1, 2017. Gardasil and Gardasil 9 are both manufactured by Merck; therefore, the CDC decided to offer the vaccine which will provide coverage for more HPV strains.¹² Gardasil-9 covers nine "high risk" strains of HPV that are known to cause cancer and genital warts: HPV 16, HPV-18, HPV-11, HPV-6, HPV-31, HPV-33, HPV-45, HPV-52 and HPV-58 and is indicated for males and females between the age of 9-26 years old.¹¹

Administration, Storage and Handling

The Gardasil-9 vaccine is administered as an intra-muscular injection into the deltoid muscle of the upper arm or into the upper anterolateral thigh area. It is available as a 0.5 mL suspension in a single dose vial or pre-filled syringe. It is encouraged to monitor all patients for fifteen minutes after vaccine administration to ensure no adverse effects occur. Vaccines should be stored in the refrigerator and maintained between 2-8°C (36-46°F). They should not be frozen or stored in the freezer. Gardasil-9 should be administered within 72 hours of removal from refrigeration.¹¹ Sharps are to be disposed of after administration in appropriate sharps containers and empty vials are to be disposed of in appropriate medical waste following reconstitution of the vaccine.

Guideline Changes

In 2017, the CDC guidelines regarding the dosing schedule of the HPV vaccine changed to reflect new available immunogenicity data of the vaccines. The 2017 CDC Guidelines recommend administration of two doses of Gardasil-9 6-12 months apart to boys and girls aged 9-14 years old. Patients aged 15-26 years old should continue to receive the standard three dose series of the vaccine at 0, 1-2, and 6 months. Patients who initiate the vaccine series at age 14 may receive only two doses even if they turn 15 prior to completing the series. Patients who initiate the series at age 15 years old should complete the standard three dose series of the vaccine.¹³

Previous 2016 guidelines recommended the standard three dose series of 0, 1-2 and 6 months to all male and female patients aged 9-26 years old.¹⁴ The rationale for changing the 2017 recommendations derived from immunogenicity trials which concluded that girls and boys less than or equal to 14 years old who received two doses of the HPV vaccine had a non-inferior immune response compared to adolescents and young women who received three doses of the vaccine. Two trials supporting the guideline change are discussed below.

Immunogenicity of 2 Doses of HPV Vaccine in Younger Adolescents vs. 3 Doses in Young Women

Methods and Inclusion Criteria

Dobson and colleagues performed a trial to assess whether two doses of Gardasil administered to girls aged 9-13 years old would result in a non-inferior immune response when compared to adolescents and women aged 16-26 years old given the standard three dose regimen. The study age stratified girls, adolescents and young women into two groups – girls aged 9-13 years old and adolescents and women aged 16-26 years old. The girls (aged 9-13 years old) were randomized to receive two doses of Gardasil 6 months apart or three doses of Gardasil at 0, 1-2, and 6 months. All adolescent girls and young women aged 16-26 years old received the standard three dose series of Gardasil.¹⁵

Primary and Secondary Outcomes

The primary outcome assessed non-inferiority of the Geometric Mean Titer (GMT) ratios for HPV-16 and HPV-18 by comparing girls who received two doses to adolescents and women who received three doses one month after receipt of the last dose of the vaccine. Study personnel drew serum levels of participants at 0 months (prior to administration of first vaccine), 7 months (one month after the last dose of the vaccine) and 24 months to assess outcomes. Participants were further randomized to have serum levels drawn at 18 months or 36 months to assess non-inferiority over time. A power calculation

was performed and determined 835 participants would result in 99% power to detect non-inferiority of the primary outcome. 830 participants were enrolled in the study: 259 girls randomized to receive two doses, 261 girls randomized to receive three doses, and 310 adolescents and young women who received three doses. Baseline characteristics were balanced between groups. Non-inferiority for the primary outcome was defined as a GMT ratio ≥ 0.5 between groups.¹⁵

Results

Girls who received two doses of Gardasil had a non-inferior immune response at month seven for HPV-16 and HPV-18 compared to adolescents and women who received three doses of the vaccine. Although the primary outcome was powered only to assess the GMT ratios for HPV-16 and HPV-18 through month seven, the results showed non-inferiority for all four HPV subtypes (HPV-16, HPV-18, HPV-6 and HPV-11) through 36 months.¹⁵

Immunogenicity of the 9-Valent HPV Vaccine Using 2-Dose Regimens in Girls and Boys vs. a 3-Dose Regimen in Women

Methods and Inclusion Criteria

Iversen and colleagues conducted a trial to assess the immunogenicity of a two dose regimen in girls and boys compared to young adolescents and women given the standard three dose regimen. The study age stratified boys and girls between the age of 9-14 years old to receive two doses of Gardasil-9 6 months or 12 months apart. The study had two control groups – one group of girls aged 9-14 years old and one group of adolescents and young women aged 16-26 years old who received three doses of the vaccine at 0, 2 and 6 months.

Primary and Secondary Outcomes

The primary outcome of the trial assessed the antibody response against the nine HPV strains in the Gardasil-9 vaccine at one month after receipt of the last dose of the vaccine series. A secondary outcome assessed seropositivity rates of all groups following the last dose of the vaccine series. For the primary and secondary outcomes, study personnel drew the serum levels at month zero prior to administration of the first vaccine and one month after the last dose of the vaccine – either at month seven or month thirteen. A power calculation determined that 1500 participants in the study would result in 99% power. 1518 participants were enrolled in the study: 301 girls randomized to receive two doses 6 months apart, 301 boys randomized to receive two doses 6 months apart, 301 boys and girls randomized to receive two doses 12 months apart, 301 girls randomized to receive three doses and 314 adolescents and young women randomized to receive three doses. Baseline characteristics were balanced between groups. Non-inferiority for the primary outcome was defined as a GMT ratio ≥ 0.67 between groups; non-inferiority for the secondary outcome of seroconversion was defined less than 5% difference between groups.

Results

Boys and girls who received two doses of the Gardasil-9 vaccine 6-12 months apart had a non-inferior immune response compared to adolescents and women who received three doses of the vaccine at one month following administration of the last dose of the vaccine series. Each group specifically – girls 9-14 years who received vaccine doses 6 months apart, boys 9-14 years who received vaccine doses 6 months

apart, girls and boys 9-14 years who received vaccine doses 12 months apart – was compared to adolescents and young women who received three doses of the vaccine.

The secondary outcome assessing seropositivity rates at month seven for girls and boys who received two doses of the vaccine compared to women who received three doses of the vaccine concluded a non-inferior seroconversion rate between groups. Authors found less than 5% difference in seroconversion rates when comparing each group – girls 9-14 years who received vaccine doses 6 months apart, boys 9-14 years who received vaccine doses 6 months apart, girls and boys 9-14 years who received vaccine doses 12 months apart – when compared to adolescents and young women who received three doses of the vaccine for all nine HPV subtypes.

Authors performed a post-hoc analysis comparing the GMT ratios of girls who received two doses 6 months apart and girls who received two doses 12 months apart to girls who received three doses of the vaccine. The GMT ratio for non-inferiority for this analysis was defined similarly to that of the primary outcome (≥ 0.67). The results concluded a non-inferior immune response between groups for all HPV subtypes at one month except for subtypes HPV-45 and HPV-52. Girls who received two doses six months apart lost non-inferiority for both HPV subtypes at one month, whereas girls who received two doses twelve months apart lost non-inferiority for only HPV-45.

Barriers to Vaccination

Cost

According to the CDC website, each dose of the HPV vaccine costs approximately \$200. This cost does not include any insurance coverage. Reducing the cost of the vaccine series from \$600 to \$400 is a significant effect of reducing the number of vaccines required based on age.¹⁷

Assistance programs are available to cover the cost of the vaccines for those who qualify. The Vaccines for Children (VFC) Program is a federally funded program which assists in covering the cost of vaccines to children who may not be able to afford the vaccine otherwise. The VFC Program provides free vaccines to children 18 years and younger who qualify for Medicaid, do not have health insurance, have health insurance that does not completely cover the cost of the vaccine or are American Indian or American Native.¹⁸

For those aged 19-26 years old, a separate program is available to cover the cost of the vaccine series. The Merck Vaccine Patient Assistance Program (MVPAP) is a privately funded program which provides the vaccine series to patients aged 19-26 years old who either do not have health insurance or cannot afford to pay for the vaccine series.¹⁸

Federally and privately funded programs are available to provide the HPV vaccine series to patients between the ages of 9-26 years old (the age range in which the vaccine is recommended) at little or no cost to the patient. Therefore, cost should not be a barrier to any patient receiving the vaccine series.

The misnomer that administration of the vaccine may encourage promiscuous behavior

Many parents are concerned that administration of Gardasil-9 to their 11-12 year olds will encourage or lead to promiscuous behavior. The idea derives from the fact that HPV can be spread via sexual contact. As discussed in an earlier section, the Human Papillomavirus may be spread via skin to skin and mucosal contact in addition to sexual transmission. It is imperative that healthcare providers change the

discussion about Gardasil-9 to reflect its ability to prevent cancer caused by HPV rather than highlighting one method of viral transmission.

Secondary to this concern, studies were conducted reviewing the evidence. Smith and colleagues conducted a study published in the Canadian Medical Association Journal comprised of >128,000 girls who received the HPV vaccine series. The study concluded that administration of the HPV vaccine had no statistically significant influence on promiscuity in girls who received the vaccine.¹⁹

Additionally, Jena and colleagues published a study in the Journal of the American Medical Association (JAMA) which included a cohort of >200,000 girls and young women who received the HPV vaccine. The primary outcome of increased rates of sexually transmitted infections was not found to be statistically significantly higher in the group which received the vaccine, suggesting that vaccination with the HPV vaccine does not increase the risk of girls or young women partaking in unsafe sexual activity.²⁰

Unaware of the Benefits

Unfortunately, a large majority of patients and parents are not familiar with the benefits of vaccinating against HPV. This barrier, in particular, is one in which pharmacists are well situated to overcome through education of parents and patients. The vaccines which protect against HPV are the only vaccines available with the ability to prevent cancer. The HPV vaccines do not stop the spread of the HPV infection. Instead, they prevent the virus from developing into an invasive cancer. The idea of herd immunity is applicable to this vaccine. Vaccinating all patients – males and females – between the ages of 9-26 years old can create a generation of patients who are protected against the development of HPV derived cancers. It is imperative for males as well as females to get vaccinated as the number of cases of HPV derived oropharyngeal cancer in males is on the rise.² HPV infections do not only affect women. As discussed previously, HPV infections can cause genital cancers in males as well.¹ Therefore, encouraging the vaccination of all males and females between the ages of 9-26 years old can protect against the development of HPV derived cancers later in life.

Access to a Vaccinator

While disparities exist in many communities for a multitude of reasons, rural areas are particularly affected by access to a vaccinator. In many rural communities, physician offices are sparse and are overloaded with patients making access to a vaccinator difficult for those without an established primary care physician or without regularly scheduled well visits. In contrast to lack of access to a vaccinating physician as a barrier, according to the National Association of Chain Drug Stores, approximately 93% of Americans live within 5 miles of a community retail pharmacy.²¹ Therefore, despite the lack of access to physicians within rural America, pharmacists are conveniently accessible. Albeit pharmacists are readily available to answer healthcare related questions and even administer vaccines, current immunization protocols vary by state and most do not allow pharmacists to administer HPV vaccines for the fully indicated age range. Five states (Florida, Kansas, Nevada, Minnesota, and Wisconsin) still operate under a prescriber-issued immunization protocol. Additionally, age restrictions for pharmacist administration still apply in these states.²¹ Therefore, if a young adolescent patient does not have a regularly seen physician, a nearby pharmacist in most states still would not be eligible to provide the vaccination secondary to state protocol age restrictions.

Follow Up to Ensure Completion of the Vaccine Series

Additionally, accessing appropriate healthcare providers to complete the full vaccine series is challenging for many patients. Not only do patients struggle to identify a provider eligible to administer the vaccine, but they are also responsible for following up to ensure proper receipt of all vaccine doses. This may be challenging for patients to recall the intricate vaccine dosing schedule, as the recommendations differ with respect to age. This grants pharmacists and pharmacy technicians the opportunity to bridge the gap of care between physicians and patients by serving as a “vaccine liaison.” Evolving pharmacist immunization protocols encourage pharmacists to screen patient vaccination history, recommend needed vaccines, then prescribe and administer the vaccines within the pharmacy setting.²² This not only improves continuity of care between the physician and patient, but also improves the likelihood that more patients will receive recommended vaccines.

Preparing for Commonly Encountered Patient Questions

What should I do if I did not complete the series of Gardasil/Cervarix?

Because Gardasil and Cervarix are no longer available in the United States, patients who initiated but did not complete the vaccine series will now need to complete the series with Gardasil-9. The Advisory Committee on Immunization (ACIP) recommends when possible to complete the HPV dosage series with the same vaccine, but completing the series following the recommended timeline is more important than using the same vaccine. This recommendation was given prior to Gardasil and Cervarix being removed from production in America; however, the principal stating that completing the series with a different vaccine remains. As Gardasil-9 is now the only available HPV vaccine this situation will diminish, but for those who initiated the series with Gardasil or Cervarix, it is recommended to complete the series with Gardasil-9.²³

What if I already got the Gardasil or Cervarix? Should I get the Gardasil-9 now?

There is no evidence suggesting that males and females who received a previously available HPV vaccine should repeat the vaccine series with Gardasil-9. Neither the Advisory Committee on Immunization Practices (ACIP) or the CDC have released statements recommending re-vaccination with Gardasil-9.²⁴ However, Merck, the producer of Gardasil and Gardasil-9 performed a study reviewing the safety and immunogenicity of HPV strains in females who received Gardasil-9 after previously receiving Gardasil. The study concluded that patients who received Gardasil-9 after previously receiving Gardasil produced a highly immunogenic response and had a tolerable safety profile.²⁵ While re-vaccinating with Gardasil-9 is not recommended by the guidelines, there is data available supporting its safety.

REF:

After completion of the series, do I still need to get a Pap smear?

While Gardasil-9 provides protection against high risk HPV strains known to cause cancer, there are other strains which are not covered by the vaccine which may cause cervical cancer. Additionally, HPV is not the only cause of cervical cancer. Cervical cancer may arise without an HPV infection. Therefore, it is important for women between the ages 21-65 years old to receive a Pap smear every three years as is recommended by the CDC.⁷

Do I need to get a booster vaccine later in life?

The guidelines do not currently recommend a booster vaccine. However, the study performed by Iversen and colleagues suggests that a booster vaccine may be beneficial. Patients who received the HPV vaccine doses twelve months apart exhibited a greater immunogenic response compared to those who received the vaccine doses six months apart. There are not clinical trials yet designed to assess this outcome; however, it is a subject that will most likely be addressed in the future.¹⁶

Should we recommend waiting 12 months rather than vaccinating at 6 months?

Current CDC guidelines do not specify a preference in waiting twelve months as opposed to six months between dose administration in boys and girls aged 9-14 years old. Iversen and colleagues' study did suggest a greater immunogenic response in those who received the vaccine series twelve months apart as opposed to six months apart; however, the study was not powered to appropriately determine if the difference was statistically significant. All groups – girls who received two doses six months apart and girls who received two doses twelve months apart were found non-inferior compared to girls who received three doses at 0, 2 and 6 months.¹⁶ This data suggests potential benefit in waiting twelve months between doses to mount a greater immune response; however, this trial did not review long term immunogenicity data beyond one month following receipt of the last dose of the vaccine series. Long term immunogenicity studies are needed to definitively determine if twelve months between doses is superior to six months between doses. According to the data currently available and the recommendation by the CDC, administration of two doses to boys and girls aged 9-14 years old is appropriate when given six to twelve months apart. There is currently no preference recommended between waiting six months or twelve months between administrations.

Can I opt out of getting this vaccination?

Just like many other vaccines recommended by the CDC, parents may refuse to have their child vaccinated. However, this is not recommended as the HPV vaccine is currently the only vaccine available with data to prevent cancer caused by human papillomavirus.

Pharmacists' Role

According to the Immunization Action Coalition, all 50 states, the District of Columbia, and Puerto Rico allow pharmacists to vaccinate.²⁶ Specifics about administration protocols, which vaccines may be administered, and the minimum age of the patient in which a pharmacist is allowed to administer a vaccination vary widely by state, however. Under the South Carolina Immunization Protocol, pharmacists are allowed to administer the vaccines listed below to patients 18 years and older without a prescription. For the influenza vaccine, pharmacists may administer to patients beginning at age 12 years.²⁷

- | | |
|---------------------------|---|
| • Haemophilus Influenzae | • Meningococcal (MCV4 and MenB) |
| • Hepatitis A | • Pneumococcal (PPSV23 and PCV13) |
| • Hepatitis B | • Tetanus and diphtheria/Tetanus, diphtheria, and pertussis (Td/Tdap) |
| • Human Papillomavirus | • Varicella |
| • Influenza | • Zoster |
| • Measles, Mumps, Rubella | |

Pharmacists practicing in SC have the authority to administer the Gardasil-9 vaccine to patients 18 years and older. Per the updated 2017 CDC guidelines, patients 15 years and older are still required to receive

three doses of the vaccine at 0, 1-2, and 6 months. Therefore, pharmacists practicing in SC would administer three doses of Gardasil-9 to appropriate patients within their scope of practice and refer other patients to physician services for those who fall outside of the limitations of pharmacist administration. It is imperative for pharmacists to be aware of the guidelines to ensure all patients are receiving an adequate number of doses of the vaccine.

Additionally, pharmacists are equipped to identify patients within the appropriate age to receive the HPV vaccine and inquire about their vaccination history. Pharmacy technicians are a valuable asset to aid in this initiative. Pharmacists and pharmacy technicians can work together to flag male and female patients within the ages 9-26 years old to open the discussion between pharmacists and patients about the importance of vaccination. Initiating dialogue about the vaccine will not only allow the opportunity for pharmacists to educate on the benefits of the HPV vaccine, but will also alert patients who may not be aware of their indicated eligibility to receive the vaccine. Pharmacists are continuing to expand their role as a vaccinator as laws change to allow protocol driven immunization administration as opposed to prescription only vaccination.

Encouraging patients to make the initial decision to get vaccinated is valuable, but ensuring patients complete the series is critical for adequate protection. Pharmacy technicians may assist in this process by sending reminder phone calls to patients when their next vaccine dose is due to aid in improving compliance. Pharmacists are no longer viewed as only medication dispensers, but instead share a greater role in ensuring patients are getting appropriately vaccinated.

Pharmacists also play an important role in being available to answer questions about the vaccine or about HPV. Pharmacists are equipped to identify barriers of vaccination and are aware of resources available to overcome these obstacles. In many instances, pharmacists have more interactions with patients and opportunities to encourage parents and patients to take the step towards vaccinating themselves and their children. The benefits of Gardasil-9 may not be seen immediately, but the protection has been documented for up to 10+ years following vaccination and can prevent the development of HPV derived cancers long after the exposure occurred.²⁸

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Exam Questions:

- 1) Which patient is at greatest likelihood to experience ineffectiveness with their P2Y12 inhibitor?
 - A) <40
 - B) >200
 - C) >500
 - D) >9

- 2) The number of HPV-derived _____ cancer has increased over the last few years.
 - A) Oropharyngeal
 - B) Penile
 - C) Anal
 - D) Vulvar

- 3) The strain of HPV responsible for the majority of HPV-derived cancers is:
 - A) HPV-11
 - B) HPV-6
 - C) HPV-16
 - D) HPV-45

- 4) All women between the age _____ should get a Pap smear every _____ year(s).
 - A) 20-60 years old; 3
 - B) 21-65 years old; 3
 - C) 20-60 years old; 1
 - D) 21-65 years old; 1

5) The 2017 CDC Immunization Guidelines recommend:

- A) Girls between 9-14 years old get vaccinated using the standard 3 dose series of the vaccine at 0, 2 and 6 months Prasugrel 10 mg daily
- B) Girls and boys between the age of 9-14 years old receive 2 doses of Gardasil-9 6-12 months apart
- C) Young adolescents and adults between the age of 15-26 years old should receive 2 doses of Gardasil-9 6 months apart
- D) Young adolescents and adults between the age of 15-26 years old should receive 3 doses of Gardasil-9 12 months apart

6) The study performed by Dobson and colleagues compared immunogenicity data between girls who received 2 doses of the vaccine to adolescents and young women who received 3 doses. The study concluded that?

- A) Girls who received 2 doses had a non-inferior immune response compared to women who received 3 doses
- B) Girls who received 2 doses had a superior immune response compared to women who received 3 doses
- C) Girls who received 2 doses had an inferior immune response compared to women who received 3 doses
- D) Girls who received 2 doses had an inferior immune response compared to girls who received 3 doses

7) The HPV vaccine(s) currently available in the United States for administration is:

- A) Gardasil
- B) Gardasil-9
- C) Cervarix
- D) A and B
- E) A, B, and C

- 8) The cost-savings vaccine program available to cover the cost of the HPV vaccine series for patients 19-26 years old is:
- A) Medicaid
 - B) Vaccines for Children's Program
 - C) Merck Vaccine Patient Assistance Program
 - D) Astra-Zeneca's Patient Assistance Program
- 9) Adolescent Annie is a 15-year-old female who presents for her second vaccine of the HPV series. She received her initial dose 6 months ago prior to her 15th birthday. How many doses and on what schedule of Gardasil-9 is Adolescent Annie indicated to receive based on the 2017 CDC Immunization Guidelines ?
- A) 3 doses at 0, 1-2, and 6 months
 - B) 2 doses at 0, 6-12 months
 - C) 3 doses at 0, 6, and 12 months
 - D) 2 doses at 0, 2 months
- 10) True/False: Administration of the HPV Vaccine to adolescents will lead to promiscuous behavior.
- A) True
 - B) False
- 11) What percent of patients live within 5 miles of a retail pharmacist?
- A) 55%
 - B) 83%
 - C) 93%
 - D) 74%

12) The pharmacists' role in the vaccination process is:

- A) Educating parents and patients on the benefits of getting vaccinated
- B) Identifying patients eligible to receive the vaccine
- C) Administering the vaccine in states where an immunization protocol is in place
- D) B and C
- E) All of the above