The Effect of Education on HPV Vaccination Rates among Females

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Abstract

Background: Human papillomavirus (HPV) vaccines have been confirmed to be safe and effective in preventing HPV-related disorders, such as cervical, vaginal, vulvar, oropharyngeal, and anal cancers. The Advisory Committee on Immunization Practices (ACIP) recommends a routine HPV vaccine at ages 11 or 12. Vaccination may be given as early as 9 years old and as late as 26 years old. However, vaccination rates remain low in the United States. *Purpose:* The purpose of this study was to improve the HPV vaccination rate among females nine to 26 years of age at a teen and young adult health center in a Mid-Atlantic state. *Methods:* This study utilized a retrospective chart review of all females from 9 to 26 years old presenting to the Teen and Young Adult Health Clinic for a well-child exam or any other reason between December 1, 2016, and January 31, 2017 using data from a clinical data repository (CDR). A computerized EMR reminder was released on November 9, 2017; and client education and provider recommendation were delivered between October 1, 2017, and November 30, 2017. A prospective chart review was also conducted between December 1, 2017 and January 31, 2018. Charts were reviewed for patient demographics, whether the interventions were offered correctly and by whom, patient response (accepted/declined, if the vaccine was initiated, and if the vaccination series was completed). Chi-square tests were used, and all statistical analyses were performed using SPSS software. *Result:* There were 353 and 216 participants in retrospective and prospective cohorts respectively. Only 17 patients (4.8%) from the retrospective cohort and 18 patients (8.3%) from prospective cohort received the HPV vaccine during their visit, $p = .090$. There was a significant difference in race, $p = .028$, and HPV note documentation, $p = .006$. *Conclusion:* There is no association between the HPV vaccine rate increase and EMR reminder, patient education, and provider recommendations if they are implemented separately.

Human papillomavirus, HPV vaccine, client education, provider knowledge/awareness

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I. Introduction

Overview and Purpose

Human Papilloma Virus (HPV) is considered as one of the most prevalent sexually transmitted infections with a global prevalence of 11–12% in women (Das, Salam, Arshad, Lassi, & Bhutta, 2016). In fact, HPV is responsible for cervical carcinoma; the second most common cancer in women (Winer, Gonzales, Noonan, & Buchwald, 2015). In America alone, each year, nearly 14 million people are newly infected and pose a major public health concern (Smulian, Mitchell, & Stokely, 2016). HPV vaccination is the most effective form of primary prevention of HPV-associated cervical cancer (Keim-Malpass, Mitchell, & Camacho, 2015). As of today, there are only three HPV vaccines authorized for use in the United States (U.S.). The Food and Drug Administration (FDA) approved the quadrivalent vaccine (4vHPV), the bivalent vaccine (2vHPV), and the nine-valent vaccine (9vHPV) in 2006, 2009, and 2014, respectively (Smulian et al., 2016). In addition, these HPV vaccines are recommended by the Advisory Committee on Immunization Practices (ACIP) (Saslow et al., 2016).

The Advisory Committee on Immunization Practices includes medical and public health professionals who are responsible for developing recommendations on the use of vaccines in the United States (Keim-Malpass, Mitchell, DeGuzman, Stoler, & Kennedy, 2017). The recommendations then stand as public health guidance for the safe use of vaccines and related biological products. The ACIP recommends regular HPV immunization at age 11 or 12 years. However, vaccination may be given as early as nine years and as late as 26 years. For females starting vaccination before their 15th birthday, the current ACIP recommends two doses of HPV vaccine; however, the second dose must be given 6–12 months after the first dose. On the other hand, for those initiating vaccination on or after their 15th birthday, ACIP recommends three

doses of HPV vaccine (Keim-Malpass et al., 2017). In this case, the second dose must be administered 1–2 months after the first dose, and the third dose must be administered six months after the first dose. For children with a history of sexual abuse or assault, ACIP recommends routine HPV vaccination beginning at age nine. The ACIP recommends vaccination with three doses of HPV vaccine for all females with immunocompromising conditions that might reduce cell-mediated or humoral immunity. These conditions include B lymphocyte antibody deficiencies, T lymphocyte total or partial defects, HIV infection, malignant neoplasms, transplantation, autoimmune disease, or immunosuppressive therapy because immune response to vaccination might be attenuated (Das et al., 2016).

Since the initiation of HPV vaccines, clinical trial data has confirmed that they are safe and efficient. In addition, after vaccine approval by FDA, comparisons revealed that immunization dramatically decreases the occurrence and prevalence of HPV, genital warts, and cervical and anal dysplasia (Keim-Malpass et al., 2015; Smulian et al., 2016). However, despite the availability of safe and harmless HPV vaccines since 2006, the vaccination rate in the U.S. is still very low (Saslow et al., 2016). The *Healthy People 2020* goal is an 80% three-dose HPV vaccine completion rate for girls 13 to 15 years of age (U.S. Department of Health and Human Services [USDHHS], 2017). However, the current coverage estimates fall short of this goal (Smulian et al., 2016). According to Smulian and colleagues, in 2014 fewer than 40% of girls 13 to 17 years of age finished the recommended three doses of HPV vaccine. Therefore, it is imperative for healthcare providers to expand attempts to increase HPV vaccination and reduce the burden of HPV-associated cancers and diseases. The National HPV guideline recommended the use of interventions such as educational pamphlets, reminder calls, parental education, text

messaging, mail reminders, school vaccine requirement, and others to increase HPV vaccine uptakes (Saslow et al., 2016).

Theoretical Framework

The current national HPV vaccine uptake is far below the *Healthy People 2020* goal. However, vaccine uptake is a potentially modifiable health behavior. The Health Belief Model (HBM) is a framework that is used to describe and forecast health behaviors. The HBM is focused on the attitudes and beliefs of individuals. The HBM has first emerged in the 1950s (Winer et al., 2015). Since then, the HBM has been broadly used as a leading conceptual framework in health behavior research, both to explain a change of health-related behaviors and as a guiding framework for interventions. The model applies to professional practices with the potential to reduce the risk of developing a disease, as well as improving prevention.

The health belief model was selected to guide this project in development of effective interventions to change HPV-related behaviors. An EMR reminder, client education, and provider recommendations based on the health belief model may help to enhance the perceived susceptibility to and seriousness of HPV-related health conditions through education about the prevalence and incidence of cervical cancer, assessments of risk, and knowledge concerning the social and medical consequences. In addition, these interventions may increase the perceived benefits and decrease the perceived barriers of HPV vaccination uptake by providing information regarding the efficacy of several behaviors to minimize the risk of HPV-related diseases, by engaging participants through social support of health professionals, and by encouraging health-promoting behaviors. Furthermore, the health belief model recommends using cues to action to remind and encourage individuals to participate in health-promoting behaviors. Potential results of these interventions include increased self-efficacy and improved HPV vaccine adherence (Winer et al., 2015).

The HBM is designed to explain and predict health-related behaviors such as the uptake of health services. Therefore, to increase the rate of HPV uptake among females between nine and 26 years of age in a city in a Mid Atlantic State, this project chose to use the health belief model as its practice model.

Statement of Research Question

Can a computerized EMR reminder, client education, and provider recommendations improve HPV vaccination uptake among female clients of the Teen Health Center who are nine to 26 years of age, as compared to the current immunization practice?

II. Review of Literature

To determine the effectiveness of educational interventions to improve HPV immunization coverage among preteens, teens, and young adults between nine and 26 years of age, literature from January 2012 to April 2017 was reviewed. Randomized controlled trials (RCT's), practice guidelines, systematic reviews, and prospective cohort studies, in which the education intervention was directed toward females nine to 26 years of age and reported immunization coverage outcomes, were targeted. Keywords included "HPV education" and "females." An initial search on Google Scholar generated 30,700 articles. When the time limit of 2012 was applied, the number of articles decreased to 16,600 (Figure 1). When the terms "preteens," "teens," and "young adults" were added, there were only 115 relevant studies found. Next, the following principal sources of electronic reference libraries were searched to access the available data: The Cochrane Library, Medline, PubMed, and CINAHL each generated six, 12, 23, and two articles, respectively. After the titles' search, 25 articles were selected for further consideration. Abstracts of all 25 studies were screened for relevance, which yielded eight articles. Inclusion criteria were set to be HPV education, reminder call, and provider recommendation targeting females ages nine to 26. Data from each study which met the inclusion criteria was extracted independently and duplicated into a standardized form. Studies were excluded if they targeted age groups younger than nine or older than 26 or did not report separate data for the age group of interest. Studies were eliminated if the intervention was not aimed at education, reminder call, and provider recommendation. One final article was eliminated after a full-text review due to lack of relevance (Figure 1). This literature review includes two systematic reviews, three RCTs, one practice guideline, and one prospective cohort study (Table 1).

Overview of Findings

Of the seven studies reviewed, most were intended to improve consumer demand and uptake of HPV vaccinations from initiation to completion. Overall, the intervention methods recognized in the literature were based on evidence-based immunization classifications recommended by the National HPV guideline. These included video-based vaccine narratives, educational pamphlets, reminder calls, parental education, text messaging, mail reminders, PowerPoint presentations, school vaccine requirements, and telephone questionnaires. However, there were notable differences in the effectiveness of the interventions. For example, four of seven studies showed significant increases in HPV vaccination coverage following reminder calls, provider recommendations, and or standardized client education interventions (Das et al., 2016; Saslow, 2016; Smulian et al., 2016; Winer et al., 2015). However, due to inadequate evidence, the CDC Community Guide does not currently recommend using patient education as an intervention by itself (Hopfer, 2012).

Combined Interventions. In general, the intervention that produced a statistically significant increase in HPV vaccine uptake was the combined application of the reminder calls, provider recommendations, and patient education (Das et al., 2016; Saslow, 2016; Smulian et al., 2016; Winer et al., 2015). In fact, the reminder and recall interventions were the most popular types of strategies examined across the literature. Studies discussed a variety of measures, comprising series initiation, series completion, and receiving of the next vaccine dose. A mailed letter intervention found significantly higher HPV series achievement (Smulian et al., 2016); another study compared a reminder letter to a telephone call intervention, and found almost similar significant increase in the second dose uptakes, and series completion in both intervention groups (Vanderpool et al., 2013). A systematic review mentioned six studies, which

applied multi-component strategies in the community; however, designs differed across the studies, although the most common approach included in the multi-component interventions was some kind of reminder or recall arrangement (Smulian et al., 2016). These efforts were often strengthened by education and incentives from parents and providers.

Patient Education. Three randomized control trial studies on patient education indicated the potential promise of using video to disseminate the knowledge of the HPV vaccine in order to increase HPV vaccination rates (Hopfer, 2012). Two RCTs targeted young adults 18 to 26 years of age (Hopfer, 2012; Vanderpool et al., 2013). Both of these RCTs showed a substantial increase in coverage compared to non-intervention groups, though their sample sizes were small.

Provider Recommendation. In one study, provider recommendation was significant when applied alone, but there were small increments in HPV vaccination initiation. As a result, these developments were not maintained one year after the study period (Das et al., 2016). Provider recommendations for HPV vaccination were highly correlated with greater coverage, however, several providers did not routinely recommend HPV vaccination (Smulian et al., 2016). Some studies intended to strengthen the provider recommendation together with other interventions (Vanderpool et al., 2013). Due to this significant correlation, there is a potential necessity for more research.

Other Interventions. Other important intervention methods that did not achieve significant results were school-located vaccination services, provider reminders used alone, immunization requirements for school attendance, and programs to reduce out-of-pocket costs (Cuff, Buchanan, Pelkofski, Korte, Modesitt, & Young, 2016; Das et al., 2016; Smulian et al., 2016). One meta-analysis observed 37 articles; of them, three studies examined the effect of vaccination requirements for school attendance on HPV vaccination coverage. Studies

consistently showed that school requirements for HPV vaccination coverage do not result in any significant increase (Das et al., 2016). A study observed the effect of mandates enacted in Virginia in 2015 on HPV vaccination coverage in a cohort of sixth graders and found no significant increase in HPV series initiation by age 13 for girls (Cuff et al., 2016).

School-based vaccination programs and provider reminders used alone are both evidence-based strategies cited by the CDC Community Guide; however, the results in relation to HPV vaccination were contradictory. Interestingly, immunization requirements for school attendance have been shown to be effective in raising vaccination coverage for other vaccines, but no difference was noted in a series initiation with a middle-school entry requirement for HPV immunization (Das et al., 2016).

Systematic Reviews. Previously issued systematic reviews have provided evidence for mediation approaches to increase HPV vaccination coverage, such as education, reminder call, text messaging, provider's recommendation, school requirements, and public awareness campaigns. Also, several systematic reviews of HPV vaccination have directly discussed determinants correlated with HPV vaccination, such as demographics, culture, and values, or have considered interventions that target standard outcomes, such as immunization knowledge or intention to vaccinate (Saslow et al., 2016). One newly published review summarized several interventions with HPV vaccination (Smulian et al., 2016). The authors concluded that most educational interventions significantly increased HPV vaccination coverage, in contrast to findings from previous studies. This recent systematic review by Smulian and colleagues is a valuable addition to the research on HPV immunization interventions.

Summary

HPV vaccinations are often unique and expanding coverage will demand several strategies. Intervention studies specific to HPV vaccination must be assessed in the context of other immunization intervention research. In this literature review, a total of seven studies were reviewed and multiple interventions recognized; among them reminder call, provider recommendations, and standardized client education showed significant increase in HPV vaccine uptake.

One major weakness of this literature review was the limited number of studies. Also, each study measured HPV vaccine uptake differently, which made comparison of studies for effectiveness difficult. Another limitation was exclusion of studies with boys; therefore, further studies are recommended.

III. Method

Introduction

Human Papilloma Virus infection is prevalent, and HPV infections may cause health problems, including several cancers in both women and men. There are safe and effective vaccines recommended by the ACIP to prevent these health problems from happening. The national HPV vaccine performance is much lower than the *Healthy People 2020* goal. In anticipation of HPV vaccine uptake improvement, the Principal Investigator (PI) of this study implemented combined interventions of computerized EMR reminder, client education, and provider recommendations for two months at a Teen and Young Adult Health Clinic on females between ages nine and 26.

Purpose

The purpose of this study was to improve the HPV vaccination rate among females nine to 26 years of age. There were three phases of descriptive correlational study: 1) an initial retrospective chart review, 2) computerized EMR reminder, client education, provider recommendations, and a provider survey, and 3) a post-intervention chart review. All phases were conducted by the principal investigator (PI) within the Teen and Young Adult Health Clinic (Figure 2).

Research Design

This study implemented computerized EMR reminder, client education, and provider recommendations to improve HPV vaccination uptake among female clients of the Mid-Atlantic States University Teen Health Center who are nine to 26 years of age. After the intervention, we collected a prospective (intervention group) data and compared the result with a retrospective (control group) data. It is a cohort study.

Definition of Terms

Human Papilloma Virus (HPV). A type of virus that may cause unexpected tissue growth and changes to different cells. HPV can cause cervical, anal, vaginal, vulvar, penile, oropharyngeal, and squamous cell skin cancers.

Cervical cancer. A type of cancer that forms in tissues of the cervix. It can be detected with regular Pap tests. The primary causative agent for cervical cancer is human papillomavirus (HPV).

The Advisory Committee on Immunization Practices (ACIP). This is a group of medical and public health experts under the CDC that have the authority to develop recommendations on the use of vaccines in the civilian population of the United States.

Clinical Data Repository (CDR). This is a data depository maintained by the Clinical Informatics Division of the Department of Public Health Sciences of a University in a Mid-Atlantic state. The data holds information related to patients seen at the University Health System. CDR provides direct access to detailed, flexible, and rapid retrospective examination of de-identified clinical and financial patient data.

HPV Vaccine Uptake. Indicates the rate or act of accepting the HPV vaccination including initiation or completion.

Setting and Sample

The Teen and Young Adult Health Center is a primary care center for teenagers and young adults aged 11 to 26 years, located in a University Health System in a Mid-Atlantic state. The setting has a team of nurses, nurse practitioners, and doctors who specialize in caring for teens. The team also has a social worker who can give individual counseling and a community educator who works with parents and students in local schools, churches, and health agencies. At

the time of this study, two medical doctors, two nurse practitioners, and a nurse ran the clinic. The team was uniquely trained to work with teenagers and help young adults with the different challenges they face. Nearly 350 patients visited the clinic for well child checkup and different reasons each month.

The teen and young adult clinic delivered a range of services including routine check-ups, care of sicknesses and minor injuries, immunizations, sports, and camp and school physicals. This clinic also provided HPV vaccinations. Therefore, the PI selected this environment to implement a combined intervention including a computerized EMR reminder ("practices alert" embedded within the EMR at the point of care), client education, and a provider recommendation, to improve HPV vaccination coverage and adherence of female clinic patients ages nine to 26.

Based on the clinic's previous year performance, the PI expected to have 46 HPV vaccine uptakes (whether initiation or completion) during visit over a two-month period from October 1, 2016 to November 30, 2016 and 57 HPV uptakes from October 1, 2017 to November 30, 2017. However, developing the EMR reminder took more time than expected. The final release day for the HPV immunization Best Practice Alert (BPA) was pushed to November 9, 2017. Thus, the PI amended the prospective data pool to be from December 1, 2017 to January 31, 2018. Based on the previous year retrospective data pool experience, the PI was expecting to have nearly 24 subjects who received HPV vaccine during their visit in the prospective cohort for the amended prospective data review.

Measures

The following measures were extracted from both the retrospective (December 1, 2016 to January 31, 2017) or prospective (December 1, 2017 to January 31, 2018) chart review of all female patients, 9 to 26 years of age, who attended the Teen and Young Adult Health Center:

1) Demographic Variables: Gender, age at the time of visit, race, and immunization status prior to the visit.
2) Vaccine Counseling: Yes or No; if yes, by whom?
3) Provider Offered Vaccine: Yes or No
4) Vaccine Accepted by patient: Yes or No (Accepted or Declined)
    a. Vaccine series was initiated: Yes or No
    b. Vaccine series was completed: Yes or No

Provider Survey. The survey was developed by modifying an existing provider survey tool about the HPV vaccine for female gender only (McRee, Gilkey, & Dempsey, 2014). This revised version allowed for comparisons between the age groups, frequencies of recommendations, and the knowledge level of the providers. All four healthcare providers and a nurse at the clinic were invited to read a gender-modified HPV information sheet before providing critical feedback related to the HPV vaccine. An 11-question survey was modified so it could be completed in seven minutes or less. Questions addressed the barriers and facilitators of vaccine recommendation, the frequency of HPV vaccine recommendation, and providers' knowledge of vaccine intervals. Moreover, the survey assessed the providers' knowledge related to the ideal age for HPV vaccination for both genders, factors affecting recommendation, attitudes toward vaccines in general, knowledge of HPV and the HPV vaccine, and females'

reasons for receiving or not receiving the HPV vaccine. Open-ended, yes or no, and multiple-choice question types were included. (See Appendix A for Provider Survey Tool)

Procedures

Initial Retrospective Chart Review (Phase 1)

Objectives. Phase 1 consisted of a retrospective chart review to: 1) determine the rate of HPV vaccination among nine to 26-year-old females presenting to the Teen and Young Adult Health clinic between December 1, 2016 to January 31, 2017, and 2) assess whether providers at the teen and young adult clinic recommended and offered the HPV vaccines to their clients according to the ACIP guidelines. Furthermore, patient demographics, including gender, age, and race, were extracted from EPIC Hyperspace and recorded.

Approach. The original retrospective chart review plan was to include all female patients 9 to 26 years of age, who presented to the clinic for their well-child exams or other reasons between October 1, 2016 and November 30, 2016. However, after running a CDR retrospective data review, this project faced a series problem of developing an EMR reminder for release by October 1, 2017 as planned. The PI of this project closely worked with EPIC ambulatory team to develop an EMR reminder and managed to release it on November 9, 2017. As a result, the retrospective data collection was amended to December 1, 2016 to January 31, 2017 to match with the new prospective data pool season. After receiving the approval from the Institutional Review Board (IRB), de-identified patient data were obtained from the CDR and EPIC for all patients meeting the inclusion criteria (females from age 9 to 26, who received an HPV vaccination during their clinic visit at Teen and Young Adult Health Clinic, during the timeframe of December 1, 2016 to January 31, 2017) using two data specialists at the EPIC ambulatory team. A chart audit tool (See Appendix B) was used to review the patient charts to determine if

vaccine counseling was provided and by whom, whether the provider offered the vaccine, whether the vaccine was accepted/declined by the patient, if the vaccine series was initiated, and if it was completed. Gender, age at the time of visit, and race were recorded. The PI collected data on 485 subjects. After filtering the recurrent visits, he further excluded 132 patients from the study due to their completion status of the required three dose HPV vaccine series prior to December 1, 2016. In this retrospective chart review, a total of 353 independent female subjects were analyzed.

The timeframe was chosen to allow two months of data collection pre- and post-intervention. This interval is intended to capture all females 9 to 26 years of age, who presented at the Teen and Young Adult Health Clinic during this time period.

Provider Survey (Phase 2)

Objectives. First, a survey was conducted to examine the providers' current practices related to recommending the HPV vaccine, their knowledge of the ACIP recommendations regarding the HPV vaccine, and their perceived barriers to promoting vaccination to their teen and adolescent patients (See Appendix B for Provider Survey Tool). All five providers participated with the provider survey.

Second, the PI worked closely with the EMR team to develop an electronic alert message to the providers.

Third, a one-to-one client education was implemented by care providers and staff members from October 1, 2017 to November 30, 2017. In every patient and provider encounter, a standardized provider recommendation was made during the intervention session.

Approach. *First,* a survey was administered to the providers using paper/pencil questionnaires. The survey was applied to all providers (doctors and nurse practitioners)

who practice within the clinic where the project takes place. The survey asked providers how often they offer the HPV vaccine to their female patients and how often patients accept the vaccine when delivered. The survey also asked about the possible barriers related to recommending the HPV vaccine that the providers might experience in practice. Most importantly, it asked a series of questions to evaluate the providers' knowledge of the ACIP recommendations concerning the HPV vaccine.

Second, on November 9, 2017 an EMR reminder and alert system focusing on HPV vaccine was embedded into the medical and nursing visit templates to remind clinical staff to review the immunization status of the patient at each visit. The EMR reminder flag was linked with the health maintenance template to remind the provider during every visit. The template listed all the vaccinations that a patient has received and the date the vaccines were given on a single screen; this critical information allowed providers to order any missing vaccination instantly. The template was custom designed by staff members from the EMR clinical informatics team. The EMR reminder message allowed the provider to review the immunization template at each visit. In addition, the template prompted the providers and other staff members to document vaccine refusal and possible reasons for incomplete vaccinations. These reminders were derived from the recent HPV immunization ACIP guidelines.

Third, the PI delivered three consecutive PowerPoint presentations to the providers between September 15, 2017 and September 30, 2017; disseminated patient education materials on the recent ACIP recommendations for the HPV vaccine throughout the intervention period; and, discussed the results of the retrospective chart review (See Appendix C and D for PPT and a copy of patient education materials). Client education was delivered to each patient by the providers and other staff members during routine client visits. The PI had a weekly meeting with

the providers and other staff members to evaluate the process. Again, the PI organized a post-intervention open forum to give providers and other stakeholders an opportunity to discuss facilitators and barriers to recommending the HPV vaccine and offer suggestions for improving related practices in the future.

Post-Intervention Chart Review (Phase 3)

Objectives. Phase 3 consisted of a post-patient education intervention chart review to determine the change in HPV vaccine uptake among nine to 26-year-old females presenting to Teen and Young Adult Health Clinic between December 1, 2017 and January 31, 2018. The PI found only 18 subjects who received HPV vaccine on this prospective chart review. During the prospective chart review, the PI collected data from 310 subjects. Among them 94 subjects were excluded from the study because of their completion status of the required HPV vaccine series prior to December 1, 2017. There were only 216 subjects included in the prospective data analysis. This chart review used the same chart audit form for data collection (Appendix B) and follow the same procedures as described in phase 1.

Data Analysis:

Preliminary data analysis included basic descriptive statistics, *i.e.*, frequency, mean, median, and mode, on all study measures. Subsequently, differences in the means of two groups were measured at two-time points. The two groups include a control group who received usual care and an intervention group from the teen and young adult health clinic who received intervention of a computerized EMR reminder, client education, and provider recommendations. The control group (n=353) data was collected retrospectively from December 1, 2016 to January 31, 2017, before the intervention, and the intervention group (n=216) data was collected prospectively from December 1, 2017 to January 31, 2018. In this study, for all cases to be

independent, recurrent visits were filtered. As a result, only the initial visits were selected for data analysis regardless of cohort or HPV vaccine uptake status. The PI calculated descriptive statistics for all variables. Chi square tests was used to examine whether differences in demographic, age group, and vaccine-related variables existed between levels of acceptance to receive the HPV vaccine including initiation or completion (yes or no). Statistical significance was evaluated using an α level of 0.05, and all statistical analyses was done using SPSS v.24 software. A Pearson product-moment correlation coefficient was computed to assess the relationship between HPV given on the same encounter day and BPA comment added to EMR. Also, a student t- test was calculated to determine whether there is a statistically significant difference between the means among the retrospective and prospective groups. In this study, the effects of the EMR reminder, client education, and provider recommendations, and HPV vaccine uptake were compared.

Protection of Human Subjects

Institutional Review Board (IRB) approval for an IRB review waiver for a QI project was received on September 5, 2017 from the University's IRB-Health Services Research (HSR). De-identified data from the CDR, and EMR was collected for all females from age 9 to 26, who received an HPV vaccination during their clinic visit, during the retrospective or prospective chart review. There were no significant risks to the participants in this study. The providers gave all patient recommendations and education, and the interventions were standard practices performed daily by healthcare providers across the nation. Data was de-identified during the chart review. Any information related to this study was kept confidential. The patient's name or any identifying features were never paired with any data. All data was encrypted and securely stored and handled by the PI. There was no risk to any participant beyond the time and effort

required to complete the regular visit. Since, this project was deemed as QI by the IRB, providers were not required to sign a consent form before participating in the project.

IV. Results

Retrospective chart review of all females from 9 to 26 years old presenting to the Teen and Young Adult Health Clinic for a well-child exam or any other reason between December 1, 2016, and January 31, 2017 was done. Client education and provider recommendation were delivered between October 1, 2017, and November 30, 2017. A computerized EMR reminder was released on November 9, 2017. A prospective chart review was also conducted between December 1, 2017 and January 31, 2018.

Comparison of Retrospective and Prospective Data

All patients included in this comparison were female, 9-26 years of age, and seen at the teen and young adult clinic for well child checkup or other reasons. The total number of female patients in the two cohorts, *i.e.*, retrospective and prospective, with no missing data was 569. During the retrospective study period from December 1, 2016 to January 31, 2017, 353 female patients were identified. Whereas 216 female patients were included in the prospective study period from December 1, 2017 to January 31, 2018 (see Table 2). During the retrospective timeframe, only 17 females (4.8%) received the HPV vaccine; and during the prospective timeframe, only 18 female patients (8.3%) received the HPV vaccine, $p = .090$ (see Table 3).

Demographic Characteristics. The mean age of the female retrospective cohort was 18.82 ($SD = 3.60$); similarly, the mean age of the prospective group was 18.31 (SD =3.65). A student t-test was computed, and there was no significant difference in age among the retrospective ($M = 18.82$, $SD = 3.60$) and prospective ($M = 18.31$, $SD = 3.65$) cohorts; $t\ (567) = 1.66$, $p = 0.097$. The minimum age in the retrospective group was nine, whereas the minimum age for the prospective group was 10 (see Table 2). Within the retrospective cohort, 222 female patients (62.8%) were identified as white; 102 patients (28.9%) were identified as African

American, and 29 female patients (8.2%) were identified as any other race. Likewise, in the prospective data, 143 female patients (66.2%) were identified as white; 44 patients (20.4%) were identified as African American, and 29 patients (13.4%) were identified as any other race. When ethnicity was examined in the retrospective cohort, 335 female patients (94.9%) were reported to be non-Hispanic versus 194 patients (89.8%) in the prospective group. A chi-squared test was computed for both cohorts to determine associations across gender, ethnicity, and race. There was no difference in gender across cohorts: χ^2 (1) = 2.872, p =.090. However, there was a significant difference in ethnicity: χ^2 (3) = 9.511, p = .023. There was also a significant difference in race: χ^2 (5) = 12.548, p = .028 (see Table 2). HPV uptake by encounter type was significantly different, χ^2 (4) = 38.611, p < .001 (see Table 2).

HPV Vaccine Rate Characteristics and Outcomes.

A chi-squared test was also computed for both cohorts to determine associations across HPV vaccine uptake including initiation or completion, HPV note documentation, and encounter types. When the retrospective vaccination rates of patients during the clinic visit were compared to those of the prospective cohort, there were no significant differences, χ^2 (1) = .2872, p = .090 (Table 3). HPV note documentation was significantly different, χ^2 (1) = 7.445, p = .006. There was no significant difference in HPV documentation prior to visits, χ^2 (2) = 1.894, p = .388.

Best Practice Alert Characteristics and Outcomes. When BPA reminder activation and HPV vaccine uptake at the visit time were compared, we found no significant association. BPA reminder was activated and triggered alert on 186 (86.1%) patients of prospective cohort and was not associated with HPV uptake during the visit, χ^2 (1) = .048, p = .827. A Pearson product-moment correlation coefficient was computed to assess the relationship between HPV given on the same encounter day and BPA comment added to EMR. There were 20 (9.3%) BPA

related comments found, and there was no correlation between the two [r =.024, n = 216, p = .723]. There was a positive correlation between BPA reminder activation and HPV note documentation [r =.128, n =216, p < .001]. In addition, there was a positive correlation between BPA comment EMR documentation and BPA decline [r =.303, n =216, p <.001].

Provider Survey

All four providers and a nurse who practice at the teen and young adult clinic responded to the survey. Two providers replied that they offered the HPV vaccine 100% of the time to 11-26-year-old female patients and all providers believed that 75-99% of females initiated vaccination. Three providers reported offering the vaccine to 75-99% of female patients; two indicated that 75-99% accepted the vaccine, and one reported a 50-74% acceptance rate for females. All providers agreed that their practice clinic participates in the Vaccines for Children Program (VFC). Two providers responded that their patients believed in primary prevention, another two providers find that only 75% of their patients believe in primary prevention, and one provider replied his/her patients do not believe in primary prevention. According to this survey, three out of the five providers responded that their patients had long-term safety concerns about the vaccine. Sixty percent of the providers believe their patients were unlikely to return for the second and third dose. All providers felt that their patients are concerned about the pain associated with the HPV vaccine (Table 4).

Other facilitators and barriers discussed in the provider survey are presented in the Table 4. All of the providers responded that they were aware of the current ACIP recommendations. Three providers answered all questions correctly regarding their knowledge of the ACIP recommendations for both males and females. One provider differed from the others on the matter of vaccine interval and ideal age of vaccination. The fifth provider differed from the

others on the question of recommendations of catch-up vaccinations, responding that "...catching up must be done anytime you can."

Providers' Characteristics. During the retrospective time frame, there were eight providers in the clinic. During the survey time period, there were only five providers. Their data were recorded and transcribed by the PI and briefly reviewed with the statistician. No identifying information was recorded during the survey to maintain confidentiality. All five providers who practice at the clinic participated. Two of the providers were physicians, two of them were nurse practitioners, and one was an expert staff nurse.

Barriers to Recommending the HPV Vaccine. Several barriers to recommending the HPV vaccine were noted by providers and are described in the following paragraphs.

Irregularities. Three providers answered that they had inconsistently offered the vaccine to different patients and were much more likely to offer the vaccine when the patient was visiting for immunization purposes. One provider noted that it is challenging to raise the HPV vaccine topic while the patient is concerned about a health problem and the provider further explained that offering HPV had not yet become a trend for her/his practice.

Patients' knowledge. The leading concerns mentioned by three providers were patients' and their parents' lack of knowledge of HPV vaccine, their low medical literacy, and their misunderstanding that "not being mandatory" means "it is not necessary." Two providers mentioned some of the parents' beliefs concerning the relation between HPV and sexual maturity as constituting significant barriers to vaccination. The clinic has a relatively large number of local patients with a high school and college background, and "frequently the 14-18-year-old children want to hear about their immediate reason for a visit," according to one of the providers. Due to this, vaccination is usually postponed for the next visit. One provider mentioned that

grandparents accompanied a significant number of children during their clinic visit. According to that provider, the lower education level of the grandparents and their hesitancy or inability to decide usually made the HPV vaccine discussion even more difficult. All the providers responded "No" to the statement "My patients are unlikely to get the vaccine because it is not required for school entry."

Challenges related to the EMR. Two providers reported EMR utilization competency and knowledge issues as potential barriers. Two other providers said being unable to have a standardized documentation template for HPV within the EMR is another challenge that they usually encounter.

Time constraint. At the teen and young adult clinic, in every visit, providers set a maximum of 20 minutes to spend with a patient. Most of the providers believe that their patients used their well-child visits as an opportunity for medication refills and other concerning issues, which meant the patient would go home without proper counseling and recommendation of the HPV vaccine.

Follow-up challenges. All providers responded that the follow-up process for the second and third doses is challenging. They described that it was hard to get patients to return to the clinic for vaccination. Among all reasons raised by the providers, clinic staffing was the most frequently mentioned issue. According to these providers, staffing shortage led the clinic to have difficulty in sending out patient reminders prior to visits.

Facilitators in recommending the HPV vaccine. Several facilitators in recommending the HPV vaccine were noted by providers and are described in the following paragraphs.

Use of the Best Practice Alert (BPA). The implementation of the BPA, which occurred on November 9, 2017 in this clinic, was mentioned during the survey as a potential facilitator

that all team members supported. Moreover, all the providers perceived that the access to the immunization record is a primary facilitator. All the providers agreed that having direct access to their patients' vaccination status is significant in reducing missed doses. Two of the providers also commented on including tools within the BPA to document "patient refusal" under the health maintenance template tab anytime that a vaccine was declined. They also suggested adding options that may let them enter a request for a next visit when the patient received either the initial or the second vaccine dose. These requests were respected and included within the BPA.

Patient Education.

Prior to material distribution, the study investigator created a PowerPoint presentation with information on HPV prevalence and transmission, HPV vaccine recommendations, dosage schedule, and vaccine efficacy and safety to increase providers' knowledge (Appendix C). The presentation targeted providers to decrease missed opportunities. On September 26, 2017, the PI delivered a 40-minute presentation at the clinic staff lounge.

Seven hundred copies of standardized HPV educational brochures, which was produced by CDC, were handed to the clinic nurse. Then the nurse disseminated the brochures to each patient and parents between October 1, 2017 to November 30, 2017 (Appendix D).

V. Discussion

The intervention strategies reported in the literature that frequently produced statistically significant increases in HPV vaccination coverage were provider reminder, recall, and patient education (Das et al., 2016). Moreover, provider recommendation was significant when applied alone, with a proven small increment in HPV vaccination initiation (Smulian et al., 2016). In this study, EMR reminder, provider recommendation, and patient education interventions were implemented; this study found a 3.5% increase in HPV vaccination at clinic visits during the prospective time period, although this increase did not achieve significance (p =.090).

The Community Guide does not recommend patient education alone as a strategy to increase vaccination coverage due to insufficient evidence (Das et al., 2016). Originally the PI of this project planned to implement three interventions simultaneously. Due to reasons beyond the researchers' control, the EMR reminder was released six weeks after client education and provider recommendation. According to Saslow and colleagues, provider knowledge survey and feedback, when used alone, produced significant but small increases in HPV vaccination initiation (Saslow et al., 2016). Again, in considering the findings of these studies, it is imperative to keep in context that significant increases in coverage are needed to reach the *Healthy People 2020* targets.

The ACIP recommends standard HPV vaccination at age 11 or 12 years of age. However, vaccination may be given as early as nine years of age and as late as 26 years; and all doses can be completed before the initiation of sexual activity (Smulian et al., 2016). HPV vaccines are a widely discussed and proven best protective measures against HPV infections (Das et al., 2016). Both our retrospective and prospective chart reviews revealed that the teen and young adult clinic HPV vaccine uptake is below the national average. We observed that provider recommendation for HPV immunization was not standardized, and their documentation was

inconsistent. There was no patient follow-up mechanism in place for the second and the third vaccine doses. As a result, patient follow-up was inconsistent.

Indeed, it is not exceptional to have low vaccination rates at clinics serving teens and young adults. The Centers for Disease Control and Prevention (CDC) issued a new ACIP recommendation and overall report in November 2017 by calling for comprehensive actions to increase national HPV vaccine uptake (USDHHS, 2017). One of the principal goals discussed in the literature is to "reduce missed opportunities to recommend and administer HPV vaccine" (Das et al., 2016). In order to meet the *Healthy People 2020* goal, healthcare providers must use every opportunity by recommending the HPV vaccine to all patients that are eligible for vaccination (Hopfer, 2012). There is also a necessity for further study of the effects of interventions to improve provider communication and recommendations for vaccination. The literature shows that though provider recommendations for HPV vaccination are highly correlated with higher coverage, several providers do not habitually recommend HPV vaccination (Winer et al., 2015).

For this study, a BPA reminder was developed and embedded in the health maintenance template to help providers to recommend the HPV vaccine for their clients. The BPA reminder release was considered an important achievement of this study, resulting in a statistically significant association between BPA activation and HPV / EMR note documentation. Although there was no correlation between HPV given on the same encounter day and BPA comment added to EMR, the BPA fired on 86.1% of patients during the prospective data review. This EMR reminder resulted in a 6.6% increase in HPV documentation. The correlation coefficient was positive between BPA comment EMR documentation and BPA decline. This indicates that providers were more likely to document about HPV when they encountered the BPA reminder. If

the providers use the BPA reminder to its full extent, it could help in reducing missed opportunities.

Notably, the provider survey revealed that all the providers at this teen and young adult clinic know about participation in Vaccine for Children Program. However, they have different opinions about their patients' views of HPV primary prevention. The critical hindrances described by the providers were irregularities in provider recommendation, perceived long-term safety concerns, lack of a follow-up mechanism, low medical literacy of parents and patients, inadequate time to discuss the vaccine with patients, and uncertainty of proper documentation within the EMR.

The barriers raised during the provider survey are not unique, and similar obstacles have been described in other studies (Smulian et al., 2016). Systematic reviews have found that a knowledge gap among patients regarding HPV, parental opinions about the HPV vaccine, and apprehensions about vaccine safety were some of the top hindrances to immunization acceptance (Das et al., 2016).

According to Winer and colleagues (2015), a strong provider recommendation was linked to increased vaccine acceptance and initiation. Social pressures and perceived vaccine benefit also increased the likelihood that patients would initiate the vaccine series (Winer et al., 2015).

Finally, the study time may have been too short to show the whole picture. Further study with a longer timeframe is recommended. Notably, this study demonstrated that the BPA, as a reminder to increase its patients' HPV vaccine rate, is a potentially robust tool. During the provider survey, most of the providers acknowledged that they were less likely to recommend the HPV vaccine to their patients due to the lack of accurate HPV status information on their patients. Research has indicated that providers must focus on educating parents about the

etiology of HPV infection and on the vaccine's role in preventing cancer in patients when discussing the HPV vaccine with the parents (Smulian et al., 2016).

Strengths and Limitations

This study did not have time and logistical constraints, which can be considered an advantage. Since the research environment was not artificial, the reactions of participants were more likely to be genuine. The study design did not need extensive pre-screening and randomization process. In addition, threats to validity such as instrumentation and statistical regression could be explicitly identified and addressed in the research design to minimize their impact.

The study lacked random assignment into test groups, which may limit the generalizability of the results to a larger population. Besides the lack of randomization and reduced internal validity, conclusions about causality may be less definitive. Lack of accurate HPV vaccination series completion data in the EMR and the inability of interface between the Virginia Immunization Information System (VIIS) and the EMR were also notable limitations of this project. In addition, due to the late release of EMR reminder, patient education and provider recommendation interventions started six weeks before the BPA official release date. The implementation of these interventions separately could have influenced the findings. Since this sample included all 9- to 26-year-old patients that had been seen at the Teen and Young Adult Clinic for a well-child exam and other reasons during the specified timeframe, it was a good indicator of how many patients have been seen in the prior year. The intervention period was limited to two months due to time constraints, and thus a lack of maturation could be one of the major threats to this study.

Nursing Implications

Standardized documentation is vital for improving the quality of nursing practice. Healthcare institutions must have a clear and standardized documentation practice concerning immunization education. Additionally, consistent and standardized provider recommendations of HPV vaccines to all eligible females will improve the uptake of HPV vaccine. Based on the health belief model, visible posters, available educational brochures, and BPA reminders embedded in EMRs could serve as excellent cues for desired provider and patient behaviors. At health institutions, educational materials should be readily accessible in other languages to help their diverse patients.

As a direct result of this project, the providers within the Teen and Young Adult Health Center clinic are mentioning HPV in their EMR documentation more frequently. This change in provider behavior is a positive outcome. The *Healthy People 2020* goal for female adolescents to complete the three-dose series is set at 80%. This project influenced initial HPV documentation; as a result, it may improve return rates for the second and third vaccine doses and expand overall HPV vaccine completion rates in the future.

Conclusion

Even though standard three-dose and the newest two-dose HPV vaccination practices have proven to be safe and effective in reducing HPV infection, vaccination rates in the U.S. are suboptimal. Low vaccination rates have triggered the U.S. Department of Health and Human Services to take action. In this regard, one of the important *Healthy People 2020* goals is to raise the number of females ages 13 to 15 years who have completed the three-dose HPV vaccine series to 80% (USDHHS, 2017). There is broad agreement that vaccination rates are inadequate, and that documentation of vaccine recommendations is not consistent.

The Teen and Young Adult Health Center providers can play an essential part in improving HPV vaccination rates among females 9 to 26 years of age. This project separately implemented an EMR reminder, client education, and provider recommendations from September 15, 2017 to January 31, 2018 in anticipation of increasing the HPV vaccine uptake according to ACIP recommendations. While HPV vaccine uptake did not increase related to these interventions, the providers acknowledged that the interventions gave them better awareness on vaccination facilitators and barriers. This project encouraged the providers to stay educated regarding ACIP recommendations, *Healthy People 2020* HPV vaccine goals, and healthcare policy related to the HPV vaccine; as a result, they can offer educated guidance to their patients. Long-term follow-up and further studies are highly recommended.

Products of the Capstone

After receiving the final approval from the academic advisor, the manuscript of this study will be ready for publication. Based on the relevance of the study, the author is seeking to publish the capstone manuscript in the Journal of the American Association of Nurse Practitioners (JAANP). The manuscript described the problem addressed in the study. Moreover,

background and significant information, study procedures including recruitment, measurements, and steps in data analysis are evaluated for accuracy. Also, the manuscript included findings and conclusions while addressing limitations. The PI expected that this study would contribute knowledge to the public through the literature reviews, recruitment procedures, data management information, and the lessons learned from this study. The target audience, types of publications, and impact factor were taken into consideration before choosing the journal.

After successfully defending the capstone project and uploading the final work to LIBRA, the PI is planning to prepare an abstract and submit to the American Public Health Association for the group's annual conference presentation. The PI also will present the same abstract to the American Association of Nurse Practitioners for possible presentation at the group's annual conference.

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Study Table

Table 1

Education related interventions for HPV vaccination study summary (n=7)

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
(Hopfer, 2012). Effects of a narrative HPV vaccination intervention aimed at reaching college women: A randomized controlled trial	N=404 18 to 26-year-old females: I1: n=101 I2: n=101 I3: n=50 C: n=152 1 university health clinic	RCT Participants were emailed asking whether they received vaccine or not two months after receiving intervention or control	I1: Video of vaccine decision narratives delivered by peers and experts/ providers I2: Video of vaccine decision narratives delivered by peers I3: Video of vaccine decision narratives delivered by experts/ providers C: Information video with no narrative, informational website, or no message	O: Series initiation after 2 months Series initiation (I1 vs. C, p =.035; I2 vs. C and I3 vs. C not significant): I1: 21.8% I2: 17.8% I3: 6.0% C: 11.8% Series initiation (OR) (I1 vs. C, p = .036; I2 vs. C and I3 vs. C not significant): I1: OR 2.07 I2: OR 1.61 I3: OR 0.48 Limitations: 1. Outcome was vaccine initiation rather than completion of HPV series 2. Findings limited to the college -aged female population at one university with largely Caucasian population

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
				3. Expert-only intervention shorter in length, which did not permit dosage effects
(Vanderpool et al., 2013). "1-2-3 Pap" intervention improves HPV vaccine series completion among Appalachian women.	N=344 18 to 26-year-old females: I: 178 C: 166 Recruited from multiple locations in Appalachian Kentucky	RCT Nurses provided dose 1 free of charge and offered study enrollment following dose 1.	I: Watched 13-minute DVD video grounded in information, motivation, and behavioral skills theory. Participants also received follow up reminder calls for doses 2 and 3, like the control group. C: Standard of care (educational pamphlet and telephone reminders for doses 2 and 3)	Series completion after 12 months Series completion (I vs. C, p =.03): I: 43.3% C: 31.9% Series completion (I vs. C, p= .001): AOR 2.44 Limitation: Cross-sectional survey
(Smulian, Mitchell, & Stokely, 2016) Interventions to increase HPV vaccination coverage: A systematic review, human vaccines & Immunotherapeutic	1. Association of Schools and Programs of Public Health, Washington, DC, USA; 2. Immunization Services Division, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, Atlanta, GA, USA;	A systematic review: 1.Nineteen studies (55.9%) utilized interventions to increase community demand for HPV vaccination. 2. Three studies examined the effect of vaccination requirements for school attendance on HPV vaccination coverage.	Of the 34 HPV vaccination intervention studies identified, most of the studies were designed to increase community demand for HPV vaccination: 1. Education of parents and/or providers, enhanced practice-based IT systems, and/or provider incentives. The studies took place in a variety of settings and there was a wide range in the number of participants 2. Reminder call, text messaging, and mailing	1. HPV vaccination coverage in two cohorts of 6th graders; one cohort of 6th graders in 2009, the other 6th graders in 2010. The study found small significant increases in HPV series initiation by age 13 for girls (hazard ratio [HR] 1.18, p < .001), especially if the HPV vaccine was co-administered at the first adolescent visit (HR 1.22, p < .001). 2. The mailed letter intervention found significantly greater HPV series completion in the entire study age range intervention group (percentage point difference: 9.8, p < .01). 3. A mailed letter intervention to a telephone reminder intervention found significantly greater dose 2

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
	3. Carter Consulting, Inc., Atlanta, GA, USA A systematic review of 34 studies suggest many types of intervention strategies to increase HPV vaccination coverage in different settings, and with modest cost.			and series completion in both intervention groups; the mailed letter intervention resulted in an 8-percentage point increase in dose 2 coverage (HR 1.5, $p < .05$), and the telephone reminder intervention resulted in an 8-percentage point increase in dose 2 (HR 1.6, $p < .01$) and a 5-percentage point increase in series completion (HR 1.5, $p < .05$). 4. Text message reminders showed increases in coverage, with significantly greater on-time receipt of next HPV vaccine dose in an intervention group against two different control groups (adjusted odds ratio [AOR] 2.03 and AOR 1.83, $p = .002$ and .003) 5. Multiple types of reminders and found that 22.9% of due or overdue patients received their next dose of HPV, and showed that this cascade method was most effective at encouraging series completion ($p < .0001$). 6. Another intervention implemented more than one reminder method by using mailed letters and telephone reminders, and found significantly greater HPV series initiation and completion from zero baseline doses in the intervention group (percentage point difference in series

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
				initiation:11.2, $p < .05$; percentage point difference in completion from zero baseline doses: 7.3, $p < .05$).
(Winer, Gonzales, Noonan, & Buchwald, 2015), A cluster-randomized trial to evaluate a mother–daughter dyadic educational intervention for increasing HPV vaccination coverage in American Indian girls	Hopi Reservation in northeastern Arizona: 88 subjects randomly assigned in to two clusters of intervention groups and two to the control group based on geographic location, Participants attended mother daughter dinners featuring educational presentations for mothers on either HPV (intervention) or juvenile diabetes (control) and completed baseline surveys. Eleven months later, researchers surveyed mothers on their daughters' HPV vaccine uptake.	A Cluster-Randomized Trial	I: Dinner with HPV educational intervention including vaccine recommendations, dosage schedule, and efficacy and safety. HPV Presentations lasting 30 to 40 minutes with educational brochures with similar content distributed C: Diabetes treatment and prevention education	1. Adjusting for household income, the proportion of daughters completing vaccination within 11 months postintervention was similar in the intervention and control groups (32 vs. 28 %, adjusted RR = 1.2, 95 % confidence interval (CI) 0.6–2.3). 2. Among unvaccinated daughters, those whose mothers received HPV education were more likely to initiate vaccination (50 vs. 27 %, adjusted RR = 2.6, 95 % CI 1.4–4.9) and complete three doses (adjusted RR = 4.0, 95 % CI 1.2–13.1) than girls whose mothers received diabetes education. 3. Community-level data showed that 80 % of girls aged 13–17 years and 20 % of girls aged 11–12 completed the vaccination series by 2013. Important limitations: 1. Statistical power was limited by the small sample size and37 % loss to follow-up for post-dinner ascertainment of HPV vaccine status. 2. Ascertainment of vaccine uptake was limited to a follow-up survey conducted <12 months after the intervention

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
				3. Daughters' vaccination status was ascertained by parental report rather than by medical record review
(Das, Salam, Arshad, Lassi, & Bhutta, 2016). Systematic review and meta-analysis of interventions to improve access and coverage of adolescent immunizations	A systematically reviewed literature published up to December 2014 and included 23 studies on the effectiveness of interventions to improve immunization coverage among adolescents.	Systematic Review and Meta-Analysis	I: 1. Vaccination requirement in school 2. Sending reminders 3. National permissive recommendation for adolescent	1. Moderate-quality evidence from 13 studies suggested an overall increase in vaccination coverage by 78% (RR: 1.78; 95% CI: 1.41- 2.23 2. Subgroup analysis suggests that vaccination requirement in school, reminders, and national permissive recommendation had a significant impact on improving coverage while clinic staff training showed a nonsignificant impact. Strategies to improve coverage for HPV vaccines including countrywide provision and clinic-based delivery resulted in a significant decrease in the prevalence of HPV by 44% (RR: .56; 95% CI: .38-.82; and genital warts by 33% (RR: .66; 95% CI: .52-.84
(Saslow et al., 2016). Human papillomavirus vaccination guideline update: American Cancer	The American Cancer Society (ACS) reviewed and updated its guideline on human papillomavirus (HPV) vaccination based on a methodologic and content review of the	Practice guideline	1. HPV "catch-up" vaccination for females age 19 to 26 2. HPV vaccination for males ages 9 to 26 3. 9-valent HPV vaccination for males and females	1. Results from a pooled analysis of 3 RCTs showed that estimates of benefits against high-grade cervical lesions are substantially reduced, therefore, "late" vaccination be recommended for females ages 19 to 26 years who have not been vaccinated previously

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
Society guideline endorsement	Advisory Committee on Immunization Practices (ACIP) HPV vaccination recommendations. ACIP recommendations, with one qualifying statement related to late vaccination. The ACS recommends vaccination of all children at ages 11 and 12 years to protect against HPV infections that lead to several cancers and precancers.			2. The manufacturer-sponsored RCTs have demonstrated vaccine efficacy, high levels of immunogenicity, and safety in males comparable to those in females, therefore, HPV vaccination be recommended for males ages 9 to 26 years 3. The available data on the 9vHPV vaccine are limited but show efficacy, immunogenicity, and safety comparable to those demonstrated for the quadrivalent vaccine, therefore, 9vHPV vaccination be recommended for males and females Important Limitations: 1. Most RCTs are done by drug manufacturers 2. Limited data availability on the efficacy, immunogenicity, and safety of 9vHPV vaccine compared to others
(Cuff et al., 2016). Rates of human papillomavirus vaccine uptake amongst girls five years after introduction of statewide mandate in Virginia	908 girls aged 11 to 12 years -old who was seen for well-child care from January to December 2014 UVA	A prospective cohort study used the clinical data repository at the University of Virginia. The purpose of this study was to evaluate the uptake of the human papillomavirus vaccine among girls seeking well-child care 5 years after the introduction of a statewide mandate in Virginia in October 2008.	I: Telephone questionaries' by trained interviewers through the University of Virginia Center for Survey Research C: Previous study in 2009	1. 50.9% of the girls received at least 1 dose of human papillomavirus vaccine. 2. White race and private insurance coverage were found to be associated negatively with human papillomavirus vaccine uptake (relative risk, 0.74 and 0.71; 95% confidence interval, 0.64-0.85 and 0.62-0.81, respectively). 3. Black race and public insurance coverage were found to be associated positively with vaccine uptake (relative risk, 1.35 and 1.39; 95% confidence

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
				interval, 1.17-1.55 and 1.22-1.58, respectively). 4. In comparison with the previous study, there has been no change in human papillomavirus vaccine uptake or distribution of uptake after the introduction of the statewide mandate for human papillomavirus vaccination. Important limitations: a. Presence of lax exemption b. Parental education and perceived susceptibility to HPV, physician recommendation, and the cost of vaccination are all almost certainly involved in the parental decision to accept or decline vaccination. c. Relatively small proportion of parents (8%) who reported that they thought their daughter was "not at risk."

Note. I= intervention, C = comparison or control; OR= odds ratio, AOR= adjusted odds ratio, RR= risk ratio, HR= hazard ratio, CI= Confidence intervals, and *p* values are used

Table 2

Demographic Characteristics

	(Retrospective)		(Prospective)		*P value*
Variable	Mean (SD)	N (%)	Mean (SD)	N (%)	
Age (female)	18.82 (3.60)		18.31 (3.65)		.097[a]
Race (female)					.028[b]
White		222 (62.8)		143 (66.2)	
African American		102 (28.9)		44 (20.4)	
Other		29 (8.2)		29 (13.4)	
Ethnicity (female)					.023[b]
Non-Hispanic		335 (94.9)		194 (89.8)	
Hispanic		18 (5.1)		22 (10.2)	
Gender (female)					.090[b]
Female		353 (100.0)		216 (100.0)	
Encounter type (female)					<.001[b]
Office visit		217 (61.5)		141 (65.2)	
Procedure visit		90 (25.5)		47 (21.8)	
Nurse visit		30 (8.5)		22 (10.2)	
Clinical support		12 (3.4)		0.(0.0)	
Immunization		4 (1.1)		6 (2.8)	

Note: [a] *– Independent t-test* [b] –2- sided chi-square test

Table 3

HPV vaccine rate characteristics and outcomes

	Retrospective, n (%)	Prospective n (%)	*P* value
HPV given during visit (females)	17 (4.8)	18 (8.3)	.090 [1]
HPV note documentation (females)			.006 [1]
Yes	21 (5.9)	27 (12.5)	
No	332 (94.1)	189 (87.5)	
Visit type (Well child visit?) (females)			.171 [1]
Yes	347 (98.3)	211 (97.7)	
No	6 (1.7)	5 (2.3)	
HPV notes documentation prior to visit			.388 [1]
None	281 (79.6)	163 (75.5)	
HPV 1	36 (10.2)	30 (13.9)	
HPV 2	36 (10.2)	23 (10.6)	

Note. [1] 2-sided chi - square test

Table 4

HPV Vaccine Uptake Facilitators and Barriers Providers Survey (n=5)

	P #1	P #2	P # 3	P #4	P #5
Facilitators					
My clinic Participates in VFC	Yes	Yes	Yes	Yes	Yes
My clinic has reminders in the EMR	No	N/A	No	No	No
My clinic uses a form during well-child exams that prompts for CDC recommended vaccinations	No	N/A	No	No	No
I have time to educate my patients about HPV and the vaccine	Yes	50%	Yes	Yes	Yes
I strongly recommend the HPV vaccine to all eligible patients	Yes	Yes	Yes	Yes	Yes
I have completed continuing education regarding HPV/ or the HPV vaccine	Yes	Yes	Yes	Yes	Yes
I am aware of the CDC/ ACIP recommendations for HPV vaccination	Yes	Yes	Yes	Yes	Yes
My patients have a good understanding of the risks of HPV infection	50%	Yes	No	No	50%
My patients/ their parents believe that they are at risk for HPV	50%	75%	Yes	No	Yes
My patients have a belief in primary prevention	Yes	75%	Yes	No	75%
My patients are aware of VFC and its coverage	Yes	>75%	Yes	No	>75%
My patients have positive peer/ family support regarding HPV vaccination	50-75%		Yes	No	
Barriers					
The HPV vaccine is not stocked or there is low availability in my practice.	No	No	No	No	No
My practice is not adequately reimbursed for HPV vaccine administration.	No	No	No	No	No
I do not have time to discuss HPV vaccination during patient visits.	No	Yes	No	No	Yes
I have concerns about the long-term safety of the HPV vaccine.	No	No	No	No	No
I feel uncomfortable discussing a vaccine for a sexually transmitted infection with my patients and/or their parents.	No	Yes	Yes	No	Yes
I do not agree with the CDC/ACIP recommendations for HPV vaccination.	No	No	No	No	No
My patients are unaware of the risks of HPV infection.	No	<25%	Yes	Yes	Yes
My patients think the cost of the HPV vaccine is too high.	No	No	No	No	No
My patients are worried about the long-term safety of the HPV vaccine.	Yes	No	Yes	No	Yes
My patients are unlikely to return for the 2nd and 3rd dose of the vaccine series.	No	Yes	Yes	No	Yes
My patients are unlikely to get the vaccine because it is not required for school entry.	No	No	No	No	No
My patients are concerned about the pain associated with the HPV vaccine.	Yes	Yes	Yes	Yes	Yes

Note. All providers agreed that their practice clinic participates in the Vaccines for Children Program (VFC). Two providers think that their patients believed in primary prevention, another two providers find that only 75 % of their patients believe in primary prevention, and a provider replied his/her patients do not believe in primary prevention.

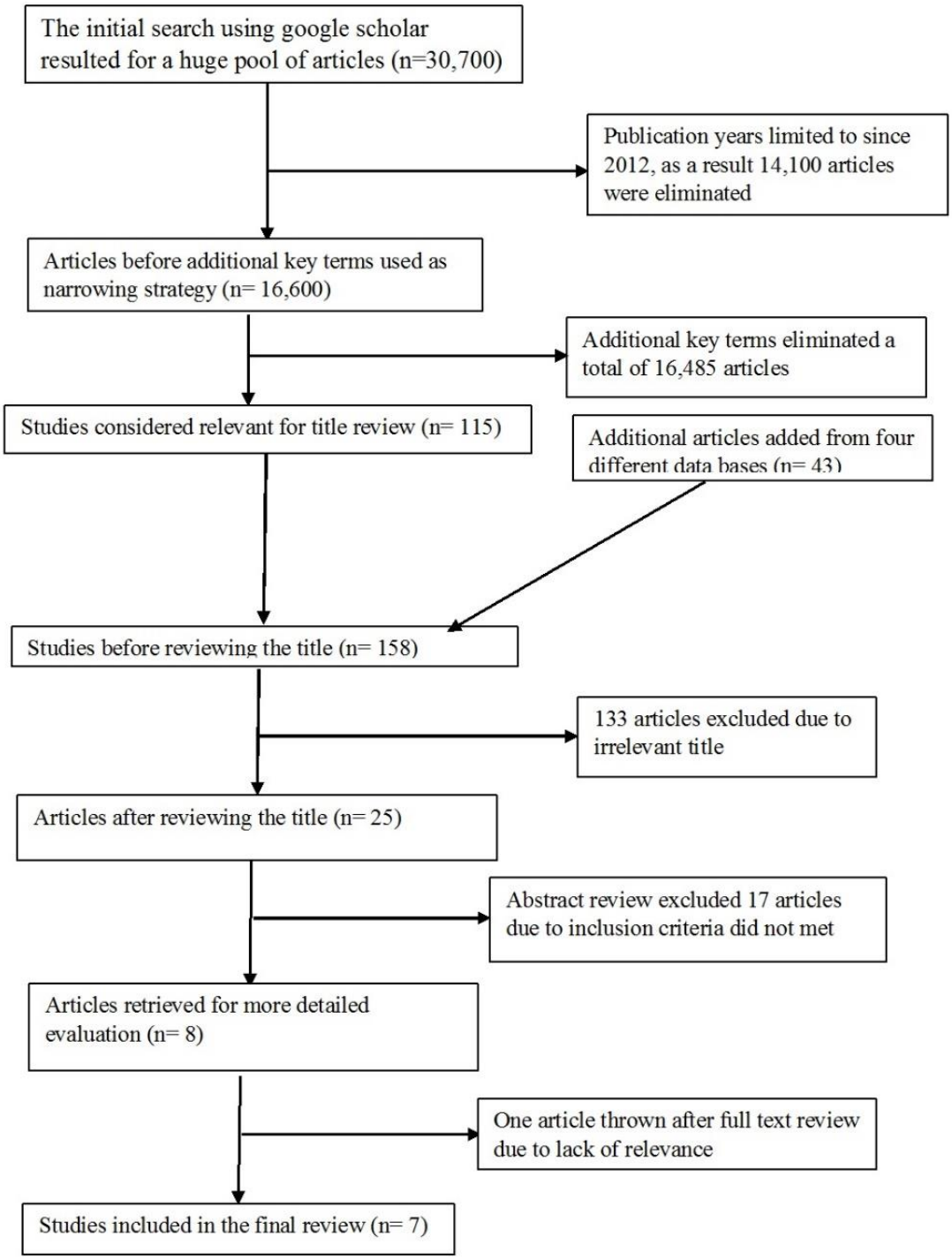


Figure 1. Flow chart of review process and study selection

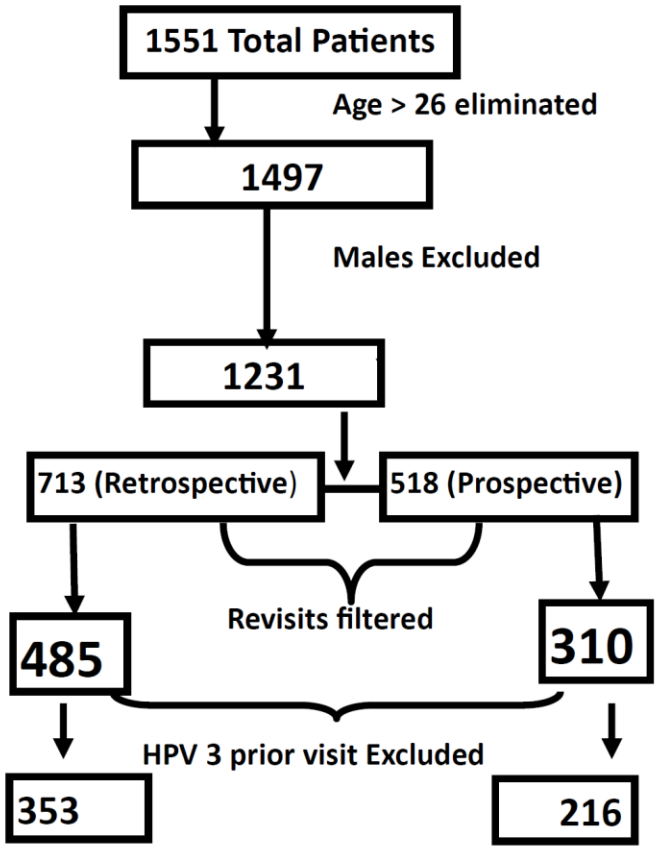


Figure 2. Flow chart of retrospective and prospective study samples

Appendix A

Assessing Providers' Facilitators and Barriers to Recommending the HPV Vaccine: Survey/Questionnaire

1. What factors in your clinic can smooth the recommendation of the HPV vaccine related to ACIP guidelines?
2. What kind of barriers do you face in your hospital that makes recommending the HPV vaccine difficult?
3. Are there any suggestions that you think would make recommending the HPV vaccine easier in your practice?

Please answer the following questions by selecting the answer that best represents your experience as a provider:

4. How often do you offer the HPV vaccine during routine well-child exams for 11-12-year-old FEMALES?

	100%		25-49%
	75-99%		0-25%
	50-74%		

5. When offered, what percentage of your FEMALE patients accept HPV vaccination:

	100%		25-49%
	75-99%		0-25%
	50-74%		

6. Which of these factors affect your decision to recommend the HPV vaccine in your current practice? Please select all that apply:

Practice Facilitators		Practice Barriers	
	My practice participates in the Vaccines for Children (VFC) program.		The HPV vaccine is not stocked or there is low availability in my practice.
	My clinic has reminders within the AEHR for HPV vaccination.		My practice is not adequately reimbursed for HPV vaccine administration.
	My clinic uses a form during well- child exams that prompts for CDC recommended vaccinations.		I do not have time to discuss HPV vaccination during patient visits.
	I have time to educate my patients about HPV and the vaccine.	Other:	
Other:			

7. Which of these factors affect your decision to recommend the HPV vaccine in your current practice? Please select all that apply:

Provider Facilitators		Provider Barriers	
	I strongly recommend the HPV vaccine to all eligible patients.		I have concerns about the long-term safety of the HPV vaccine.
	I have completed continuing education regarding HPV and/or the HPV vaccine.		I feel uncomfortable discussing a vaccine for a sexually transmitted infection with my patients and/or their parents.
	I am aware of the CDC/ACIP recommendations for HPV vaccination.		I do not agree with the CDC/ACIP recommendations for HPV vaccination.
Other:		Other:	

8. Please answer the following questions about the CDC/ACIP recommendations for HPV vaccination to the best of your knowledge:

Patient Facilitators		Patient Barriers	
	My patients have a good understanding of the risks of HPV infection.		My patients are unaware of the risks of HPV infection.
	My patients/their parents believe that they are at risk for HPV.		My patients think the cost of the HPV vaccine is too high.
	My patients have a belief in primary prevention.		My patients are worried about the long-term safety of the HPV vaccine.
	My patients are aware of the Vaccines for Children (VFC) program and its coverage.		My patients are unlikely to return for the 2nd and 3rd dose of the vaccine series.
	My patients have positive peer/family support regarding HPV vaccination.		My patients are unlikely to get the vaccine because it is not required for school entry.
Other:			My patients are concerned about the pain associated with the HPV vaccine.
		Other:	

9. What is the recommended interval for HPV vaccination?
   - 0, 3, and 6 months
   - 0, 1-2, and 6 months
   - 0, 3, and 9 months
   - 0, 6, and 9 months

10. What is the ideal age of vaccination for males and females?
    - ages 11-12, can be given as early as 9
    - ages 13-15, can be given as early as 11
    - ages 9-13, can be given as early as 9
    - ages 15-18, can be given as early as 9
11. What are the recommendations for catch-up vaccination for males and females?
    - Catch-up for unvaccinated men and women ages 13-18
    - Catch-up for unvaccinated men and women ages 13-21
    - Catch-up for unvaccinated men ages 13-21 (and up to 26 for special populations), catch-up for women 13-26
    - Catch-up for unvaccinated men ages 15-21 (and up to 26 for special populations), catch-up for women 15-26

Comments: Please feel free to share any comments or ideas you have related to the HPV vaccine recommendations

Appendix B

Assessing Providers' Facilitators and Barriers to Recommending the HPV Vaccine Chart Audit Tool

Study number:_____
Age:_____
Race:_____

At the patient's well-child visit or annual checkups, were the following documented:

Information	**Yes**	**No**	**Comments**
Was counseling on the HPV vaccine provided?	By: _____NP _____MD		
Was the HPV vaccine offered?			
Patient's response if vaccine was offered	Accepted	Declined	
Was the HPV vaccine series initiated?			
Was the vaccine series initiated or completed prior to this visit?			

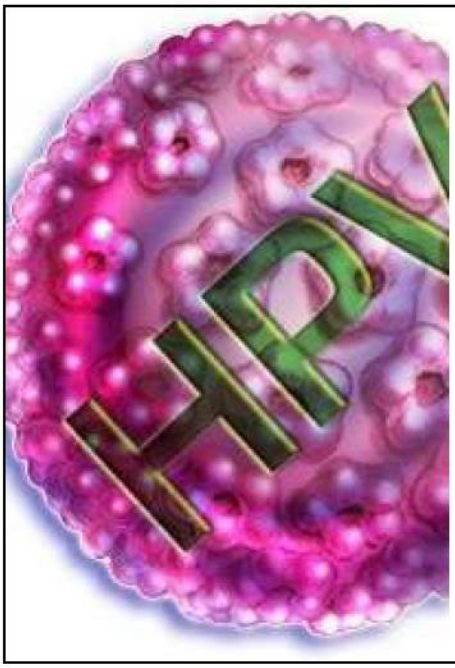
Doses given (Y/N)? #1_____#2_____#3_____
On-time? Y/N Y/N Y/N

Appendix C
Education Material PPT

Strategies for Increasing HPV Vaccination Rates

Your Strong Recommendation Is Essential!

Tilahun Goshu, RN, MSN, DNP Student
UVA School of Graduate Nursing
07-30-2017

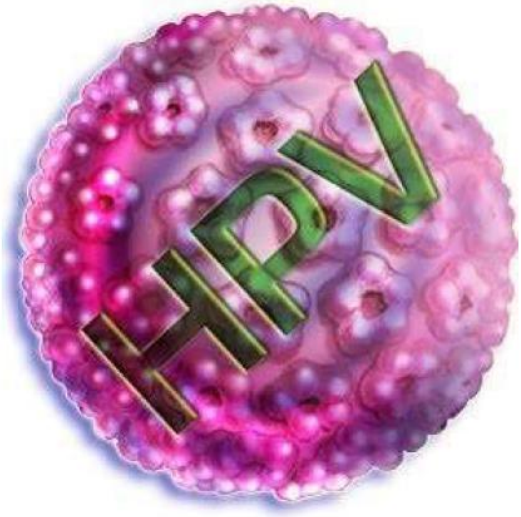


Disclosures

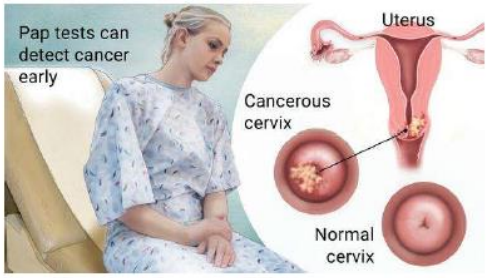
- I, Tilahun Goshu, have no associations to disclose with any commercial entities that are either providing financial support for HPV immunization program or whose products or services are mentioned during my presentations.
- All discussions related to the use of vaccines do not have to do with the approval of the U.S. Food and Drug Administration.
- But all discussions are in accordance with ACIP recommendations

Outline

- HPV Immunization Initiative
- National Call to Action to Prevent Cancer
- Burden of HPV-Related Disease
- Strong Provider Recommendation and Other Evidence-Based Strategies
- Resources



National Call to Action to Prevent HPV-Related Cancer



- President's Cancer Panel
  - Goals:
    - Reduce missed clinical opportunities to recommend and administer HPV vaccines,
    - Increase parents', caregivers', and adolescents' acceptance of HPV vaccines, and
    - Maximize access to HPV vaccination services.
- American Association for Cancer Research
  - New case of HPV-related cancer every 20 minutes
  - 39.7 percent of girls ages 13 to 17 and 21.6 percent of boys of the same age had received three or more doses of an HPV vaccine.

(Saslow et al., 2016)

Cervical Cancer

Cervical cancer is the most common HPV-associated cancer among women

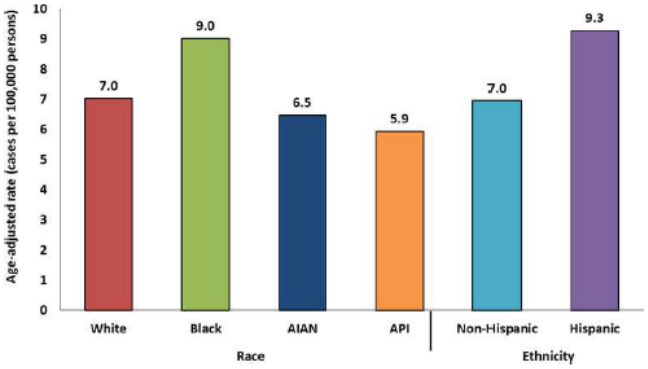
About 12,820 new cases of invasive cervical cancer will be diagnosed.

About 4,210 women will die from cervical cancer.

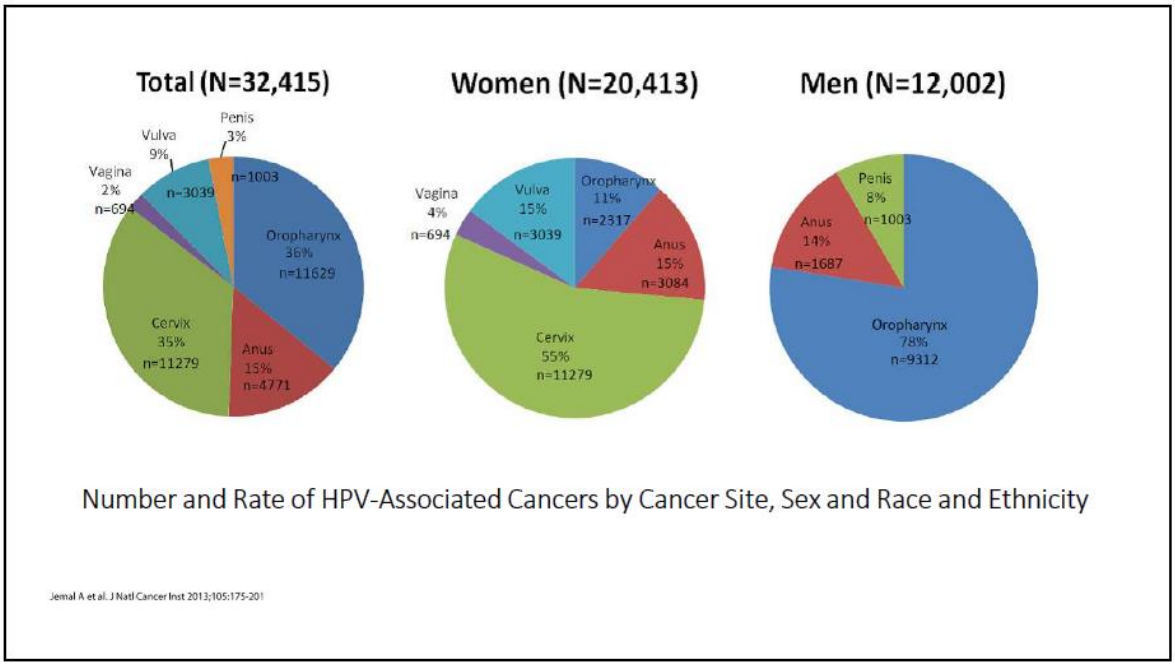
37% of cervical cancers occur in women who are between the ages of 20 and 44

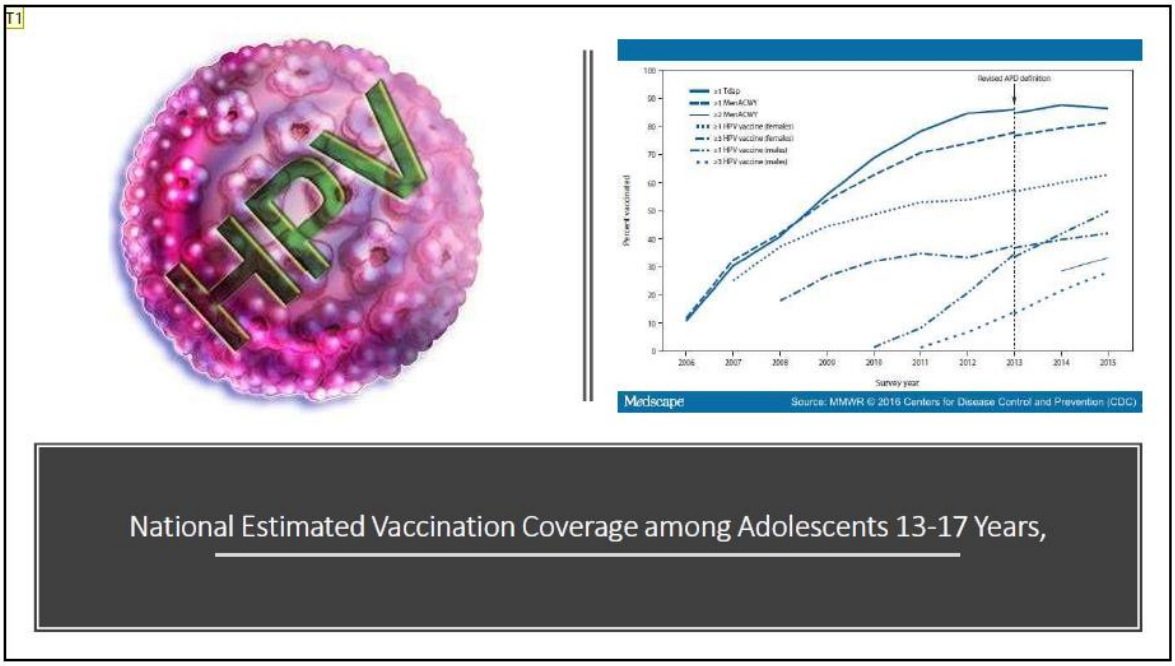
(Smulian et al., 2016)

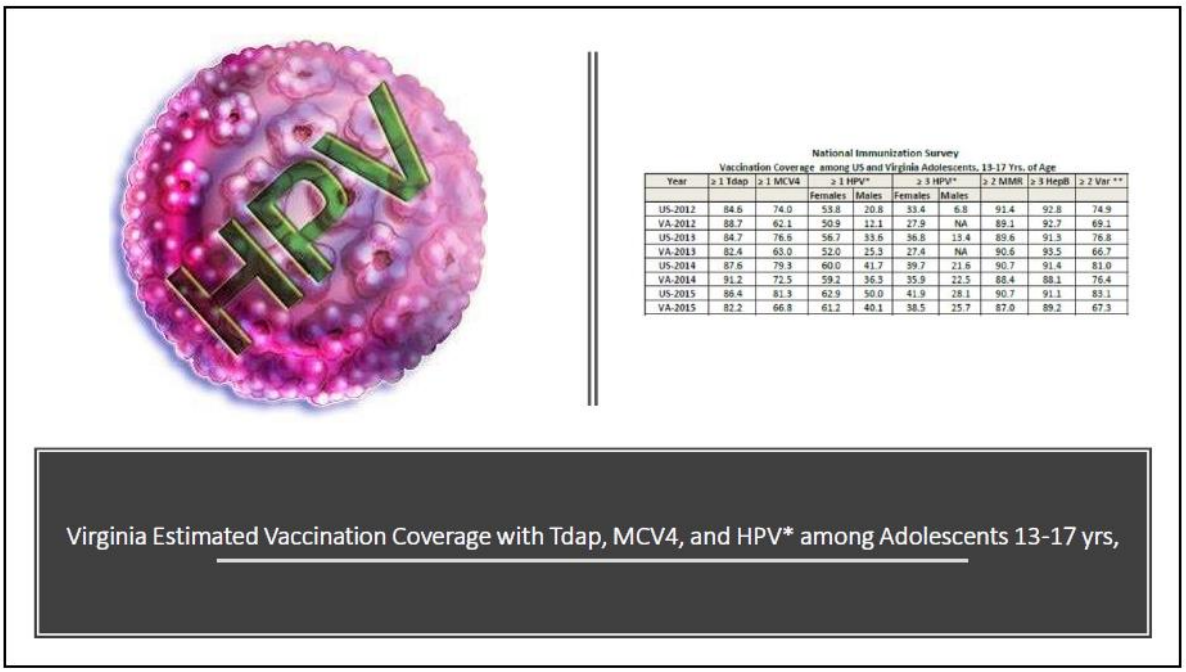
Cervical Cancer Continued .....

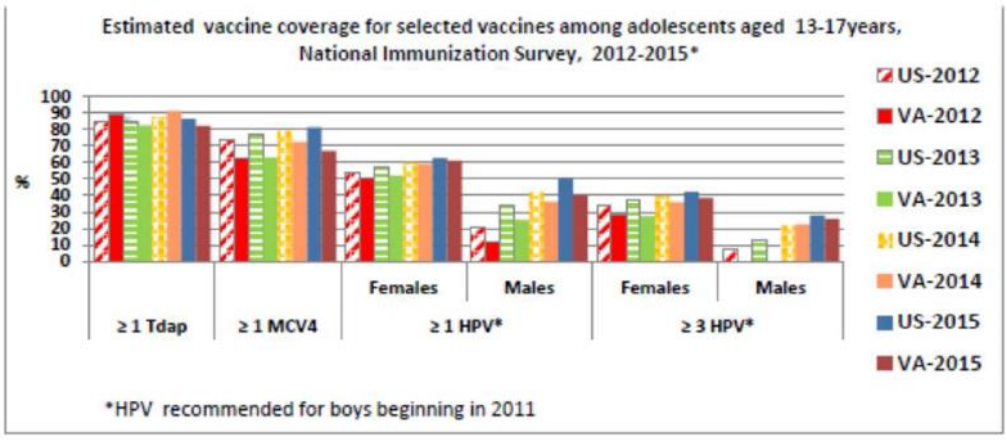


(Smulian et al., 2016)

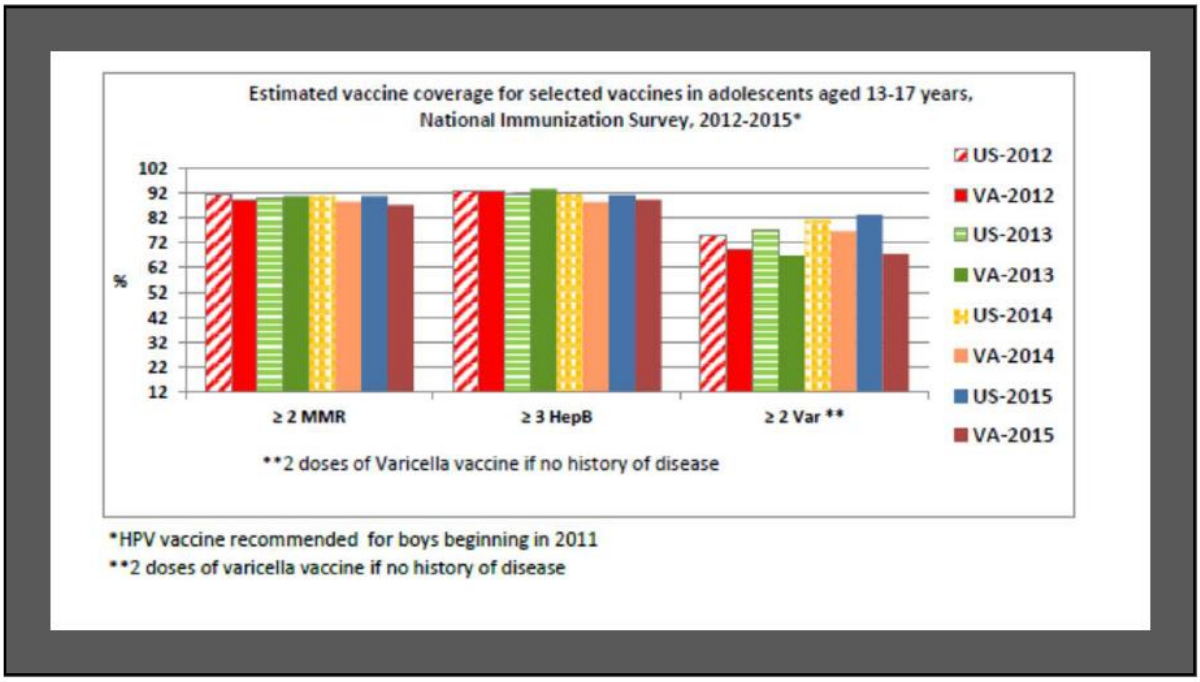

Total (N=32,415)
Penis 3% n=1003
Vulva 9% n=3039
Vagina 2% n=694
Oropharynx 36% n=11629
Cervix 35% n=11279
Anus 15% n=4771
Women (N=20,413)
Vagina 4% n=694
Vulva 15% n=3039
Oropharynx 11% n=2317
Anus 15% n=3084
Cervix 55% n=11279
Men (N=12,002)
Penis 8% n=1003
Anus 14% n=1687
Oropharynx 78% n=9312
Number and Rate of HPV-Associated Cancers by Cancer Site, Sex and Race and Ethnicity
Jemal A et al. J Natl Cancer Inst 2013;105:175-201

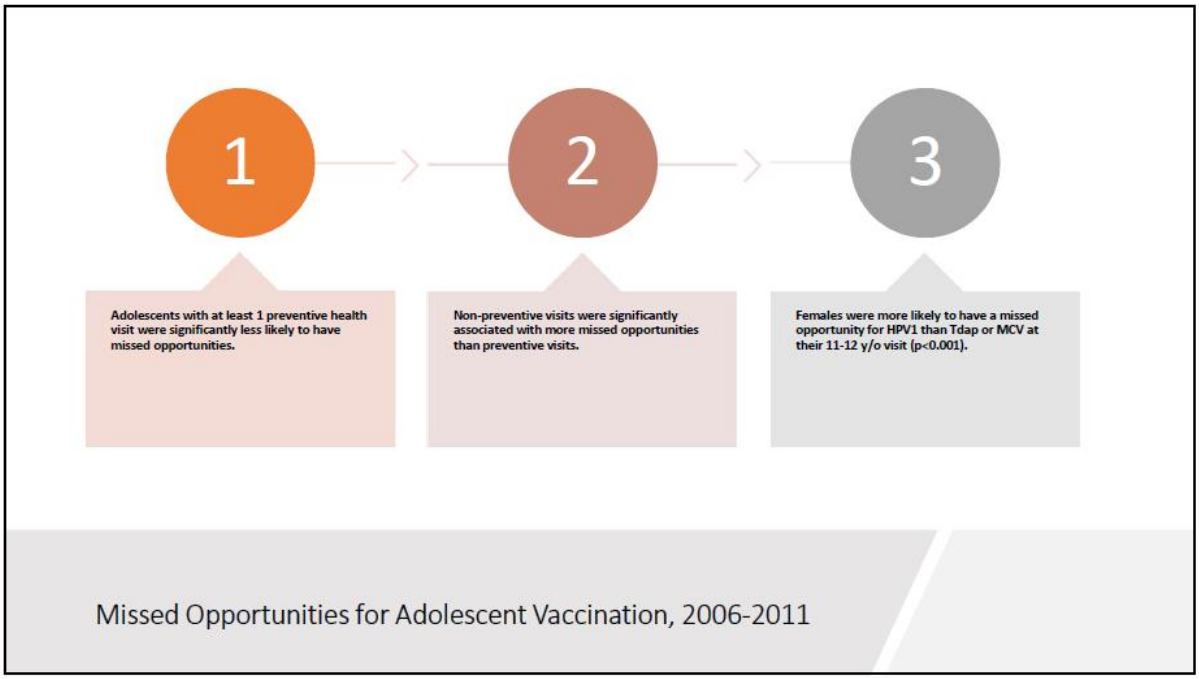

T1
HPV
Revised APD definition
Percent vaccinated
Survey year
Medscape
Source: MMWR © 2016 Centers for Disease Control and Prevention (CDC)
National Estimated Vaccination Coverage among Adolescents 13-17 Years,





HPV
Common Infection.
Common Reality.™


Estimated vaccine coverage for selected vaccines in adolescents aged 13-17 years, National Immunization Survey, 2012-2015*
%
102
92
82
72
62
52
42
32
22
12
≥ 2 MMR
≥ 3 HepB
≥ 2 Var **
US-2012
VA-2012
US-2013
VA-2013
US-2014
VA-2014
US-2015
VA-2015
**2 doses of Varicella vaccine if no history of disease
*HPV vaccine recommended for boys beginning in 2011
**2 doses of varicella vaccine if no history of disease


1
2
3
Adolescents with at least 1 preventive health visit were significantly less likely to have missed opportunities.
Non-preventive visits were significantly associated with more missed opportunities than preventive visits.
Females were more likely to have a missed opportunity for HPV1 than Tdap or MCV at their 11-12 y/o visit (p<0.001).
Missed Opportunities for Adolescent Vaccination, 2006-2011

Strategies to Increase Immunization Rates

- EMR reminder
- Client education
- Provider recommendation

www.thecommunityguide.org/vaccines/index.html

Task Force Methodology

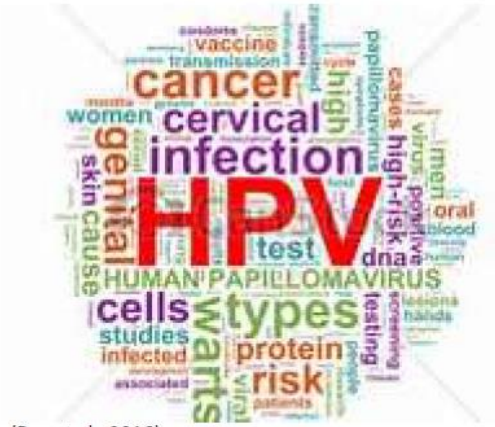
Steps in a systematic review	Conduct search of peer-reviewed literature	Review and assess quality of each study	Summarize body of evidence
How strategies work in different populations and settings	Cost-effectiveness	Publications	Identify gaps and develop recommendations

AAP's Adolescent Immunizations: Strategies for Increasing HPV Coverage Rates

- AAP Quality Improvement for Practices
  In 2015, completion of the three-dose HPV series was only 42% (range 24%-68%) for females and 28% (range 16%-58%) for males
- A strong recommendation from the health care provider is the most important reason why parents choose to vaccinate their children
- Every health care visit is an opportunity to review and update immunization status.
- Health care technology can be useful and effective in decreasing missed opportunities for vaccination.

http://www.aappublications.org/news/2017/02/06/AdolescentImmunization020617

What Providers Can Do ?



(Das et al., 2016)

- Strong, clear, routine recommendation for HPV vaccine
- Assess and vaccinate at every visit
- Use epic reminder
- Assessment and feedback
- Standing Orders
- Immunization Champion

Reason	%
Not needed or necessary	19.1%
Not recommended by provider	14.2%
Safety concern/side effects	13.3%
Lack of knowledge	12.6%
Not sexually active	10.1%

Top 5 reasons for not vaccinating daughter, among parents with no intention to vaccinate in the next 12 months, NIS-Teen 2012

MMWR. 2013; 62:591-5

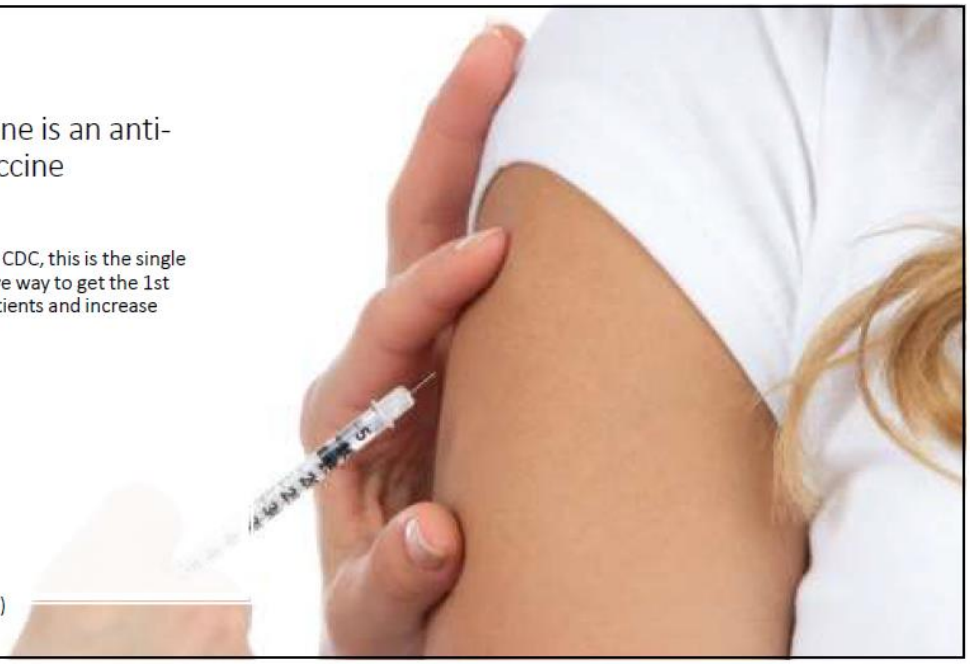
Primary care physicians' adherence to expert recommendations for cervical cancer screening and prevention in the context of human papillomavirus vaccination(N = 574)

- 80% correctly reported rarely or never using HPV testing results to guide vaccine recommendations
- 66% often or always recommended vaccination to patients with an abnormal Pap result
- 41% reported recommendation-consistent practices with all three measures
- Obstetrician-gynecologist specialty and private practice type were associated with higher average overall adherence to recommendations

(Malo et al., 2016)

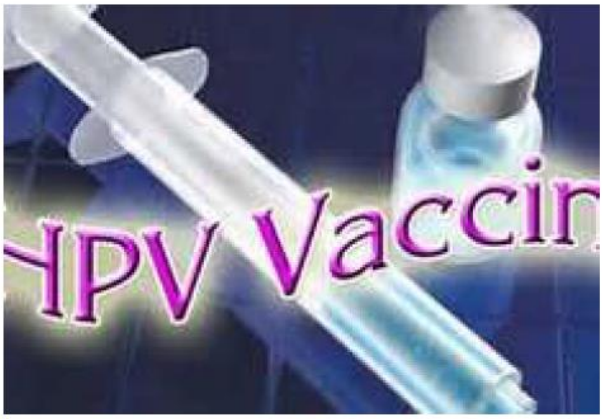
HPV Vaccine is an anti-cancer vaccine

- According to CDC, this is the single most effective way to get the 1st dose into patients and increase coverage!



(Das et al., 2016)

Reducing Missed Opportunities

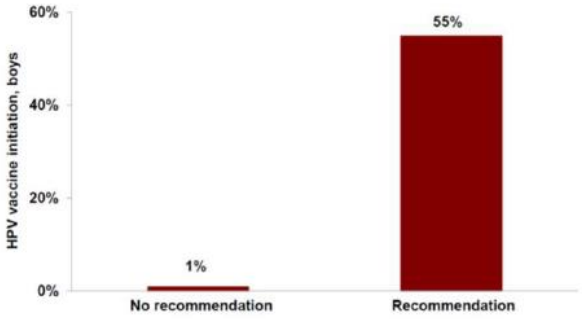


- ASSESS for and ADMINISTER all needed vaccines, including HPV at every opportunity
- Well child
- Sick visits
- Sports physicals
- Nurse only visits
- Schedule follow-up appointments before leaving
- Extend hours
- Collaborate with other agencies

(Winer et al., 2015)

Your HPV vaccination recommendation is uniquely influential!!!

Clinician Recommendation

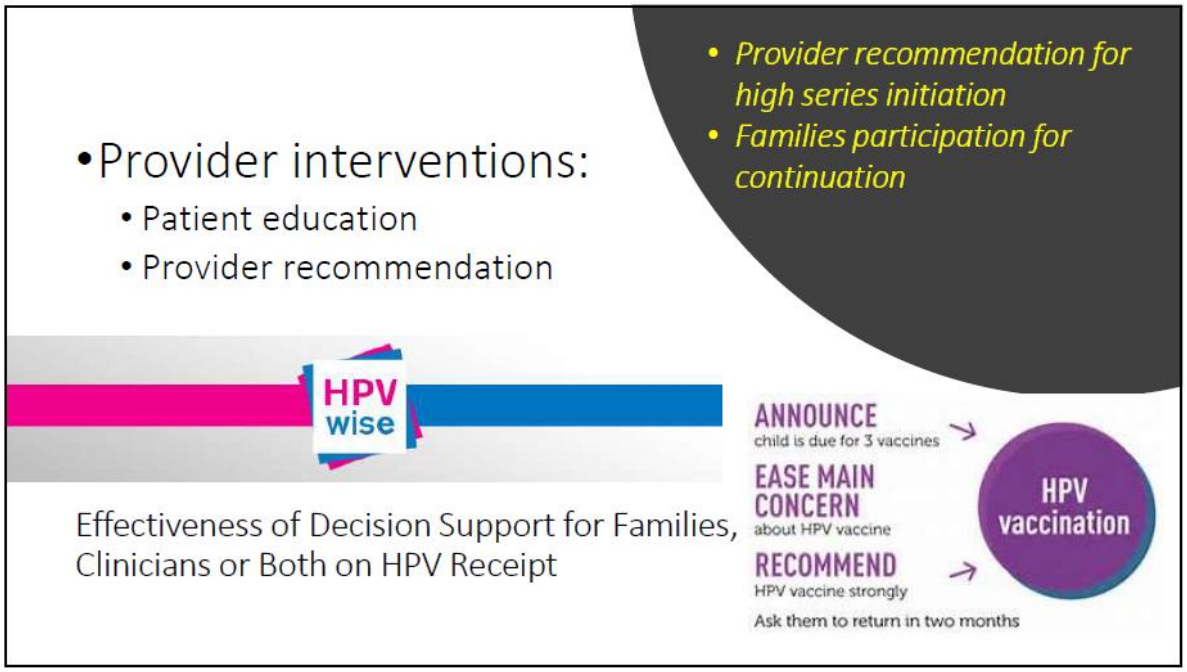


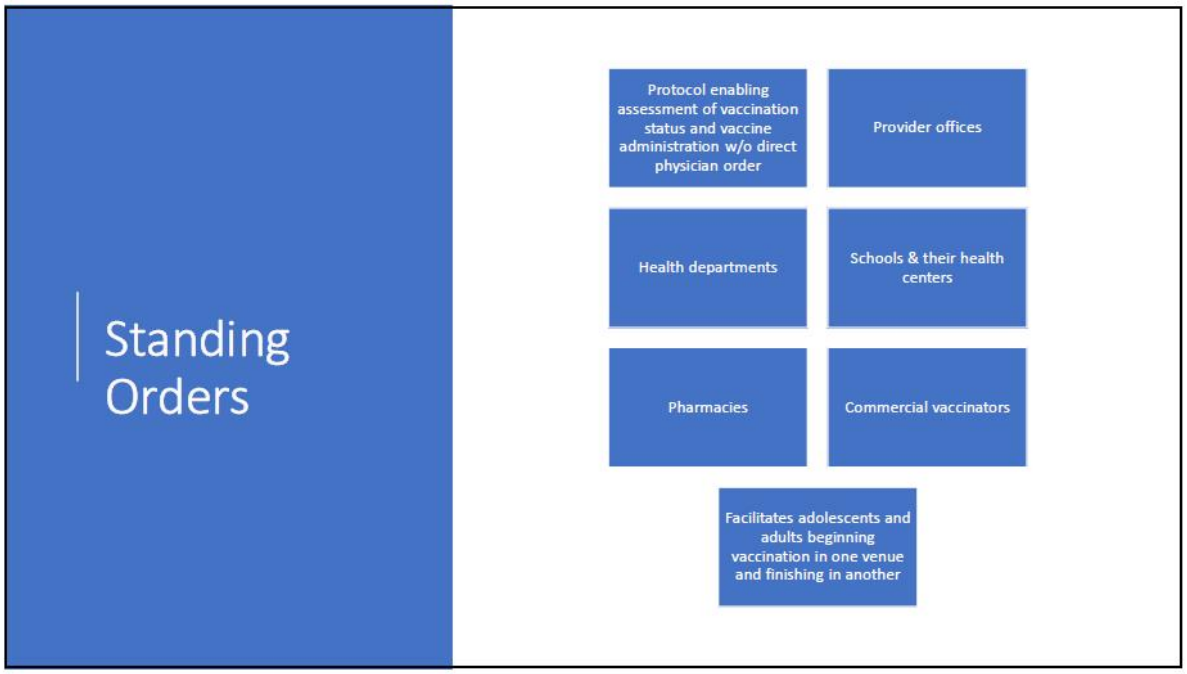
AJPH (Reiter et al., 2013)

- EMR prompts:
  - Automatic pop-ups
  - 'To do' task list
  - Many EHRs have prompts
  - Pre-installed that can be customized
  - Immunization Registries

- Nurse prompts:
  - Sticky notes
  - Checklists
  - Preprinted notes in clients chart

Using EMR Reminder


• Provider recommendation for high series initiation
• Families participation for continuation
• Provider interventions:
• Patient education
• Provider recommendation
HPV wise
Effectiveness of Decision Support for Families, Clinicians or Both on HPV Receipt
ANNOUNCE
child is due for 3 vaccines
EASE MAIN CONCERN
about HPV vaccine
RECOMMEND
HPV vaccine strongly
Ask them to return in two months
HPV vaccination


Standing Orders
Protocol enabling assessment of vaccination status and vaccine administration w/o direct physician order
Provider offices
Health departments
Schools & their health centers
Pharmacies
Commercial vaccinators
Facilitates adolescents and adults beginning vaccination in one venue and finishing in another

- Providers change their behavior (clinical practices) based on feedback that they are different from their peers

Methods:

- Immunization record review
- Giving feedback
- Can include incentives or benchmarking
- Immunization registries

Provider Assessment and Feedback

Measurements

Strategies

- Compare vaccination rates pre- and post- implementation
- Set a goal prior to implementing strategy and track vaccination rates over time (benchmarking), for example:
- 80% of girls will receive HPV1

Task #1

- Start your vaccine discussions with all 11-12 year-olds and their parents by saying:

" Your child needs 3 vaccines today – HPV, Tdap and meningococcal."

- Assess and vaccinate at every visit
- Use EMR reminder
- Standing Orders
- Assessment and feedback

Task #2

Which other evidence-based strategy discussed today will you try?

- References

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Appendix D
Patient Education

DISEASES and the VACCINES THAT PREVENT THEM
Updated December 2016

HPV

also known as *Human Papillomavirus*

As parents, you do everything you can to protect your children's health for now and for the future. Today, there is a strong weapon to prevent several types of cancer in our kids: the HPV vaccine.

HPV and Cancer

HPV is short for Human Papillomavirus, a common virus. In the United States each year, there are about 17,500 women and 9,300 men affected by HPV-related cancers. Many of these cancers **could be prevented with vaccination.** In both women and men, HPV can cause anal cancer and mouth/throat (oropharyngeal) cancer. It can also cause cancers of the cervix, vulva and vagina in women; and cancer of the penis in men.

For women, screening is available to detect most cases of cervical cancer with a Pap smear. Unfortunately, there is no routine screening for other HPV-related cancers for women or men, and these cancers can cause pain, suffering, or even death. **That is why a vaccine that prevents most of these types of cancers is so important.**

More about HPV

HPV is a virus passed from one person to another during skin-to-skin sexual contact, including vaginal, oral, and anal sex. HPV is most common in people in their late teens and early 20s. Almost all sexually active people will get HPV at some time in their lives, though most will never even know it.

Most of the time, the body naturally fights off HPV, before HPV causes any health problems. But in some cases, the body does not fight off HPV, and HPV can cause health problems, like cancer and genital warts. Genital warts are not a life-threatening disease, but they can cause emotional stress, and their treatment can be very uncomfortable. About 1 in 100 sexually active adults in the United States have genital warts at any given time.

HPV vaccination is recommended for preteen girls and boys at age 11 or 12 years

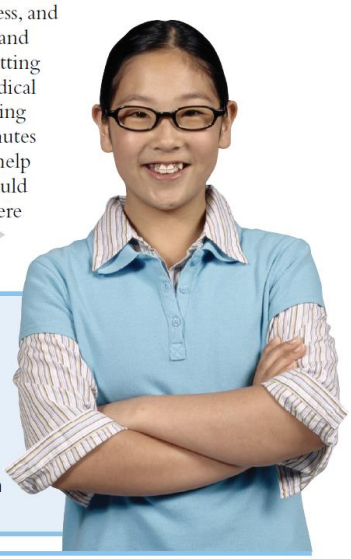
All preteens need HPV vaccination so they can be protected from HPV infections that cause cancer. Teens and young adults who didn't start or finish the HPV vaccine series also need HPV vaccination. Young women can get HPV vaccine until they are 27 years old and young men can get HPV vaccine until they are 22 years old. Young men who have sex with other men or who have weakened immune systems can also get HPV vaccine until they are 27.

HPV vaccination is a series of shots given over several months. The best way to remember to get your child all of the shots they need is to make an appointment for the remaining shots before you leave the doctor's office or clinic.

Is the HPV vaccine safe?

Yes. HPV vaccination has been studied very carefully and continues to be monitored by CDC and the Food and Drug Administration (FDA). No serious safety concerns have been linked to HPV vaccination. **These studies continue to show that HPV vaccines are safe.**

The most common side effects reported after HPV vaccination are mild. They include pain and redness in the area of the arm where the shot was given, fever, dizziness, and nausea. Some preteens and teens may faint after getting a shot or any other medical procedure. Sitting or lying down for about 15 minutes after getting shots can help prevent injuries that could happen if your child were to fall while fainting.



Why does my child need this now?

HPV vaccines offer the best protection to girls and boys who complete the series and have time to develop an immune response **before** they begin sexual activity with another person. This is not to say that your preteen is ready to have sex. In fact, it's just the opposite—it's important to get your child protected before you or your child have to think about this issue. The immune response to this vaccine is better in preteens, and this could mean better protection for your child.

DISTRIBUTED BY:

Serious side effects from HPV vaccination are rare. Children with severe allergies to yeast or latex shouldn't get certain HPV vaccines. Be sure to tell the doctor or nurse if your child has any severe allergies.

Help paying for vaccines

The Vaccines for Children (VFC) program provides vaccines for children ages 18 years and younger who are uninsured, Medicaid-eligible, or American Indian/Alaska Native. Learn more about the VFC program at **www.cdc.gov/Features/VFCprogram/**

Whether you have insurance, or your child is VFC-eligible, some doctors' offices may also charge a fee to give the vaccines.

Jacquelyn's story: "I was healthy—and got cervical cancer."

When I was in my late 20's and early 30's, in the years before my daughter was born, I had some abnormal Pap smears and had to have further testing. I was told I had the kind of HPV that can cause cancer and mild dysplasia.

For three more years, I had normal tests. But when I got my first Pap test after my son was born, they told me I needed a biopsy. The results came back as cancer, and my doctor sent me to an oncologist. Fortunately, the cancer was at an early stage. My lymph nodes were clear, and I didn't need radiation. But I did need to have a total hysterectomy.

My husband and I have been together for 15 years, and we were planning to have more children. We are so grateful for our two wonderful children, but we were hoping for more—which is not going to happen now.

The bottom line is they caught the cancer early, but the complications continue to impact my life and my family. For the next few years, I have to get pelvic exams and Pap smears every few months, the doctors measure tumor markers, and I have to have regular x-rays and ultrasounds, just in case. I have so many medical appointments that are taking time away from my family, my friends, and my job.

Worse, every time the phone rings, and I know it's my oncologist calling, I hold my breath until I get the results. I'm hopeful I can live a full and healthy life, but cancer is always in the back of my mind.

In a short period of time, I went from being healthy and planning more children to all of a sudden having a radical hysterectomy and trying to make sure I don't have cancer again. It's kind of overwhelming. And I am one of the lucky ones!

Ultimately I need to make sure I'm healthy and there for my children. I want to be around to see their children grow up.

I will do everything to keep my son and daughter from going through this. I will get them both the HPV vaccine as soon as they turn 11. I tell everyone—my friends, my family—to get their children the HPV vaccine series to protect them from this kind of cancer.

What about boys?

HPV vaccine is for boys too! This vaccine can help prevent boys from getting infected with the types of HPV that can cause cancers of the mouth/throat, penis and anus. The vaccine can also help prevent genital warts. HPV vaccination of males is also likely to benefit females by reducing the spread of HPV viruses.

Learn more about HPV and HPV vaccine at **www.cdc.gov/hpv**

For more information about the vaccines recommended for preteens and teens:
800-CDC-INFO *(800-232-4636)*
www.cdc.gov/vaccines/teens

Appendix E

Anonymous Survey Consent

You are requested to participate in a provider survey for a research project entitled *"*The Effect of Education on HPV Vaccination Rates among Females*"* designed to analyze the providers' current practices related to recommending the HPV vaccine, their knowledge of the ACIP recommendations regarding the HPV vaccine, and their perceived barriers to promoting vaccination to their teen and adolescent patients. The study is being conducted by ***Tilahun Goshu*** from ***UVA Graduate School of Nursing***. This survey is being conducted as part of the ***DNP scholarly project*** for ***Tilahun Goshu***.

This survey is comprised of ***11 HPV related questionnaires***, which might take ***five to six*** minutes to complete the survey. Your replies will be anonymous, so do not put your name anywhere on the form. There are no known risks involved with this study. Participation is completely voluntary and there will be no penalty or loss of benefits if you choose to not participate in this survey or to withdraw. If you choose not to participate you may either return the blank survey or you may discard it. You may choose to not answer any question by simply leaving it blank. Returning the survey *within blank envelope* indicates your consent for use of the answers you supply. If you have any questions about the study you may contact *Pamela Kulbok (Program advisor)* at *434-466-4313*, or Tilahun Goshu at 434-249-9752.

If you have any questions concerning your rights as a survey participant you may contact the University of Virginia IRB for Health Sciences Research at (434) 924-2620.

By completing this survey and returning it you are also confirming that you are **18** years of age or older.

Please keep this page for your records.

Name: _____

Signature: _____

Date: _____

Manuscript

The Effect of Education on HPV Vaccination Rates

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University of Virginia

Abstract

Human papillomavirus (HPV) vaccines have been confirmed to be safe and effective in preventing HPV-related disorders. A routine HPV vaccine is recommended at age 11 or 12, but it can be given as early as nine or as late as 26. However, vaccination rates in the United States remain very low. This study aims to improve the HPV vaccination rate among females 9 to 26 years of age. A retrospective (December 1, 2016 to January 31, 2017) and prospective (December 1, 2017 to January 31, 2018) chart review of all females from 9 to 26 years old presenting to a teen and young adult health clinic for a well-child exam or any other reason were performed. An EMR reminder, client education, and provider recommendation were delivered separately. Chi-square tests and student t-tests were used. There were 353 and 216 participants in the retrospective and prospective cohorts, respectively. Only 17 patients (4.8%) from the retrospective cohort and 18 patients (8.3%) from the prospective cohort received the HPV vaccine during their visit, $p = .090$. There was a significant difference in race, $p = .028$, and HPV note documentation, $p = .006$. If they are implemented separately, there is no association between the HPV vaccine rate increase and EMR reminder, patient education, and provider recommendations.

Human papillomavirus, HPV vaccine, client education, provider knowledge/awareness

The Effect of Education on HPV Vaccination Rates

Human papilloma virus (HPV) is considered one of the most prevalent sexually transmitted infections with a global prevalence of 11–12% in women (Das, Salam, Arshad, Lassi, & Bhutta, 2016). In America nearly 14 million people are infected with HPV annually, which poses a major public health concern (Smulian, Mitchell, & Stokely, 2016). An HPV vaccination is the most effective form of primary prevention of HPV-associated cervical and other related cancers (Keim-Malpass, Mitchell, & Camacho, 2015). The Food and Drug Administration (FDA) approved the quadrivalent vaccine (4vHPV), the bivalent vaccine (2vHPV), and the nine-valent vaccine (9vHPV) in 2006, 2009, and 2014, respectively (Smulian et al., 2016). These HPV vaccines are recommended by the Advisory Committee on Immunization Practices (ACIP) (Saslow et al., 2016). These recommendations provide public health guidance for safe use of vaccines. The current ACIP recommends regular HPV immunization at 11 or 12 years. However, the vaccination may be given as early as nine years and as late as 26 years (Das et al., 2016; Keim-Malpass, Mitchell, DeGuzman, Stoler, & Kennedy, 2017).

Clinical trial data has confirmed that HPV vaccines are safe and dramatically decrease the prevalence of HPV, genital warts, and cervical and anal dysplasia (Smulian et al., 2016). Nevertheless, the vaccination rate in the United States (U.S.) is still too low (Saslow et al., 2016). The *Healthy People 2020* goal is an 80% three-dose HPV vaccine completion rate for girls of 13 to 15 years of age (U.S. Department of Health and Human Services [USDHHS], 2017). In 2014 fewer than 40% of girls 13 to 17 years of age finished the recommended three doses of HPV vaccine (Smulian et al., 2016). It is imperative for healthcare providers to expand attempts to increase HPV vaccination and reduce the burden of HPV-associated cancers and diseases.

Review of Literature

Literature from January 2012 to April 2017 was reviewed to determine the effectiveness of several interventions to improve HPV immunization coverage between 9 and 26 years of age. Randomized controlled trials (RCTs), practice guidelines, systematic reviews, and prospective cohort studies with educational interventions were targeted. Keywords included "HPV education, females, teens, preteens, and young adults" (Figure 1). The inclusion criteria were HPV education, reminder calls, and provider recommendations targeting females ages nine to 26. The literature review yielded two systematic reviews, three RCTs, one practice guideline, and one prospective cohort study (Table 1).

Of the seven studies reviewed, most were intended to improve consumer demand and uptake of HPV vaccinations. Overall, the intervention methods were evidence-based approaches recommended by the national HPV guidelines. These included video-based vaccine narratives, educational pamphlets, reminder calls, parental education, text messaging, mail reminders, PowerPoint presentations, and telephone questionnaires (Winer, Gonzalez, Noonan, & Buchwald, 2015) with notable differences in effectiveness. Four of seven studies showed significant increases in HPV vaccination coverage following reminder calls, provider recommendations, and/or standardized client education interventions (Das et al., 2016; Saslow, 2016; Smulian et al., 2016; Winer et al., 2015). The intervention that produced significant increases in HPV vaccine uptake was the combined application of reminder calls, provider recommendations, and patient education (Das et al., 2016; Saslow, 2016; Smulian et al., 2016; Winer et al., 2015).

Rationale

Vaccine uptake is a potentially modifiable health behavior. The Health Belief Model (HBM) is used to describe and forecast health behaviors (Winer et al., 2015). The Health Belief Model was selected to guide this project in the development of effective interventions to change HPV-related behaviors. An EMR reminder, client education, and provider-recommendations based on the Health Belief Model may help to enhance the perceived susceptibility to and seriousness of HPV-related health conditions, through learning about the prevalence and incidence of cervical cancer, assessments of risk, and knowledge concerning the social and medical consequences. Furthermore, the HBM recommends using cues to action to remind and encourage individuals to participate in health-promoting behaviors. Potential results of these interventions include increased self-efficacy and improved HPV vaccine adherence (Winer et al., 2015).

Method

In anticipation of HPV vaccine uptake improvement, separate interventions of EMR reminders, client education, and provider recommendations were implemented at a Teen and Young Adult Health Clinic for females between ages nine and 26. The goal of this quality improvement study was to increase the HPV vaccination rate among females from nine to 26 years of age. There were three phases of descriptive correlational study: 1) an initial retrospective chart review, 2) EMR reminders, client education, provider recommendations, and a provider survey, and 3) a post-intervention chart review. After the intervention, prospective (intervention group) data were collected and compared the result with retrospective (control group) data. The University's Institutional Review Board (IRB) deemed this study as a quality improvement (QI) project

Setting and Sample

The Teen and Young Adult Health Center is a primary care center for teenagers and young adults aged 11 to 26, located in a University Health System in a Mid-Atlantic state. At the time of this study, two medical doctors, two nurse practitioners, and a nurse ran the clinic. Nearly 350 patients visited the clinic for a well-child checkup and various reasons each month.

Measures and Procedures

Demographic variables, vaccine counseling status, and vaccine offering, and acceptance trends were extracted from both retrospective and prospective chart reviews of all female patients, nine to 26 years of age, who attended the clinic. An existing provider survey tool about the HPV vaccine was modified to include 11-questions (McRee, Gilkey, & Dempsey, 2014). Questions addressed the barriers and facilitators of vaccine recommendation, females' reasons for receiving or not receiving the HPV vaccine, frequency of HPV vaccine recommendation, factors affecting recommendations, the ideal age for vaccination, attitudes towards the vaccine, and providers' knowledge of vaccine intervals. Open-ended, yes or no, and multiple-choice question types were included.

Phase one of the project consisted of a retrospective chart review. The purposes of this review were to determine the rate of HPV vaccination among nine to 26-year-old females presenting to the clinic between December 1, 2016, and January 31, 2017 and to assess whether providers at the clinic recommended and offered the HPV vaccine to their clients according to the ACIP guidelines.

De-identified patient data was obtained from a clinical data repository (CDR) and electronic medical records (EMRs) of all patients meeting the inclusion criteria. A chart audit tool was used to determine if vaccine counseling was provided and by whom, whether the

provider offered the vaccine, and whether the vaccine was accepted or declined by the patient. Gender, age at the time of visit, and race were included. After filtering for recurrent visits, 485 patients were identified; 132 patients were also excluded due to completion of the recommended three-dose HPV vaccine prior to December 1, 2016.

During phase two, on November 9, 2017, an EMR reminder and alert system focusing on the HPV vaccine were embedded into the health maintenance template to remind clinical staff to review immunization status of patients at each visit. The template listed all vaccinations that patients received and the date the vaccines were given on a single screen; this critical information allowed providers to order any missing vaccines. In addition, the clinic nurse disseminated patient education materials on the ACIP recommendations for the HPV vaccine throughout the intervention period. Client education was delivered to each patient by the providers and other staff members during routine client visits. The PI had a weekly meeting with the providers and other staff members to evaluate the process.

In phase three, a prospective chart review was done to determine the change in HPV vaccine uptake among nine to 26-year-old females presenting to the clinic between December 1, 2017 and January 31, 2018. After filtering for recurrent visits, data from 310 patients were collected. Among these, 94 cases were excluded due to completion of the recommended HPV vaccine series prior to December 1, 2017. This chart review used the same chart audit form for data collection and followed the same procedures as described in phase one.

Data Analysis

Preliminary data analysis included basic descriptive statistics on all study measures. The control group (n=353) data were collected retrospectively from December 1, 2016 to January 31, 2017; the intervention group (n=216) data were collected prospectively from December 1, 2017

to January 31, 2018 (Figure 2). Descriptive statistics were calculated for all variables. Chi-square tests were used to examine whether differences in demographic, age group, and vaccine-related variables existed between levels of acceptance to receive the HPV vaccine including initiation or completion (yes or no). Statistical significance was evaluated using an α level of 0.05, and all statistical analyses were done using SPSS v.24 software. A student t-test was calculated to determine whether there was a statistically significant difference between mean ages among the retrospective and prospective groups.

Results

Comparison of Retrospective and Prospective Data. All patients included in this comparison were female, nine to 26 years of age, and seen at the teen and young adult clinic for a well-child checkup or other reasons. The total number of female patients in the two cohorts with no missing data was 569. During the retrospective study period, 353 female patients were identified; 216 female patients were included in the prospective study period (see Table 2). During the retrospective timeframe, only 17 females (4.8%) received the HPV vaccine; and during the prospective timeframe, only 18 female patients (8.3%) received the HPV vaccine, p = .090 (see Table 3).

The mean age of the retrospective cohort was 18.82 (SD = 3.60) and the mean age of the prospective group was 18.31 (SD =3.65); there was no significant difference in age among the retrospective and prospective cohorts (t [567] =1.66, p = 0.097). The minimum age in the retrospective group was 9 and the minimum age for the prospective group was 10 (see Table 2). Within the retrospective cohort, 222 female patients (62.8%) were identified as white; 102 patients (28.9%) were African American, and 29 patients (8.2%) were other race. Likewise, in the prospective data, 143 patients (66.2%) were identified as white; 44 patients (20.4%) were

African American, and 29 patients (13.4%) were other race. When ethnicity was examined, 335 female patients (94.9%) in the retrospective cohort were reported to be non-Hispanic, versus 194 patients (89.8%) in the prospective group. There was no difference between the two cohorts in gender ($\chi 2$ [1] = 2.872, p =.090). However, there were significant differences in ethnicity ($\chi 2$ [3] = 9.511, p = .023) and race ($\chi 2$ [5] = 12.548, p = .028) (see Table 2).

When the retrospective vaccination rates of patients during the clinic visit were compared to those of the prospective cohort, there were no significant differences (χ^2 [1] = .2872, p = .090) (Table 3). HPV note documentation was significantly different (χ^2 [1] = 7.445, p = .006). There was no significant difference in HPV documentation prior to visits (χ^2 [2] = 1.894, p = .388). The EMR reminder was activated and triggered an alert on 186 (86.1%) patients of the prospective cohort and was not associated with HPV uptake during the visit ($\chi 2$ [1] = .048, p = .827).

Provider Survey. All providers who practice at the teen and young adult clinic responded to the survey. Two of the providers were physicians, two of them were nurse practitioners, and one was an expert staff nurse. Two providers reported offering the HPV vaccine 100% of the time to their female patients, and all providers believed that 75-99% of females initiated vaccination. Three providers reported offering the vaccine to 75-99% of female patients; two indicated that 75-99% accepted the vaccine and one reported a 50-74% acceptance rate for females. Two providers responded that their patients believed in primary prevention, another two providers found that only 75% of their patients believe in primary prevention, and one provider replied that his/her patients do not believe in primary prevention. Three out of the five providers responded that their patients had long-term safety concerns about the vaccine. Sixty percent of the providers believe that their patients were unlikely to return for the second and third dose (Table 4).

All of the providers responded that they were aware of the current ACIP recommendations. Three providers answered all questions correctly regarding their knowledge of the ACIP recommendations for both males and females. One provider differed on the matter of vaccine interval and ideal age of vaccination. Another provider differed from others on the recommendations of catch-up vaccinations, responding that "...catching up must be done any time you can."

Three providers answered that they had inconsistently offered the vaccine to different patients, and were more likely to offer the vaccine when the patient was visiting for immunization purposes. The leading concerns mentioned by three providers were patients' and parents' lack of knowledge of the HPV vaccine and their low medical literacy. Two providers reported EMR competency and knowledge issues as potential barriers. Providers had a maximum of 20 minutes to spend with a patient; as a result, most providers believe that time constraint was a hindering issue.

All providers responded that the follow-up process for the second and third doses was challenging; and clinic staffing was the most frequently mentioned reason. According to these providers, staffing shortage led to difficulty in sending out patient reminders before visits.

Education. On September 26, 2017, a PowerPoint presentation was delivered with information on HPV prevalence and transmission, HPV vaccine recommendations, dosage schedule, and vaccine efficacy and safety to improve providers' knowledge. The presentation targeted providers to decrease missed opportunities. In addition, seven hundred copies of standardized HPV educational brochures produced by CDC were handed to the clinic nurse. Then the nurse disseminated the pamphlets to each patient and parents between October 1, 2017 to November 30, 2017.

Discussion

The intervention strategies reported in the literature that produced statistically significant increases in HPV vaccination coverage were provider reminder, recall, and patient education (Das et al., 2016). In this study, EMR reminder, provider recommendation, and patient education interventions were implemented. A 3.5% increase in HPV vaccination at clinic visits during the prospective time-period was found, although this increase did not achieve significance (p =.090).

The Community Guide does not recommend patient education alone as a strategy to increase vaccination coverage due to insufficient evidence (Das et al., 2016). Originally, three simultaneous interventions were planned; however, due to reasons beyond the researchers' control, the EMR reminder was released six weeks after client education and provider recommendation. According to Saslow and colleagues, provider knowledge survey and feedback, when used alone, produced significant but small increases in HPV vaccination initiation (Saslow et al., 2016).

HPV vaccines are a widely discussed and proven best protective measures against HPV infections (Das et al., 2016). Both the retrospective and prospective chart reviews revealed that the teen and young adult clinic HPV vaccine uptake is below the national average. In the study clinic, the provider recommendation for HPV immunization was not standardized, documentation was inconsistent, and no patient follow-up mechanism was in place for the second and third vaccine doses.

One of the goals discussed in the literature was to "reduce missed opportunities to recommend and administer HPV vaccine" (Das et al., 2016). To meet the *Healthy People 2020* goal, healthcare providers must use every opportunity by recommending the HPV vaccine to all eligible patients (Hopfer, 2012). The literature indicated that although provider recommendations

for HPV vaccination are highly correlated with higher coverage, several providers do not routinely recommend HPV vaccination (Winer et al., 2015).

For this study, an EMR provider reminder was developed and embedded in the health maintenance template. The EMR reminder release was considered as a significant achievement of this study. The EMR reminder triggered on 86.1% of patients during the prospective data review and resulted in a 6.6% increase in HPV documentation (see Table 3); providers were more likely to document about HPV when they encountered the EMR reminder. If the providers use the EMR reminder to its full extent, it may help in reducing missed opportunities for vaccination.

Notably, the provider survey revealed critical obstacles including irregularities in provider recommendation, perceived long-term safety concerns, lack of a follow-up mechanism, low medical literacy of parents and patients, and inadequate time to discuss the vaccine with patients. The barriers raised during the provider survey are not unique, and similar obstacles have been described in other studies (Smulian et al., 2016). Systematic reviews have found that a knowledge gap among patients regarding HPV, parental opinions about the HPV vaccine, and apprehensions about vaccine safety were some of the top hindrances to immunization acceptance (Das et al., 2016).

Strengths and Limitations

This study did not have time and logistical constraints, which can be considered an advantage. Since the research environment was not artificial, the reactions of participants were more likely to be genuine. However, the study lacked random assignment into test groups, which may limit the generalizability. Lack of accurate HPV vaccination series completion data in the EMR and the inability of interface between the Virginia Immunization Information System

(VIIS) and the EMR were also notable limitations of this project. In addition, due to the late release of the EMR reminder, patient education and provider recommendation interventions started six weeks before the official release date. The implementation of these interventions separately may have influenced the findings. According to Winer and colleagues (2015), a strong provider recommendation was linked to increased vaccine acceptance and initiation. Social pressures and perceived vaccine benefits also increased the likelihood that patients would initiate the vaccine series (Winer et al.). The intervention period of two months may have been too short to show the whole picture; therefore, study with a more extended timeframe is recommended.

Conclusion

Standardized documentation is important for improving the quality of nursing practice. Consistent and standardized provider recommendations of HPV vaccines to all eligible females will improve the uptake of the HPV vaccine. Based on the health belief model, visible posters, available educational brochures, and provider reminders embedded in EMRs could serve as excellent cues for desired provider and patient behaviors. As a result of this project, the providers mention HPV in their EMR documentation more frequently.

This project separately implemented an EMR reminder, client education, and provider recommendations in anticipation of increasing the HPV vaccine uptake according to ACIP recommendations. While HPV vaccine uptake did not show a statistically significant increase related to these interventions, providers acknowledged that interventions increased awareness of vaccination facilitators and barriers. This project encouraged the providers to stay educated regarding ACIP recommendations, *Healthy People 2020* HPV vaccine goals, and healthcare policy related to the HPV vaccine; as a result, they can offer educated guidance to their patients in the future. Long-term follow-up and further studies are recommended.

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Study Table

Table 1

Education related interventions for HPV vaccination study summary (n=7)

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
(Hopfer, 2012). Effects of a narrative HPV vaccination intervention aimed at reaching college women: A randomized controlled trial	N=404 18 to 26-year-old females: I1: n=101 I2: n=101 I3: n=50 C: n=152 1 university health clinic	RCT Participants were emailed asking whether they received vaccine or not two months after receiving intervention or control	I1: Video of vaccine decision narratives delivered by peers and experts/ providers I2: Video of vaccine decision narratives delivered by peers I3: Video of vaccine decision narratives delivered by experts/ providers C: Information video with no narrative, informational website, or no message	O: Series initiation after 2 months Series initiation (I1 vs. C, p =.035; I2 vs. C and I3 vs. C not significant): I1: 21.8% I2: 17.8% I3: 6.0% C: 11.8% Series initiation (OR) (I1 vs. C, p = .036; I2 vs. C and I3 vs. C not significant): I1: OR 2.07 I2: OR 1.61 I3: OR 0.48 Limitations: 1. Outcome was vaccine initiation rather than completion of HPV series 2. Findings limited to the college -aged female population at one university with largely Caucasian population

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
				3. Expert-only intervention shorter in length, which did not permit dosage effects
(Vanderpool et al., 2013). "1-2-3 Pap" intervention improves HPV vaccine series completion among Appalachian women.	N=344 18 to 26-year-old females: I: 178 C: 166 Recruited from multiple locations in Appalachian Kentucky	RCT Nurses provided dose 1 free of charge and offered study enrollment following dose 1.	I: Watched 13-minute DVD video grounded in information, motivation, and behavioral skills theory. Participants also received follow up reminder calls for doses 2 and 3, like the control group. C: Standard of care (educational pamphlet and telephone reminders for doses 2 and 3)	Series completion after 12 months Series completion (I vs. C, p =.03): I: 43.3% C: 31.9% Series completion (I vs. C, p= .001): AOR 2.44 Limitation: Cross-sectional survey
(Smulian, Mitchell, & Stokely, 2016) Interventions to increase HPV vaccination coverage: A systematic review, human vaccines & Immunotherapeutic	4. Association of Schools and Programs of Public Health, Washington, DC, USA; 5. Immunization Services Division, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, Atlanta, GA, USA; 6. Carter Consulting, Inc., Atlanta, GA, USA	A systematic review: 1.Nineteen studies (55.9%) utilized interventions to increase community demand for HPV vaccination. 2. Three studies examined the effect of vaccination requirements for school attendance on HPV vaccination coverage.	Of the 34 HPV vaccination intervention studies identified, most of the studies were designed to increase community demand for HPV vaccination: 1. Education of parents and/or providers, enhanced practice-based IT systems, and/or provider incentives. The studies took place in a variety of settings and there was a wide range in the number of participants 2. Reminder call, text messaging, and mailing	7. HPV vaccination coverage in two cohorts of 6th graders; one cohort of 6th graders in 2009, the other 6th graders in 2010. The study found small significant increases in HPV series initiation by age 13 for girls (hazard ratio [HR] 1.18, $p < .001$), especially if the HPV vaccine was co-administered at the first adolescent visit (HR 1.22, $p < .001$). 8. The mailed letter intervention found significantly greater HPV series completion in the entire study age range intervention group (percentage point difference: 9.8, $p < .01$). 9. A mailed letter intervention to a telephone reminder intervention found significantly greater dose 2 and series completion in both intervention groups; the mailed letter

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
	A systematic review of 34 studies suggest many types of intervention strategies to increase HPV vaccination coverage in different settings, and with modest cost.			intervention resulted in an 8-percentage point increase in dose 2 coverage (HR 1.5, $p < .05$), and the telephone reminder intervention resulted in an 8-percentage point increase in dose 2 (HR 1.6, $p < .01$) and a 5-percentage point increase in series completion (HR 1.5, $p < .05$). 10. Text message reminders showed increases in coverage, with significantly greater on-time receipt of next HPV vaccine dose in an intervention group against two different control groups (adjusted odds ratio [AOR] 2.03 and AOR 1.83, $p = .002$ and .003) 11. Multiple types of reminders and found that 22.9% of due or overdue patients received their next dose of HPV, and showed that this cascade method was most effective at encouraging series completion ($p < .0001$). 12. Another intervention implemented more than one reminder method by using mailed letters and telephone reminders, and found significantly greater HPV series initiation and completion from zero baseline doses in the intervention group (percentage point difference in series initiation:11.2, $p < .05$; percentage

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
				point difference in completion from zero baseline doses: 7.3, $p < .05$).
(Winer, Gonzales, Noonan, & Buchwald, 2015), A cluster-randomized trial to evaluate a mother–daughter dyadic educational intervention for increasing HPV vaccination coverage in American Indian girls	Hopi Reservation in northeastern Arizona: 88 subjects randomly assigned in to two clusters of intervention groups and two to the control group based on geographic location, Participants attended mother daughter dinners featuring educational presentations for mothers on either HPV (intervention) or juvenile diabetes (control) and completed baseline surveys. Eleven months later, researchers surveyed mothers on their daughters' HPV vaccine uptake.	A Cluster-Randomized Trial	I: Dinner with HPV educational intervention including vaccine recommendations, dosage schedule, and efficacy and safety. HPV Presentations lasting 30 to 40 minutes with educational brochures with similar content distributed C: Diabetes treatment and prevention education	4. Adjusting for household income, the proportion of daughters completing vaccination within 11 months postintervention was similar in the intervention and control groups (32 vs. 28 %, adjusted RR = 1.2, 95 % confidence interval (CI) 0.6–2.3). 5. Among unvaccinated daughters, those whose mothers received HPV education were more likely to initiate vaccination (50 vs. 27 %, adjusted RR = 2.6, 95 % CI 1.4–4.9) and complete three doses (adjusted RR = 4.0, 95 % CI 1.2–13.1) than girls whose mothers received diabetes education. 6. Community-level data showed that 80 % of girls aged 13–17 years and 20 % of girls aged 11–12 completed the vaccination series by 2013. Important limitations: 4. Statistical power was limited by the small sample size and37 % loss to follow-up for post-dinner ascertainment of HPV vaccine status. 5. Ascertainment of vaccine uptake was limited to a follow-up survey conducted <12 months after the intervention 6. Daughters' vaccination status was ascertained by parental report rather than by medical record review

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
(Das, Salam, Arshad, Lassi, & Bhutta, 2016). Systematic review and meta-analysis of interventions to improve access and coverage of adolescent immunizations	A systematically reviewed literature published up to December 2014 and included 23 studies on the effectiveness of interventions to improve immunization coverage among adolescents.	Systematic Review and Meta-Analysis	I: 4. Vaccination requirement in school 5. Sending reminders 6. National permissive recommendation for adolescent	3. Moderate-quality evidence from 13 studies suggested an overall increase in vaccination coverage by 78% (RR: 1.78; 95% CI: 1.41- 2.23 4. Subgroup analysis suggests that vaccination requirement in school, reminders, and national permissive recommendation had a significant impact on improving coverage while clinic staff training showed a nonsignificant impact. Strategies to improve coverage for HPV vaccines including countrywide provision and clinic-based delivery resulted in a significant decrease in the prevalence of HPV by 44% (RR: .56; 95% CI: .38-.82; and genital warts by 33% (RR: .66; 95% CI: .52-.84
(Saslow et al., 2016). Human papillomavirus vaccination guideline update: American Cancer Society guideline endorsement	The American Cancer Society (ACS) reviewed and updated its guideline on human papillomavirus (HPV) vaccination based on a methodologic and content review of the Advisory Committee on Immunization Practices (ACIP) HPV	Practice guideline	4. HPV "catch-up" vaccination for females age 19 to 26 5. HPV vaccination for males ages 9 to 26 6. 9-valent HPV vaccination for males and females	4. Results from a pooled analysis of 3 RCTs showed that estimates of benefits against high-grade cervical lesions are substantially reduced, therefore, "late" vaccination be recommended for females ages 19 to 26 years who have not been vaccinated previously 5. The manufacturer-sponsored RCTs have demonstrated vaccine efficacy, high levels of immunogenicity, and

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
	vaccination recommendations. ACIP recommendations, with one qualifying statement related to late vaccination. The ACS recommends vaccination of all children at ages 11 and 12 years to protect against HPV infections that lead to several cancers and precancers.			safety in males comparable to those in females, therefore, HPV vaccination be recommended for males ages 9 to 26 years 6. The available data on the 9vHPV vaccine are limited but show efficacy, immunogenicity, and safety comparable to those demonstrated for the quadrivalent vaccine, therefore, 9vHPV vaccination be recommended for males and females Important Limitations: 3. Most RCTs are done by drug manufacturers 4. Limited data availability on the efficacy, immunogenicity, and safety of 9vHPV vaccine compared to others
(Cuff et al., 2016). Rates of human papillomavirus vaccine uptake amongst girls five years after introduction of statewide mandate in Virginia	908 girls aged 11 to 12 years -old who was seen for well-child care from January to December 2014 UVA	A prospective cohort study used the clinical data repository at the University of Virginia. The purpose of this study was to evaluate the uptake of the human papillomavirus vaccine among girls seeking well-child care 5 years after the introduction of a statewide mandate in Virginia in October 2008.	I: Telephone questionaries' by trained interviewers through the University of Virginia Center for Survey Research C: Previous study in 2009	1. 50.9% of the girls received at least 1 dose of human papillomavirus vaccine. 2. White race and private insurance coverage were found to be associated negatively with human papillomavirus vaccine uptake (relative risk, 0.74 and 0.71; 95% confidence interval, 0.64-0.85 and 0.62-0.81, respectively). 3. Black race and public insurance coverage were found to be associated positively with vaccine uptake (relative risk, 1.35 and 1.39; 95% confidence interval, 1.17-1.55 and 1.22-1.58, respectively). 4. In comparison with the previous study, there has been no change in human

Study	Subjects and Setting	Design	Intervention and Comparison Intervention	Outcomes
				papillomavirus vaccine uptake or distribution of uptake after the introduction of the statewide mandate for human papillomavirus vaccination. Important limitations: d. Presence of lax exemption e. Parental education and perceived susceptibility to HPV, physician recommendation, and the cost of vaccination are all almost certainly involved in the parental decision to accept or decline vaccination. f. Relatively small proportion of parents (8%) who reported that they thought their daughter was "not at risk."

Note. I= intervention, C = comparison or control; OR= odds ratio, AOR= adjusted odds ratio, RR= risk ratio, HR= hazard ratio, CI= Confidence intervals, and *p* values are used

Table 2

Demographic Characteristics

	(Retrospective)		(Prospective)		*P value*
Variable	Mean (SD)	N (%)	Mean (SD)	N (%)	
Age (female)	18.82 (3.60)		18.31 (3.65)		.097[a]
Race (female)					.028[b]
White		222 (62.8)		143 (66.2)	
African American		102 (28.9)		44 (20.4)	
Other		29 (8.2)		29 (13.4)	
Ethnicity (female)					.023[b]
Non-Hispanic		335 (94.9)		194 (89.8)	
Hispanic		18 (5.1)		22 (10.2)	
Gender (female)					.090[b]
Female		353 (100.0)		216 (100.0)	
Encounter type (female)					<.001[b]
Office visit		217 (61.5)		141 (65.2)	
Procedure visit		90 (25.5)		47 (21.8)	
Nurse visit		30 (8.5)		22 (10.2)	
Clinical support		12 (3.4)		0 (0.0)	
Immunization		4 (1.1)		6 (2.8)	

Note: [a] *– Independent t-test* [b] –2- sided chi-square test

Table 3

HPV vaccine rate characteristics and outcomes

	Retrospective, n (%)	Prospective n (%)	*P* value
HPV given during visit (females)	17 (4.8)	18 (8.3)	.090 [1]
HPV note documentation (females)			.006 [1]
Yes	21 (5.9)	27 (12.5)	
No	332 (94.1)	189 (87.5)	
Visit type (Well child visit?) (females)			.171 [1]
Yes	347 (98.3)	211 (97.7)	
No	6 (1.7)	5 (2.3)	
HPV notes documentation prior to visit			.388 [1]
None	281 (79.6)	163 (75.5)	
HPV 1	36 (10.2)	30 (13.9)	
HPV 2	36 (10.2)	23 (10.6)	

Note. [1] 2-sided chi - square test

Table 4

HPV Vaccine Uptake Facilitators and Barriers Providers Survey (n=5)

	P #1	P #2	P # 3	P #4	P #5
Facilitators					
My clinic Participates in VFC	Yes	Yes	Yes	Yes	Yes
My clinic has reminders in the EMR	No	N/A	No	No	No
My clinic uses a form during well-child exams that prompts for CDC recommended vaccinations	No	N/A	No	No	No
I have time to educate my patients about HPV and the vaccine	Yes	50%	Yes	Yes	Yes
I strongly recommend the HPV vaccine to all eligible patients	Yes	Yes	Yes	Yes	Yes
I have completed continuing education regarding HPV/ or the HPV vaccine	Yes	Yes	Yes	Yes	Yes
I am aware of the CDC/ ACIP recommendations for HPV vaccination	Yes	Yes	Yes	Yes	Yes
My patients have a good understanding of the risks of HPV infection	50%	Yes	No	No	50%
My patients/ their parents believe that they are at risk for HPV	50%	75%	Yes	No	Yes
My patients have a belief in primary prevention	Yes	75%	Yes	No	75%
My patients are aware of VFC and its coverage	Yes	>75%	Yes	No	>75%
My patients have positive peer/ family support regarding HPV vaccination	50-75%		Yes	No	
Barriers					
The HPV vaccine is not stocked or there is low availability in my practice.	No	No	No	No	No
My practice is not adequately reimbursed for HPV vaccine administration.	No	No	No	No	No
I do not have time to discuss HPV vaccination during patient visits.	No	Yes	No	No	Yes
I have concerns about the long-term safety of the HPV vaccine.	No	No	No	No	No
I feel uncomfortable discussing a vaccine for a sexually transmitted infection with my patients and/or their parents.	No	Yes	Yes	No	Yes
I do not agree with the CDC/ACIP recommendations for HPV vaccination.	No	No	No	No	No
My patients are unaware of the risks of HPV infection.	No	<25%	Yes	Yes	Yes
My patients think the cost of the HPV vaccine is too high.	No	No	No	No	No
My patients are worried about the long-term safety of the HPV vaccine.	Yes	No	Yes	No	Yes
My patients are unlikely to return for the 2nd and 3rd dose of the vaccine series.	No	Yes	Yes	No	Yes
My patients are unlikely to get the vaccine because it is not required for school entry.	No	No	No	No	No
My patients are concerned about the pain associated with the HPV vaccine.	Yes	Yes	Yes	Yes	Yes

Note. All providers agreed that their practice clinic participates in the Vaccines for Children Program (VFC). Two providers think that their patients believed in primary prevention, another two providers find that only 75 % of their patients believe in primary prevention, and a provider replied his/her patients do not believe in primary prevention.

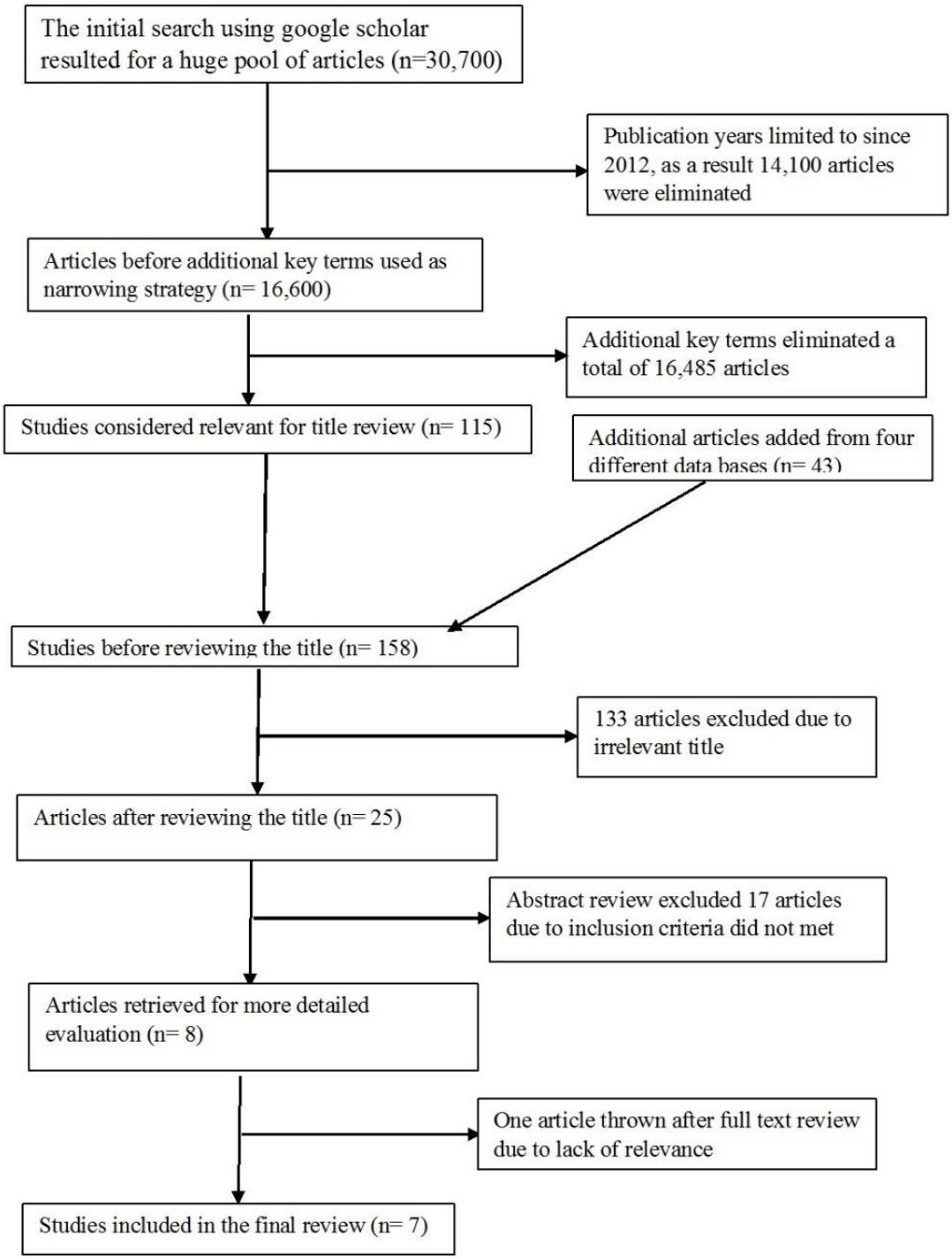

Figure1. Flow chart of review process and study selection

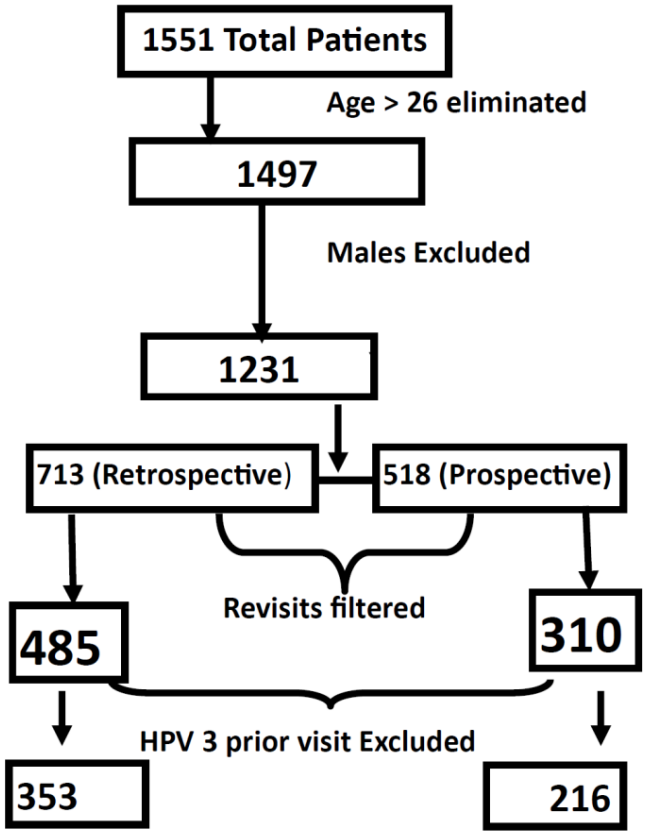

Figure 2. Flow chart of retrospective and prospective study samples