

Research Article

## Reducing the missed opportunities and Increasing Human Papillomavirus Vaccination Rates among Early Adolescents with Low Socioeconomic Status

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### Abstract

**Background:** Almost 43,000 people in the United States have an HPV-associated cancer each year, with cancers in varying sites including the vagina, cervix, penis and anus. A majority of these cancers can be prevented through the 9-valent human papillomavirus (HPV) vaccination that is the current recommended type of vaccine by the Advisory Committee on Immunization Practices (ACIP). Unfortunately, the rates of individuals that have fully been vaccinated against HPV in the United States is still less than 50%. The goal of our study was to analyze the HPV vaccination rate of vaccine eligible patients (VEP), between the ages of 9-15 years attending a community Children's Physician (CP) Pediatrics Clinic in Omaha, Nebraska and assess missed opportunities (MO) before and after intervention. **Method:** We did two provider-focused interventions after an initial lunch and learn education session about HPV vaccination: 1. avoiding MO by checking vaccination records and 2. weekly reminder emails with HPV information to PCPs. **Result:** The baseline immunization rate, calculated as percent of VEP vaccinated at their visit, was significantly lower in 2018 (13.16% MO 86.84%) than in 2017 (23.45% MO 76.55),  $p < 0.05$ . Immunization rates of VEP in 2018 increased during intervention 1 (23.35% MO 76.65%) compared to baseline (13.16% MO 86.84%). Rates further improved during intervention 2 (46.32% MO 53.68%), and this was higher than the same months in 2017 (35.68% MO 64.32%), when no intervention was in place. This is the only time-period which differs significantly from its 2017 counterpart. Male vaccination rates for VEP trended similarly to the combined results: lower baseline in 2018 (11.7% MO 88.3%) vs. 2017 (28.17% MO 71.83%), increased rate during intervention 1 (21.43% MO 78.57%), and further increased rate during intervention 2 (48.33% MO 51.67%). Female vaccination rates of VEP showed an upward trend from baseline in 2018 (14.58% MO 85.42%) to maintenance period 2 (45.92% MO 54.08%), but there were no significant changes from the same time periods in 2017. **Conclusion:** Through provider education and email reminders the missed opportunities for HPV vaccination was reduced.

**Keywords:** HPV, HPV-associated cancer, vaccine eligible patients, missed opportunity

### Introduction

HPV is an oncovirus associated with several types of cancers, including cervical, oropharyngeal, vaginal, anal and penile, that can affect people of both genders. There are about 23,000 women and almost 16,000 men that are affected by HPV-associated cancers each year in the United States. The most common HPV-associated cancer in women is cervical cancer and the most common in men are oropharyngeal cancers; the majority of these cancers can be prevented through vaccination with the 9-valent HPV vaccine, which is the current vaccination against HPV utilized in the United States [1-3].

The 9vHPV vaccine immunizes against nine different types of HPV, including HPV 16 and 18 which are responsible for the majority of HPV-associated cancers as well as HPV 6 and 11 which cause anogenital warts. Prior to the ACIP recommending the use of only the 9vHPV vaccine for routine vaccinations, the 4vHPV and 2vHPV vaccines were used for routine vaccination of adolescents. Following the administration of the 4-valent HPV vaccine, an 89% decrease in cancers associated with HPV 16 and 18 as well as decreases in the incidence of anogenital warts caused by HPV 6 and 11 among females between the ages of 14-24 years has been shown [4]. The change to the vaccine recommendation occurred recently since it protects against five additional types of HPV that are associated with about 15% of cervical cancers [1-3]. With the existence of this vaccine, a majority of HPV-associated cancers are now preventable; unfortunately, the rate of fully vaccinated individuals in the United States, and specifically Nebraska, is still less than 50%.

According to the MMWR, the rate of female adolescents between the ages of 13-17 that have completed three doses of the HPV vaccine in 2015 in Nebraska was 48.2% ( $\pm$  8.6). The rate for male adolescents of the same age that has completed the three doses of the vaccination was at a lower rate, 32.2% ( $\pm$  7.2%). Many adolescents may start their HPV vaccination and don't complete it, or they never start their vaccination process; 67.3% ( $\pm$  7.9) of female and 54.3% ( $\pm$  7.9) of male adolescents between the ages of 13-17 in Nebraska have either only received one or even none of the HPV vaccine doses [5].

Since less than half of the adolescent population has received the recommended 3 doses of the HPV vaccine for those older than 15 years of age and the recommended 2 doses for those ages 9-15<sup>1-3</sup>, it is important to implement methods to increase the rate of vaccination among these age groups to prevent HPV related complications. With the benefits of the newly recommended 2-dose schedule by ACIP, including lower potential adverse effects and more cost effectiveness, having patients between the ages of 9-14 years receive the vaccination would be preferable [1-3,6].

As stated previously, HPV can cause a variety of different cancers in both males and females. It is a very common sexually transmitted infection and the vaccination has shown great efficacy in decreasing vaccine type HPV [1-3,6,7]. Among the cancers associated with HPV is cervical cancer, which is one of the top causes of cancer in women, contributing to almost 8% of all cancers in women [8]. A significant problem in regard to the current status of HPV vaccination among adolescents and pre-pubescent individuals is the low rate of vaccination among these individuals. As mentioned previously, in 2015, the percentage of females between the ages of 13-17 in Nebraska that received 3 or more doses of the HPV vaccination was 48.2%, and for males of the same age it was only at 32.2% [5]. This rate of vaccination did not meet the target for HPV vaccine by Healthy People 2020 in either gender, which aimed at an 80% vaccination rate [8,9].

There are numerous reasons for this; studies have shown that parents may refuse because of safety concerns, lack of knowledge and religious affiliation [10]. One common myth that parents believe is from a study showing that adolescent females  $\geq$  15 years that receive the 4v HPV vaccination over the course of 12 months showed an increased risk of HPV associated anogenital infection [11]. Along with this initial barrier, the compliance with the dosage of the vaccination is also highly important. This proposed study is unique in the combination of techniques utilized to increase HPV vaccination and completion in specific group of patients from families with low socioeconomic status.

This study addresses the low vaccination rate for the HPV vaccine and discusses the effectiveness of a combination of methods to increase the rate of vaccination. The ultimate goal of this study is to implement methods to help make vaccination for HPV more routine and meet the target rate of Healthy People 2020. The combination of using vaccination record review of each patient on the daily schedule and provider targeted reminder emails will improve the vaccination rate among males and females between the ages of 9-15 living in families with low

socioeconomic status. The results of this study can be utilized to increase national HPV vaccination rates in order to meet the target rate of 80% set by Healthy People 2020.

## Methods

The goal of our study was to analyze the HPV vaccination rate of vaccine eligible patients (VEP), between the ages of 9-15 years attending a community Children’s Physician (CP) Pediatrics Clinic in Omaha, Nebraska and assess missed opportunities (MO) before and after intervention. We did two provider-focused interventions after an initial lunch and learn education session about HPV vaccination: 1) avoiding MO by checking vaccination records and 2) weekly reminder emails with HPV information to PCPs. To capture these opportunistic appointments, for each appointment scheduled regardless of the reason for visit, the patient’s HPV vaccination status was checked. By implementing this strategy, the goal was to make it routine for providers to discuss HPV vaccination with all patients and parents that meet the age range for the vaccination.

The first intervention involved reviewing daily schedules and identifying VEP for one month. Specifically, patient immunizations were reviewed according to the ACIP guidelines for the HPV vaccine. Patients that are between the ages of 9-14 should receive two doses of the vaccination, with the second dose between 6-12 months after the first dose. Patients that are 15 years and older are recommended to receive three doses of the vaccine. The second vaccine should be between 1-2 months after the first and the third dose should be about six months after the first dose [3,8,9]. Documentation during the analysis of data specified each patient’s status regarding the number of doses received and gap between the doses. A two-month period of no interventions between the first and second interventions was utilized as a maintenance period.

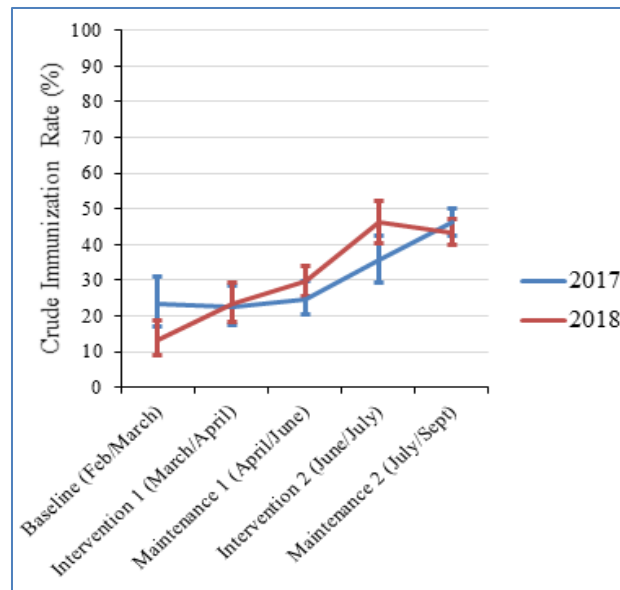
The second intervention consisted of a series of 6 emails with HPV information sent to providers over a period of one month. The information discussed in the emails included the national HPV rate *vs.* NE HPV rate, the current clinic HPV rate, vaccination outcome and effect on cancer, tips for effective communication with parents, tips for effective communication with healthcare staff, and tips on long-term improvement in HPV rates. The three months following intervention 2 was the second maintenance period.

## Results

The baseline immunization rate, calculated as percent of VEP vaccinated at their visit, was significantly lower in 2018 (13.16% MO 86.84%) than in 2017 (23.45% MO 76.55),  $p < 0.05$ . Table 1 and Figure 1 demonstrate the immunization rates by month in 2017, prior to the intervention, which is used as baseline, and during 2018 when the interventions were implemented.

**Table 1:** Immunization Rate by Year and Cycle.

	2017		2018		P
	Immunized/Visits	Rate	Immunized/Total	Rate	
<b>Baseline (Feb/March)</b>	34/145	23.5	25/90	13.2	0.014
<b>Intervention 1 (March/April)</b>	47/209	22.49	53/227	23.35	0.831
<b>Maintenance 1 (April/June)</b>	80/322	24.84	122/412	29.61	0.151
<b>Intervention 2 (June/July)</b>	71/199	35.68	126/272	46.32	0.021
<b>Maintenance 2 (July/Sept)</b>	296/639	46.32	342/786	43.51	0.289



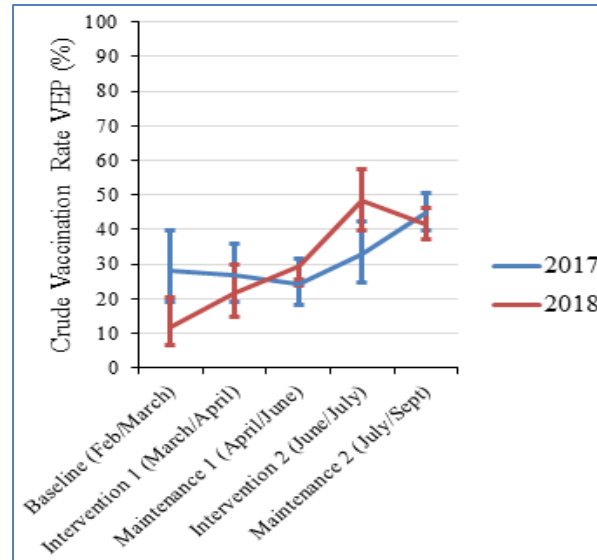
**Figure 1:** Immunization Rate VEP - Boys & Girls

Immunization rates of VEP in 2018 increased during intervention 1 (23.35% MO 76.65%) and maintenance period 1 (29.61% MO 70.39%), compared to baseline (13.16% MO 86.84%). Rates further improved during intervention 2 (46.32% MO 53.68%) and maintenance period 2 (43.51% MO 56.49%). Rates during the second intervention period in 2018 were higher (46.32% MO 53.68%) than in 2017 (35.68% MO 64.32%) when no intervention was in place. This is the only time-period which differs significantly from its 2017 counterpart.

**Table 2:** Immunization Rate for Boys and Girls by Year and Cycle.

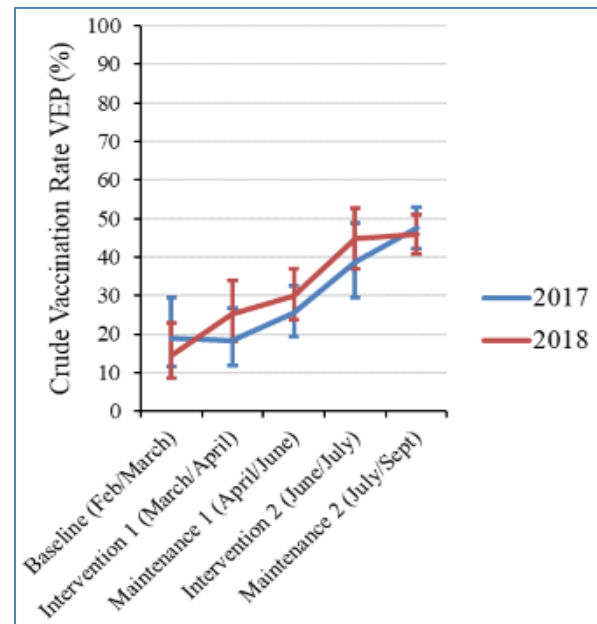
	2017		2018		P
	Immunized/Visits	Rate	Immunized/Total	Rate	
<b>Boys</b>					
<b>Baseline (Feb/March)</b>	20/71	28.17	11/94	11.7	0.001
<b>Intervention 1 (March/April)</b>	28/105	26.67	24/112	21.43	0.366
<b>Maintenance 1 (April/June)</b>	37/153	24.18	66/225	29.33	0.270
<b>Intervention 2 (June/July)</b>	35/106	33.02	58/120	48.33	0.020
<b>Maintenance 2 (July/Sept)</b>	143/317	45.11	179/431	41.53	0.329
<b>Girls</b>					
<b>Baseline (Feb/March)</b>	14/74	18.92	14/96	14.58	0.450
<b>Intervention 1 (March/April)</b>	19/104	18.27	29/115	25.22	0.215
<b>Maintenance 1 (April/June)</b>	43/169	25.44	56/187	29.95	0.344
<b>Intervention 2 (June/July)</b>	36/93	38.71	68/152	44.74	0.354
<b>Maintenance 2 (July/Sept)</b>	153/322	47.52	163/355	45.92	0.677

Male vaccination rates for VEP trended similarly to the combined results: lower baseline in 2018 (11.7% MO 88.3%) vs. 2017 (28.17% MO 71.83%), increased rate during intervention 1 (21.43% MO 78.57%) and maintenance period 1 (29.33% MO 70.67%), and further increased rate during intervention 2 (48.33% MO 51.67%) and maintenance period 2 (41.53% MO 58.47%). Figure 2 compares the vaccination rate of VEP males in 2017 vs. 2018.



**Figure 2:** Immunization Rate VEP - Boys

Female vaccination rates of VEP showed an upward trend from baseline in 2018 (14.58% MO 85.42%) to maintenance period 2 (45.92% MO 54.08%), but there were no significant changes from the same time periods in 2017. Figure 3 compares the vaccination rate of VEP females in 2017 vs. 2018.



**Figure 3:** Immunization Rate VEP - Girls

## Discussion

Studies have shown a variety of strategies that may be effective in helping increase the rate of HPV vaccination. A study using the 4 Pillars™ Practice Transformation Program showed that by using more than ten strategies in the 4 Pillars™ Practice Transformation Program, there was an increase in initiation of the vaccination process [11,12]. This demonstrates that use of multiple techniques will be more beneficial in improving vaccination rates rather than using a single tactic.

Parental refusal of the HPV vaccine typically revolves around the lack of knowledge about possible diseases caused by HPV as well as lack of discussion among patients, parents and healthcare providers regarding the vaccine

10. Studies have also shown that another possible barrier to low vaccination rates stem from lack of clinician knowledge regarding the HPV vaccine [11-14]. With the new recommendations regarding the vaccine, this may have an effect on HPV vaccination rates in regard to providing clinicians with the most up-to-date knowledge regarding the vaccine. The lunch and learn session were utilized to provide updated vaccine recommendations for the different age groups to healthcare providers and clinic staff. The goal of the emails was to remind providers of the importance of the HPV vaccine and also provide useful strategies in discussing vaccination with reluctant parents.

Aside from parental refusal, missed opportunities are a major factor in the high number of patients unvaccinated against HPV. Among well-adolescent visits for insured girls eligible for the HPV vaccine, nearly 75% did not initiate HPV vaccination [16]. Missed opportunities occur due to many factors, including insurance coverage, parents' beliefs, and knowledge gaps [16]. In this study, we successfully decreased the missed opportunities among vaccine eligible boys and girls from 86.84% in 2017 to 76.65% in 2018 just after the first intervention. After the second intervention, the rate of missed opportunities dropped even further, down to 53.68%. Though the rate of MO did increase after maintenance period 2, it was still lower than after the initial intervention, at 56.49%. In comparison to the retrospective study from 2017 showing a rate of 75% MO, this study successfully brought down the rate of MO from ~76% to ~56% [16]. However, 56% is still over the 51% rate of MO among only pediatricians, excluding non-pediatric providers, in the retrospective study [16].

Additionally, studies have demonstrated the correlation of increased poverty with decreased rates of vaccination [15]. According to the CDC, the rates of patients receiving  $\geq 1$ -dose HPV vaccine in adolescents living below the poverty level was surprisingly higher than for adolescents living at or above the poverty level in 2015; however, there was no specification on whether these patients had a higher completion rate of the vaccination compared to those living at or above poverty level [5]. By specifically targeting patients with lower socioeconomic status, this study strives to improve the completion of vaccination among these individuals.

## Conclusion

Provider-focused interventions can significantly improve HPV vaccination rates and reduce missed opportunities. Effects can be maintained by simple email reminders with HPV resources after the intervention is over. This study shows the effect of a multi-part intervention targeting providers, but further studies are needed to demonstrate the effectiveness of each intervention alone.

## Acknowledgements

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