A Quality Improvement Initiative to Increase HPV Vaccine Rates Using an Educational and Reminder Strategy With Parents of Preteen Girls

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ABSTRACT

Introduction: A quality improvement project was undertaken to determine if an evidence-based educational brochure and reminder system can increase human papillomavirus (HPV) vaccine uptake and dose completion rates.

Method: Development of a brochure to promote HPV vaccine uptake was based on predictors of parental acceptance and Health Belief Model concepts. Electronic alerts prompted telephone reminders for dose completion. This quality improvement project utilized a quasi-experimental design with 24 parents of preteen girls from a private pediatric practice and a historical control group of 29 parents. HPV vaccine rates were compared between the groups.

Results: A significant difference in HPV vaccine uptake (χ^2 = 11.668, P = .001; odds ratio [OR] = 9.429, 95% confidence interval [CI] = 2.686-33.101) and dose completion (χ^2 = 16.171, P < .001; OR = 22.500, 95% CI = 4.291-117.990) rates were found between the historical control and intervention groups. Parents who received the clinical protocol were 9.4 times and 22.5 times more likely to have HPV vaccine uptake and dose completion, respectively.

Discussion: Low national HPV vaccine rates demonstrate the need for theory-based vaccine delivery programs. These results show that an evidence-based educational brochure and

reminder system appeared to improve HPV vaccine uptake and dose completion rates at this private pediatric practice. J Pediatr Health Care. (2014) *28*, 155-164.

KEY WORDS

HPV vaccine, reminder systems, patient education, health promotion

Human papillomavirus (HPV), an extremely common sexually transmitted infection, has an estimated national prevalence rate of greater than 20 million (Centers for Disease Control and Prevention [CDC], 2011a), with highest rates from 18 to 28 years of age; approximately three quarters of these infections are among persons 15 to 24 years of age (Constantine & Jerman, 2007; Davis, Dickman, Ferris, & Dias, 2004). HPV strains 16 and 18 are responsible for 70% of cervical cancer. The HPV vaccine, which is available for females 9 to 26 years of age, has an excellent safety profile and has been shown to have 100% efficacy for protection against these two strains when all three required doses are administered prior to coital debut (Markowitz et al., 2007). Despite building evidence of the benefits of the HPV vaccine and a lack of evidence for significant adverse reactions, parents have continued to demonstrate hesitancy to vaccinate their daughters, particularly at a younger age (< 13 years), even though it is recommended at 11 to 12 years of age (Markowitz et al., 2007). Recent reports of HPV vaccine uptake rates have shown only a modest increase from 49% in 2010 to 53% in 2011; dose completion rates have only risen from 32% to 35%, with lowest rates remaining the same in younger girls (23.2% to 22.9%; CDC, 2011b, 2012). An ongoing need exists for interventions that increase uptake of the HPV vaccine and appropriate strategies to improve completion of this three-dose series with younger girls.

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The clinical impact of vaccinating girls at ages 11 to 12 years with the HPV vaccine, as recommended by the CDC (Markowitz et al., 2007), is overwhelming because it will greatly reduce the incidence of cervical cancer in the United States, where racial disparities in the prevalence of this disease continue to exist. Reports of racial disparity persist between White and non-White women who are diagnosed with cervical cancer (Barnholtz-Sloan et al., 2009; Patel et al., 2009). Multiple factors have been cited as being potentially associated with higher rates of cervical cancer in Hispanic and non-Hispanic Black women, including lower socioeconomic status, lack of insurance coverage, and differences in Papanicolaou (Pap) screening and follow-up of abnormal tests (Barnholtz-Sloan et al., 2009; Patel et al., 2009). The incidence of HPV infection has also been reported as highest in non-Hispanic Black women with nonracial independent risk factors cited, such as young age, marital status, and sexual behaviors (Dunne et al., 2007). Furthermore, although there continues to be higher uptake of the first HPV vaccine dose in Hispanics compared with non-Hispanic Blacks and Whites, three-dose series completion (i.e., the percentage of those who received three doses among those who received at least one dose) has risen in 2011 among Hispanics (56.1% to 69.4%) but has dropped among non-Hispanic Blacks (65.4% to 60.8%), whereas Whites have remained the same (74.7% to 74.8%; CDC, 2011b, 2012). Focus on prevention efforts can help reduce racial disparities in the incidence of cervical cancer and HPV infection in Hispanic and non-Hispanic Black women. This evidence highlights the critical need to reduce cultural barriers in order to promote prevention of HPV infection. Improving health literacy with evidence-based educational interventions that are culturally sensitive can reduce these racial disparities. Although evidence supports targeted education for uptake of the HPV vaccine, there does not appear to be any literature regarding targeted education for the highly vulnerable preteen age group, despite lower intention for uptake and uptake rates for younger girls (CDC, 2011b; Chan, Cheung, Lo, & Chung, 2007; Constantine & Jerman, 2007; Dempsey, Zimet, Davis, & Koutsky, 2006; Marlow, Waller, & Wardle, 2007; Rosenthal et al., 2008).

A review of the literature evaluating targeted educational interventions for uptake of HPV vaccine has identified seven data-based articles that have investigated educational strategies to promote HPV vaccine uptake: two randomized controlled trials (Dempsey et al., 2006; Leader, Weiner, Kelly, Hornik, & Cappella, 2009), four quasi-experimental studies (Chan et al., 2007; Davis et al., 2004; Ogilvie et al., 2007; Stretch et al., 2008), and one observational study (Sperber, Brewer, & Smith, 2008). According to the U.S. Preventive Services Task Force grading criteria, the quality of the evidence was graded moderate (Agency for Healthcare Research and Quality, 2010). Calculated effect sizes of targeted educational interventions in two of these articles demonstrated that 37% to 63% of parents were more likely to have uptake of the HPV vaccine after receiving targeted education (Chan et al., 2007; Davis et al., 2004). Sperber and colleagues (2008) demonstrated that the likelihood of parents having uptake of the HPV vaccine

increased from 1.9 to 3.6 times if the message was framed to emphasize protection against genital warts, HPV infection, or cervical cancer. According to Leader and colleagues (2009), reading information about HPV vaccine cost had a small effect on parental attitudes. Trends were also noted toward change in parental attitudes and knowledge when reading information about HPV infection and cervical cancer. Finally, age differences have been found to be associated with less uptake of HPV vaccine in younger girls (CDC, 2011b; Dempsey et al., 2006; Marlow et al., 2007). The need exists to add strategies to the literature that specifically focus on targeted educational interventions to improve uptake of the HPV vaccine for parents of the most vulnerable age group, preteen girls.

Use of reminders for multidose vaccines, such as patient reminders, physician interventions, and system capabilities, have been shown to contribute to improved vaccine rates as early as 1984 (Brink, 1989). Jacobson Vann and Szilagyi (2009) updated a systematic review on the use of intervention strategies involving patient reminder systems to improve vaccine rates. This review found that vaccine rates increased when reminders were used in all settings studied and with all populations, except adolescents in an urban setting in one study (Szilagyi et al., 2006). Telephone reminders were used in this study; however, accuracy of telephone numbers was a major limitation affecting the results of the intervention. Use of single and multiple patient reminders in the form of mailings or telephone calls were compared in the systematic review and revealed greater vaccination completion rates with multiple reminders and use of telephone calls (Jacobson Vann & Szilagyi, 2009). Overall, patient reminders contributed to improved uptake rates of immunizations (odds ratio [OR] = 1.57, 95% confidence interval [CI] = 1.40-1.75). When comparing the effectiveness of different types of reminders, the use of both patient and provider reminders were most effective (OR = 3.65, 95% CI = 1.54-8.67).

Much of the research on this topic has focused on the use of the Health Belief Model (HBM; Brewer & Fazekas, 2007; Constantine & Jerman, 2007; Kahn, Rosenthal, Hamann, & Bernstein, 2003; Kahn et al., 2008; Miller, Wilson, & Waldrop, 2008). In a systematic review of studies (Brewer & Fazekas, 2007) that examined beliefs about HPV and acceptability of the HPV vaccine with use of the HBM as a theoretical framework, it was found that vaccine acceptability was higher when parents believed that the vaccine was effective, when the vaccine was recommended by providers, and when perceived susceptibility to contracting HPV infection was likely. Several studies in this systematic review reported that 21% to 46% of adolescents and young adults perceived that they were likely to become infected, and acceptability was higher in those who perceived greater likelihood of exposure or infection. Although perceived severity of HPV infection was not associated with greater vaccine acceptability in some of these studies, it was a factor in others. No reports of vaccine acceptability associated with risk of cervical cancer were reported. Cost was identified as a barrier to parental acceptance, and only 6% to 12% of parents were concerned that vaccination would promote sexual behaviors. Brewer and Fazekas (2007) concluded that perceived effectiveness of vaccine in preventing HPV infection was a critical factor predicting vaccine acceptability, perceived barriers to HPV vaccine must be addressed, and physician recommendation is a crucial component of successful HPV vaccine programs.

This article reports HPV vaccine uptake and dose completion rates before and after initiation of a quality improvement (QI) initiative to evaluate a culturally sensitive evidence-based educational and reminder strategy for parents of 11- to 12-year-old preteen girls in a private pediatric practice. The specific aims of the clinical project were to:

1. Evaluate the impact of using an evidence-based educational brochure and electronic/telephone reminders on improving HPV vaccine rates as evidenced by uptake and dose completion of HPV vaccine
2. Describe satisfaction of parents, staff, and providers with the evidence-based clinical protocol

METHODS

Design

A quasi-experimental design was used with a historical control group of parents of girls who met eligibility criteria as detailed below. Two chart reviews were conducted to compare (a) HPV vaccine uptake rates over 6 months and (b) dose completion rates over the subsequent 7 months between the historical control and prospective cohort groups. The review periods included two 13-month time frames, and the retrospective review period occurred 1 year before the start of the intervention. The retrospective review period was August 15, 2009, through September 20, 2010, and the prospective review period was August 15, 2010, through September 20, 2011. Primary outcomes were measured through comparison of HPV vaccine uptake and dose completion rates between the groups.

Setting and Sample

The setting was a small private pediatric practice in an urban location with three providers who were present consistently throughout the QI initiative: the physician owner, a pediatric resident, and a pediatric nurse practitioner who was also the principal investigator (PI) of the QI initiative. A convenience sample of eligible parents of preteen girls was established from a database of active girls in the practice who met eligibility criteria and presented for an office visit during the review

TABLE 1. Characteristics of prospective cohort (n = 23)[a]

Characteristic	n	%
Race		
White	14	60.9
African American	8	34.8
Asian	1	4.3
Education		
Grade school	1	4.3
High school	3	13.0
Vocational/technical school	3	13.0
2-year Associate degree	8	34.8
4-year college degree	4	17.4
Graduate school	4	17.4
Employment		
Works full time	10	43.5
Full-time homemaker	8	34.8
Works part time, unemployed, disabled, retired, student	5 (1 each)	21.7
Family income		
≤ $19,999	1	4.3
$20,000-$39,999	6	26.0
$40,000-$59,999	5	21.7
$60,000-$99,999	4	17.3
≥ $100,000	4	17.3
Unknown	1	4.3
Refused	2	8.7

[a]*One of 24 subjects refused to provide information.*

periods. The database was established by reviewing birth dates of active eligible girls, and groups were created of historical controls for 13 months prior to August 15, 2010 (n = 29) and a potential prospective cohort from August 15, 2010 forward for 13 months (n = 66). Inclusion criteria included parents/legal guardians of 11- to 12-year-old girls presenting for an office visit during the review period, including well child care (WCC), episodic, or vaccine-only visits. Exclusion criteria included known pregnancy, moderate or severe illness, or hypersensitivity to yeast or any component of the HPV vaccine. The final sample consisted of a historical control group composed of parents or guardians of 29 eligible girls who presented during the retrospective review period and a prospective cohort of 24 parents or guardians of eligible girls who presented during the prospective review period. Thirty-one of 66 eligible girls did not present for an appointment during the prospective review period, and 11 of 66 girls became ineligible during the prospective review period because the patient transferred out of practice (n = 2, 3%), the patient was older than 12 years at the time of the visit (n = 2, 3%), or the patient was older than 12 years during the review period (n = 7, 11%). Ninety-six percent (n = 22) of the parents were mothers, 61% (n = 14) were White, 83% (n = 19) had greater than a high school education, 44% (n = 10) were employed full time, and 52% (n = 12) had a family income of less than $60,000 (Table 1).

Intervention

Based on a literature review of predictors and barriers associated with parental intention for uptake of the HPV vaccine by their daughters (Cassidy & Schlenk, 2012), an educational frequently asked questions (FAQ) brochure and brief 1:1 intervention were developed to use with parents of eligible 11- to 12-year-old girls. The constructs of the educational FAQ brochure were based on evidence in the literature of HBM concepts associated with parental intention for uptake of the HPV vaccine by their daughters (Table 2). Pictures included in the educational FAQ brochure were mothers and grandmothers of varied races with their daughters to address cultural sensitivity in the brochure. The script for the brief 1:1 intervention was developed in conjunction with the physician owner of the practice before implementation of the clinical protocol. After finalization of the educational FAQ brochure and script and before implementation of the intervention, the physician, pediatric resident, and office staff in the practice received training that included general information about HPV and the HPV vaccine, as well as the protocol for use of the brochure and script. Parents of girls who presented for an office visit received the educational FAQ brochure from the staff at the time they signed in for the visit. Providers were prompted by the script, placed in the chart of eligible girls prior to the prospective review period, to complete the 1:1 brief intervention with the parent/guardian after the physical examination, providing a cue to action based on the HBM. If consent was obtained, the HPV vaccine was given and the parent was encouraged to schedule the appointment for the following dose before leaving the office.

Electronic alerts prompted telephone reminders for dose completion through the use of a Web-based software, *Study 360* (formerly known as *R-Track*; Engberg, Tamres, Caruthers, Dunbar-Jacob, & Sereika, 2006). Telephone reminders served as another cue to action based on the HBM. The PI configured *Study 360* to receive electronic alerts from her computer 1 week before the second and third HPV vaccine doses for which girls were due. This electronic prompt allowed the PI to place a standardized telephone call from the practice site to parents who had not made an appointment for the next dose and to ensure that a 1-day telephone reminder occurred for all scheduled appointments. The PI tracked all appointments through the *Study 360* software during the prospective review period.

Measures

The primary outcomes of HPV vaccine uptake and completion of the three-dose series, which were recorded as dichotomous responses of yes/no, was measured through the use of the *Study 360* project management software, which was used for managing

the groups, tracking receipt of the three doses of the HPV vaccine from chart reviews, and providing electronic alerts for telephone reminders. The multiple features of this Web-based software were ideal to reduce project management burden and increase efficiency in this QI initiative (Engberg et al., 2006).

Secondary outcomes describing satisfaction with the clinical protocol were measured through parent, staff, and provider satisfaction surveys. A 6-item initial parent satisfaction survey, with five dichotomous items answered yes/no and one open-ended item, was designed by the PI for this QI initiative to elicit parental satisfaction regarding helpfulness of the educational brochure and provider recommendation for decision making about the HPV vaccine. The open-ended question assessed other information requested by parents. For girls who completed the three-dose series of the HPV vaccine, an eight-item final parent satisfaction survey, with a 5-point Likert scale ranging from not helpful to very helpful, was developed by the PI for this QI initiative to determine parent's beliefs about helpfulness of the brochure, provider recommendation, and telephone reminders to keep appointments for subsequent doses. Mean scores were computed for each item.

The FAQ brochure, sociodemographic questionnaire, and parent satisfaction surveys were all reviewed by experts for face validity and pilot tested for readability by several parents of divergent ethnic backgrounds in the practice prior to implementation. Ease of readability of the brochure was assessed at 87%, and the grade level was measured at 2.2 through the use of the Flesch-Kincaid Microsoft Word tool. Staff (three-item, 4-point Likert scale and three dichotomous items) and provider (six-item, 4-point Likert scale) satisfaction surveys were also developed by the PI for this QI initiative to assess the ease of usefulness of the protocol.

Data Collection

Prior to the prospective review period, charts of girls in the potential prospective cohort group were prestuffed with packets that included the educational FAQ brochure, 1:1 brief intervention script, sociodemographic questionnaire, and initial and final parent satisfaction surveys. Chart packets prompted staff to distribute the brochure to parents upon arrival and cued providers to initiate the 1:1 intervention. The sociodemographic questionnaire and initial parent satisfaction survey were completed by parents at the end of the office visit. Staff gave the parents who completed the three-dose series the final parent satisfaction survey after receipt of the third dose. Staff and provider satisfaction surveys were completed after the prospective review period ended.

After the intervention occurred, charts and satisfaction surveys were reviewed by the PI, and girls from the potential prospective cohort group were placed in the prospective cohort group in the *Study 360* software.

TABLE 2. Brochure development

FAQ brochure questions	FAQ brochure answers	Evidence base for discussion	HBM constructs
What is HPV?	A common virus that can cause cervical cancer later in life	A sexually transmitted virus that can cause cervical cancer and is estimated to affect more than 80% of sexually active women by age 50 years[a]	Perceived risk
What are the chances of my daughter getting HPV?	6 million new cases each year; more than half occur in those 14-24 years of age	PAP smears detect 6 million new cases each year[b]; three quarters occur in those 15-24 years of age[c]	Perceived susceptibility
How is HPV connected to cervical cancer?	> 70% of cervical cancer is caused by HPV; half of women diagnosed were exposed at a young age	HPV strains 16 and 18 are responsible for 70% of cervical cancer[a]	Perceived severity
Why so young?	Protective response to vaccine is greatest at a young age	Improved immunogenic response at younger ages[a]	Perceived benefit
How does the vaccine work?	Three doses are given over 6 months; protection is 100% after all three doses are given	HPV vaccine is 100% effective for protection against strains 16 and 18 when all three required doses are given prior to coital debut[a]	Perceived benefit
Is it safe?	Similar to other vaccines; no serious effects	Excellent safety profile[a]	Perceived barrier
How much will it cost?	There is no cost to patient	Covered by all insurance plans and Free Vaccines for Children	Perceived barrier

FAQ, Frequently asked questions; HBM, Health Belief Model; HPV, human papillomavirus; PAP, Papanicolaou.
[a]Data from Markowitz et al. (2007).
[b]Data from Centers for Disease Control and Prevention (2011a).
[c]Data from Constantine & Jerman (2007).

TABLE 3. Type of visit and human papillomavirus vaccine uptake (*n* = 24)

Type of visit	Vaccine uptake (*n* = 18) *n* (%)	Vaccine declined (*n* = 6) *n* (%)
Well-child care visit	16[a] (66.7)	2 (8.3)
Episodic visit	0 (0.0)	2 (8.3)
Vaccine-only visit	2 (8.3)	2 (8.3)

[a]*One parent initially declined at an episodic visit and agreed to uptake at a later well-child care visit and thus is included in the well-child care visit category.*

At that time, HPV vaccine uptake or refusal and reasons for declining were entered into the *Study 360* software. If uptake of the first dose occurred, the PI set electronic reminders for the scheduled appointment for the second dose or the due dates for the second and third doses. Procedures included generating a reminder list every month of girls who were scheduled, were due, or had missed appointments for the second and third doses to electronically prompt cuing by telephone reminders 1 week prior to the due dates. Telephone reminders occurred via an auto-dialer used for all appointments 24 hours in advance of the office visit. If a patient did not show up for the second or third dose, a standardized telephone call was made by the staff or PI to notify the parent of the missed appointment and to reschedule the appointment. Using *Study 360* software, quarterly reports were generated to monitor vaccine uptake and dose completion rates, types of visit during the intervention, reasons for declining the vaccine, and timing of doses.

Data Analysis

Oracle 9i for Windows Server 2003 was used for data management. For paper-and-pencil instruments, Teleform, an automated data entry/verification system, was used for form design, data entry, and data verification. SPSS version 19.0 was used for data analysis, and a *P* value of <.05 was considered statistically significant. Data analysis was performed using χ^2 analysis to determine statistically significant differences between parents who receive the clinical protocol and historical controls who do not receive the clinical protocol on HPV vaccine uptake and dose completion rates. ORs with 95% CIs were used to determine the clinical meaningfulness of the protocol. Descriptive statistics were used to summarize data from the sociodemographic questionnaires and parent, staff, and provider satisfaction surveys.

TABLE 4. Reasons for declining human papillomavirus vaccine

Reason	*n*[a]
Not ready, not sexually active	2
Vaccine safety concerns	2
Alternate vaccine schedule	2
Too many shots	2
Vaccine too new	1

[a]*More than one reason given by the parents who declined the vaccine.*

RESULTS

Primary Outcomes

Most visits during the prospective review period were for WCC, which was expected because the review period occurred in the first 6 months of the school year. As shown in Table 3, more HPV vaccine uptake occurred at WCC visits than at episodic visits or vaccine-only visits combined ($\chi^2(23) = 4.741$, $P = .029$). Reasons for declining the HPV vaccine are shown in Table 4.

At the end of the 13-month prospective review period, HPV vaccine rates were compared between the groups. The HPV vaccine uptake rate was 75.0% (n = 18) in the prospective cohort compared with 24.1% (n = 7) in the historical control group. Parents who received the clinical protocol had a significantly greater HPV vaccine uptake rate than did parents in the historical control group ($\chi^2(52) = 11.668$, $P = .001$). Parents who received the intervention were 9.4 times more likely to have uptake of the HPV vaccine compared with the historical control group (OR = 9.429, 95% CI = 2.686-33.101).

The HPV vaccine dose completion rate was 62.5% (n = 15) in the prospective cohort compared with 6.9% (n = 2) in the historical control group. Parents who received the clinical protocol had a significantly greater HPV vaccine dose completion rate than did parents in the historical control group ($\chi^2(52) = 16.171$, $P < .001$). Parents who received the intervention were 22.5 times more likely to complete the three-dose series compared with the historical control group (OR = 22.500, 95% CI = 4.291-117.990).

When examining the subset of parents who initiated uptake, there was also a significantly greater HPV vaccine dose completion rate in the prospective cohort compared with the historical control subjects (n = 15, 83.3% vs. n = 2, 28.6%; $\chi^2(24) = 4.657$, $P = .031$; OR = 12.500, 95% CI = 1.600-97.647). A crucial factor is timely completion of the second and third doses, which would increase the likelihood of completing the series prior to coital debut (Table 5). No one in the historical control group received either the second or third dose within the CDC recommended interval, whereas 44% of the parents in the prospective cohort group returned on time for the second dose (≤ 60 days) and more than 16% were on time for the third dose (< 180 days) (Markowitz et al., 2007).

Secondary Outcomes

Whereas 65.2% (n = 15) of parents stated that the educational FAQ brochure helped them make their

TABLE 5. Timing of human papillomavirus vaccine doses in girls with human papillomavirus vaccine uptake

Dose *n*	Did not receive dose 2 *n* (%)	≤ 60 days[a] after dose 1 *n* (%)	61-90 days after dose 1 *n* (%)	91-120 days after dose 1 *n* (%)	121-180 days after dose 1 *n* (%)	Did not receive dose 3 *n* (%)	≤ 180 days after dose 1[a] *n* (%)	181-270 days after dose 1 *n* (%)	271-365 days after dose 1 *n* (%)
Dose 2 Historical controls: 4	3 (42.9)	0 (0)	3 (42.9)	1 (14.3)	0 (0)				
Prospective cohort: 16	2 (11.1)	8 (44.4)	5 (27.8)	2 (11.1)	1 (5.6)				
Dose 3 Historical controls: 2						5 (71.4)	0 (0)	2 (28.6)	0 (0)
Prospective cohort: 15						3 (16.7)	3 (16.7)	11 (61.1)	1 (5.6)

[a]*Centers for Disease Control and Prevention recommended interval.*

decision about the HPV vaccine, 78.3% (n = 18) agreed that provider recommendation contributed to their decision making. A few parents requested further information about side effects (8.7%, n = 2), long-term effects (8.7%, n = 2), and reason for administration at a young age (8.7%, n = 2). Parents found the educational FAQ brochure, provider recommendation, and telephone reminders helpful (Table 6).

Staff evaluated the protocol as easy to implement (80%, n = 4/5) and believed the protocol should continue to be used (100%, n = 5/5). All providers agreed that the educational FAQ brochure prompted recommendations and discussion of parental concerns during all visits and believed the protocol should continue to be used.

DISCUSSION

Aims to improve HPV vaccine uptake and dose completion rates at this small private pediatric practice were accomplished with use of an evidence-based, simple, and easily adapted intervention. The evidence-based educational and reminder strategy for parents of this preteen age group significantly improved HPV vaccine uptake and dose completion at this private pediatric practice. Healthy People 2020 objectives include reducing the proportion of females with HPV infection (U.S. Department of Health & Human Services, 2009a) and increasing coverage of HPV vaccine to 80% (U.S. Department of Health & Human Services, 2009b). It is critical to focus on effective educational approaches with this vulnerable population, because the literature has cited multiple studies demonstrating decreased uptake of HPV vaccine in younger daughters (CDC, 2011b, 2012; Dempsey et al., 2006; Marlow et al., 2007). The CDC recommendation for the HPV vaccine to be given to 11- to 12-year-old girls is in stark contrast to these findings (CDC, 2011a). Barriers for mothers of younger girls must be addressed with targeted educational approaches. Using the HBM to address barriers, such as dangers associated with vaccine, susceptibility, likelihood of HPV infection, and severity related to dangers of getting cervical cancer, can help cue action with parental decision making about vaccines. Addressing information about racial differences with HPV infection and cervical cancer can target the decreased uptake rates of preteen daughters of African American mothers (CDC, 2011b, 2012;

The evidence-based educational and reminder strategy for parents of this preteen age group significantly improved HPV vaccine uptake and dose completion at this private pediatric practice.

TABLE 6. Parent satisfaction *(n = 15)*

Factor	*M* (*SD*)
Helpfulness (possible range of 1-5)	
Brochure	3.93 (1.100)
Provider recommendation	4.60 (.507)
Scheduling appointment before leaving office	3.87 (1.552)
Reminder telephone calls	4.73 (.704)

Constantine & Jerman, 2007) and slow the increasing rate of invasive cervical cancer in African American women (Patel et al., 2009). Providing culturally sensitive educational materials will address the decreased likelihood of African Americans to accept HPV vaccine at a younger age (Constantine & Jerman, 2007).

The HPV vaccine uptake rate improvement from 24% to 75% in this QI initiative demonstrates that methods to address these issues with parents of preteen girls can significantly improve uptake rates. National HPV vaccine uptake rates of 53% with only modest increases over time (CDC, 2012) can be more effectively improved by using evidence in the literature to target educational approaches that address issues specific to vulnerable age groups. Targeting this vulnerable age group can potentially improve the vaccine rates of girls prior to coital debut. Younger age groups are more likely to accept the vaccine when information is targeted toward decreasing barriers of cost and adverse effects (Kahn et al., 2008). Using targeted strategies rather than standard educational materials may be more effective when educating parents about the HPV vaccine (Kahn et al., 2003).

Patient reminders continue to demonstrate improvements in vaccination coverage (Jacobson Vann & Szilagyi, 2009). The use of electronic alerts combined with telephone prompts for this three-dose vaccine can be translated into practice by utilizing alert systems in electronic health records to improve completion of the series. It is critical to focus on reminder strategies to increase low national dose completion rates before coital debut for primary prevention of cancer.

Limitations of this QI initiative are that the quasi-experimental design does not allow us to say with confidence that the intervention caused the increase in HPV vaccine uptake and dose completion, or which component of the intervention, education or reminders, was the most effective; however, the aims of the project were achieved. Because no sociodemographic information was available in the medical records, it is not known if there were sociodemographic differences between girls in the historical control group and prospective cohort, and we were unable to compare baseline differences between the two groups. Although the groups were unable to be compared, the sociodemographic characteristics of the prospective cohort demonstrate a fairly diverse racial group (Table 1). Although multiple confounding factors could not be controlled for because of the design of the project, strengths include the training of staff before the implementation of the intervention and again when ancillary staffing changes occurred during the prospective review period. Close monitoring of vaccine administration also occurred, along with delivery of reminders through the use of a reliable Web-based electronic software program. The satisfaction surveys were study specific and not pretested prior to use. Finally, no significant negative announcements were made about the HPV vaccine by the CDC or American Academy of Pediatrics during the review period.

IMPLICATIONS

By using evidence that supports the uptake of the HPV vaccine and effective interventions that promote completion of the three-dose series, HPV vaccine uptake and dose completion rates can be greatly improved from the low national rates of 53% and 35%, respectively (CDC, 2012). Increasing the number of 11- to 12-year-old girls who are protected against HPV infection will positively affect future HPV infection and cervical cancer rates. Utilizing culturally sensitive approaches for vaccine education can reduce the racial disparity that occurs with both of these medical conditions.

Increasing the number of 11- to 12-year-old girls who are protected against HPV infection will positively affect future HPV infection and cervical cancer rates.

The simplicity of the project allows for replication of the QI initiative in other similar settings and the development of larger intervention studies. The focus on barriers and predictors of parents of 11- to 12-year-old girls, the age recommended by the CDC to receive the HPV vaccine, and the inclusion of cultural sensitivities will add to the literature available to build successful HPV vaccine delivery programs that also use technology to improve vaccine rates.

CONCLUSION

The clinical protocol has affected the practice at this pediatric site by enhancing the vaccine delivery approach for the HPV vaccine. It has become usual care for the staff to offer available educational FAQ brochures on not only the HPV vaccine but all adolescent vaccines at the 11-year-old office visit, and providers now counsel about the HPV vaccine at all visits. Furthermore, reminder telephone calls now occur for all vaccine-only

visits 24 hours prior to appointments, and follow-up calls are made for all missed appointments. There is a standing order for staff to administer the second and third doses of the HPV vaccine, because girls may present for a vaccine-only visit without a provider order for the next dose that is due. The physician owner has initiated the process to upload all vaccines into the state immunization registry, which has a reminder component, with further consideration for potential implementation of an electronic health record at the practice. These practice changes allow for the process to be continued without direct coordination of a provider to ensure that all windows of opportunity are used to improve HPV vaccine rates. These clinical practice changes will likely continue to improve vaccination rates at this practice site for HPV vaccine, as well as other multidose vaccine series. Promotion of adolescent vaccines at the age of 11 years will further enhance vaccinations in this vulnerable population, which is a national Healthy People 2020 goal endorsed by the CDC and the Society for Adolescent Medicine (Middleman, 2007).

In the future, research on cross-protection of the quadrivalent vaccine, as well as the recent Advisory Committee on Immunization Practice recommendation to the CDC for routine administration of the HPV vaccine to boys (CDC, 2011c), will likely initiate a public health campaign to increase national HPV vaccine uptake and dose completion rates (Kim, 2011; Southall, 2009). Public, parent, and patient education, as well as public health policy, will likely take time but will be instrumental in significant health promotion and disease prevention efforts in the near future (Zacharyczuk, 2009).

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