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Improving human papillomavirus (HPV) vaccination in the postpartum setting

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Abstract

Objectives—Although the HPV vaccine has been shown to be highly effective in preventing cervical dysplasia, vaccination rates remain low. The objective of this study was to assess the effectiveness of an electronic medical record (EMR) prompt on HPV vaccination rates in the postpartum setting.

Study Design—We conducted a pre-post intervention study among postpartum women ages 18 to 26 seen at an outpatient clinic from 09/01/2012 to 08/31/2013 (pre-intervention) and from 10/01/2013 to 03/31/2014 (post-intervention). The intervention was a drop-down menu that was inserted into the EMR postpartum note template inquiring about the patient's HPV vaccination status and whether or not the vaccine was administered at that visit. HPV vaccination uptake was compared pre and post-intervention.

Results—Of the 278 postpartum visits during the study period, 241 were eligible for analysis. There was a significant increase of the HPV vaccine uptake, from 1.2 % (2/173) among pre-intervention visits to 26.5% (18/68) among post-intervention visits ($p < 0.001$). After adjusting for age, ethnicity, insurance, and religion, HPV vaccination was significantly higher at postpartum visits during the intervention period, with an adjusted OR = 93.49 [95% CI: 15.29-571.52]. Among visits in which the vaccine was not given, HPV vaccination was not discussed in 46% and patients refused the vaccine in 40% of visits.

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Conclusions—An EMR prompt in the postpartum note could be an effective way to promote HPV vaccination in the postpartum setting. It will likely take a combination of strategies to optimize vaccination uptake.

Keywords

human papillomavirus; immunizations; vaccinations; electronic medical record

1. Introduction

The human papillomavirus (HPV) affects men and women, causing diseases ranging from warts to oropharyngeal and anogenital cancers. In the United States, HPV causes approximately 18,000 new cases of cancer in women and 8,000 new cases of cancer in men each year [1]. As with many other diseases, disparities exist with low income and minority women having the highest risk for HPV-related diseases [2,3].

In 2006, the FDA approved the use of a quadrivalent HPV vaccine for the primary prevention of HPV-related cancer and anogenital warts [4]. The complete vaccination series of three shots is administered over a six-month period. Large studies have shown that the vaccine is over 98% effective in preventing high-risk HPV-related cervical dysplasia, or the precursors to cervical cancer [5,6]. The population impact of this vaccine was recently demonstrated when a nationwide analysis found a 64% decrease in the prevalence of the four types of HPV covered by the first quadrivalent vaccine within six years of its introduction [7]. Because of the demonstrated safety [8] and efficacy of the HPV vaccine, the Center for Disease Control and Prevention (CDC) Advisory Committee on Immunization Practices (ACIP) recommended the HPV vaccine for girls and boys at age 11-12 years, with catch-up vaccination recommended at age 13-26 years [9,10]. Additionally, medical professional societies such as the American Medical Association [11], the American Academy of Pediatrics [12], and the American Congress of Obstetricians and Gynecologists [13] have endorsed these recommendations.

Despite these recommendations, vaccination rates in the U.S. remain low. In 2014, 60% of girls 13-17 years old received 1 dose of the HPV vaccine and 39.7% received 3 doses of the vaccine [14]. Although the ideal time to receive the HPV vaccine is prior to the onset of sexual activity, almost 60% of adult women age 19-26 years have not been vaccinated [15] and could still benefit from the vaccine. National health initiatives have recognized increasing HPV vaccine uptake as a public health priority [16].

The Kapiʻolani Women's Outpatient Clinic in Honolulu, Hawaiʻi is an ambulatory clinic where the University of Hawaiʻi (UH) Obstetrics and Gynecology (OB/gyn) resident physicians see approximately 7,000 medical visits annually. A majority of patients receive public insurance through Medicaid, and many of them qualify under pregnancy-related coverage expansion. Despite 7,000 annual visits, the clinic administered only 47 HPV vaccine injections from 2010 to 2012 (personal communication with the Manager of Clinical Operations). Pregnancy-related visits make up the majority of the appointments at this clinic, and the HPV vaccine is not recommended during pregnancy. We speculated that the high percentage of obstetrics services and urgent care visits could account for this low

vaccination uptake. The one to two months of postpartum care represent an opportunity to discuss the HPV vaccine with young women who are now eligible for the vaccine but who might not otherwise be engaged in the health care system, especially if their insurance coverage is pregnancy-related.

Targeting this window of opportunity, this study sought to evaluate the effectiveness of an electronic medical record (EMR) prompt in the routine postpartum note template requiring clinicians to ask patients about their HPV vaccination status. We hypothesized that this intervention would increase postpartum HPV vaccine uptake.

2. Material and Methods

A pre-post intervention study, approved by the Western Institutional Review Board, was designed to examine the effect of a computer-based provider intervention on postpartum HPV vaccination uptake. Charts included in this analysis were from women ages 18-26 years who visited the Kapi'olani Women's Outpatient Clinic during the pre-intervention (September 1, 2012 to August 31, 2013) and post-intervention periods (October 1, 2013 to March 31, 2014) and: (1) who presented for care between 0 and 6 weeks postpartum; (2) had not completed 3 doses of the HPV vaccine; (3) were not being seen within 2 months of their 1st dose of the HPV vaccine; (4) were being seen by an OB/gyn resident. The intervention was the insertion of a prompt into the standard postpartum note template that reminded physicians to ask about HPV vaccination (Figure 1), as well as short presentations to the UH OB/gyn faculty and residents describing the modification. Each chart was reviewed for: (1) completion of the vaccination series in the past; (2) receipt of the HPV vaccine at a postpartum visit among those who had not previously had the series; and (3) demographic information, including type of insurance, religion, and education. The main outcome was whether an eligible patient received at least one dose of the vaccine, before and after the intervention.

The primary objective was to compare the postpartum vaccination uptake before and after the intervention. We hypothesized that the postpartum vaccination uptake would increase after the intervention. The secondary objective was to determine any patient characteristics associated with receipt of the HPV vaccine postpartum. Assuming a baseline postpartum HPV vaccination of under 5%, and a clinically significant 20% absolute increase in vaccination, we needed 55 patients in each group to achieve an 80% statistical power of detecting such an immunization increase from 5% to 25% with a two-tailed $\alpha=0.05$.

Data was summarized by descriptive statistics. Demographic characteristics were compared using Fisher's exact tests for categorical variables and two-sample t-tests for continuous variables. The proportion of patients who received an HPV vaccine postpartum before and after the intervention was compared using Fisher's exact test. Multivariable logistic regression was used to assess the impact of the intervention, adjusting for important covariates. All statistical analyses were performed with Statistical Package for the Social Sciences (SPSS) version 20.0 (IBM).

3. Results

The charts from the 12 month pre-intervention period were reviewed and 173 patients were eligible for inclusion in this analysis. We conducted the intervention, introduction of the EMR in the standard postpartum note template and notification of faculty and residents of this modification, from September 1-30, 2013. The postpartum charts from the six months post-intervention period were reviewed for eligibility and 68 patients were included in the post-intervention analysis. Table 1 shows characteristics of the patients in the pre- and post-intervention groups. There were no differences between groups in age, marital status, education level, religion, proportion of women breastfeeding, or whether or not they resided in Honolulu. More patients (88.3% vs 77.6%) in the pre-intervention group used public insurance than the post-intervention group ($p=0.043$), and more patients (26.6% vs 11.8%) in the pre-intervention group reported that English was not their primary language ($p=0.016$). There were also differences in ethnicity ($p=0.021$) with more Micronesians/Marshallese in the pre-intervention group (43.5% vs 23.5%) and more whites (14.7% vs 7.7%) and Filipinas (23.5% vs 10.7%) in the post-intervention group.

In the 173 pre-intervention postpartum visits that were included in the analysis, the patient received the HPV vaccine in 1.2% of those visits (Figure 2). After the intervention, 18 of the 68 eligible patients (26.5%) received the HPV vaccine. This was a statistically significant ($p<0.001$) increase in the uptake of the HPV vaccine from pre-intervention to post-intervention. In a multivariable logistic regression (Table 2), after adjusting for age, ethnicity, insurance and religion, patients seen in the period after the implementation of the EMR prompt were significantly more likely to receive the HPV vaccine than women seen prior to the intervention [adjusted odds ratio 93.49 (95% CI 15.29-571.52)]. Of the 50 post-intervention visits in which an eligible patient did not receive the vaccine, 40% of those patients refused, the prompt was not used in 14% of visits, and the vaccine was not discussed in 46% (Figure 2).

4. Discussion

This study found that uptake of the HPV vaccine among postpartum women increased significantly following this short provider intervention. While the ideal time for both girls and boys to be vaccinated against HPV is prior to the onset of sexual activity, the postpartum visit provides an opportunity to start the vaccination process among women who might otherwise not be engaged in the health care system, especially those women who will lose insurance coverage once the postpartum period has ended. In two recently published surveys, health care providers in Hawaii reported insurance coverage to be a barrier to providing the HPV vaccine [17,18]. Two studies that offered the HPV vaccine immediately postpartum found a high degree of patient satisfaction and acceptability [19,20], although completion rates of all three doses remained low [19]. In both of these studies, researchers explored the feasibility of HPV vaccination after delivery and prior to discharge from the hospital. The benefit of this approach is that the second dose can be administered at the routine 4-6 week postpartum visit, and follow-up efforts can be targeted to getting the patient her third dose, which is given six months after the first. Additionally, if a patient is lost to follow-up or loses her pregnancy-related insurance after the 6-8 week postpartum

period, at least she has received two doses, which some early research indicates may be as effective as three [21]. Because we were piloting this intervention, we chose a controlled group of providers, the UH OB/gyn residents at their clinic, rather than the broader hospital system with many community physicians. Future research should assess the acceptability and effectiveness of introducing this EHR prompt into this community hospital setting so that patients could initiate the series prior to hospital discharge.

After this project was initiated, ACOG published a committee opinion recommending the use of EMR prompts to promote immunizations in the OB/gyn office setting [22]. The use of EMR alerts or prompts to increase vaccination has been investigated in several recent studies. A pre-post computer-based provider intervention for immediate postpartum Tdap (tetanus-diphtheria-pertussis) vaccinations showed an increase in the Tdap vaccination uptake after introduction of preselected orders in the routine postpartum order set [23]. Although it did not target postpartum women, one U.S. study compared visits among females age 9-26 years at a multi-site primary care practice that uses an electronic reminder system for all vaccines to a cohort of females seen at a multi-site health care practice that does not use electronic prompting or reminders for vaccines [24]. Authors found that women seen in the practice that used an electronic reminder system were more likely to initiate and complete the HPV vaccination series.

Strengths of this study included the simplicity, ease, and inexpensiveness of the intervention. It was not difficult to have this short prompt inserted into the EMR postpartum note template. This prompt could be easily added to other templates in other physician primary care specialties, increasing access as more providers and health care systems are converting to electronic records. Another strength is that the intervention targets the physician. Many studies, including a qualitative study in which researchers interviewed parents in Hawaii [25], show that the strongest predictor of HPV vaccination is physician recommendation [25-29].

There are several limitations to our study. Use of a historical control introduces temporal bias in which the difference in outcome may be accounted for by the normal evolution of medical practice and technology, or by other events temporally related to the groups. The effect size observed in this study however seems too great to be entirely related to temporal bias. Second, some patients may have completed their HPV vaccination series at an outside facility and may not be able to recall this. However, the proportion of patients with this history would not be expected to significantly change from year to year, so this non-differential misclassification would be more likely to bias toward the null. Lastly, this project did not address vaccination series completion, which ranges from 41-88% of those who initiate the vaccine [14]. Strategies to improve vaccine completion rates, such as reminders to patients via phone, emails, or text messages have been explored. A recent study successfully used patient navigators to assist in contacting patients and arranging visits for the 2nd and 3rd doses of the vaccine [30].

HPV infection is very common and is a necessary step for the development of HPV-related cancers such as cervical cancer. The vaccine has been shown to be highly effective at preventing pre-cancerous lesions and in time will show a decrease in cervical cancer rates.

The CDC recently estimated that an additional 53,000 cases of cervical cancer would be prevented during the lifetime of those currently younger than 12 years if HPV vaccine coverage were increased to 80% [31]. As HPV diseases disproportionately affect minorities and those with lower income [3], these statistics should serve as a public health and social justice mandate to find strategies to increase uptake of the HPV vaccine. Although sustainably increasing uptake will likely require a multi-pronged approach, an EHR prompt appears to be a simple, inexpensive and effective intervention.

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References

- Centers for Disease Control and Prevention. Human papillomavirus-associated cancers – United States, 2004–2008. Morbidity and Mortality Weekly Report. 2012; 61:258–261. [PubMed: 22513527]
- Singh G, Miller B, Hankey B, Edwards B. Persistent area socioeconomic disparities in U.S. incidence of cervical cancer, mortality, stage, and survival, 1975–2000. Cancer. 2004; 101:1051–1057. [PubMed: 15329915]
- Kahn J, Lan D, Kahn R. Sociodemographic factors associated with high-risk human papillomavirus infection. Obstetrics and Gynecology. 2007; 110:87–95. [PubMed: 17601901]
- Markowitz LE, Dunne EF, Saraiya M, Lawson HW, Chesson H, Unger ER. Quadrivalent human papillomavirus vaccine: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recommendations and Reports. 2007; 56(RR02):1–24.
- Kjaer SK, Sigurdsson K, Iversen OE, et al. A pooled analysis of continued prophylactic efficacy of quadrivalent human papillomavirus (types 6/11/16/18) vaccine against high-grade cervical and external genital lesions. Cancer Prevention Research. 2009; 2:868–878. [PubMed: 19789295]
- Munoz N, Kjaer SK, Sigurdsson K, et al. Impact of human papillomavirus (types 6/11/16/18) vaccine on all HPV-associated genital diseases in young women. J Natl Cancer Inst. 2010; 102:325–339. [PubMed: 20139221]
- Markowitz LE, Liu G, Hariri S, Steinau M, Dunne EF, Unger ER. Prevalence of HPV after introduction of the vaccination program in the United States. Pediatrics. 2016; 137(3):1–9.
- Slade BA, Leidel L, Vellozzi C, et al. Postlicensure safety surveillance for quadrivalent human papillomavirus recombinant vaccine. JAMA. 2009; 302:750–57. [PubMed: 19690307]
- Centers for Disease Control and Prevention. Quadrivalent human papillomavirus vaccine: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR. 2007; 56(No.RR-2):1–24.
- Centers for Disease Control and Prevention. Recommendations on the Use of Quadrivalent Human Papillomavirus Vaccine in Males – Advisory Committee on Immunization Practices (ACIP), 2011. MMWR. 2011; 60:1705–1708. [PubMed: 22189893]
- American Medical Association. [Accessed May 27, 2016] H-440.872 HPV vaccine and cervical cancer prevention worldwide. <https://www.ama-assn.org/ssl3/ecom/PolicyFinderForm.pl?site=www.ama-assn.org&uri=/resources/html/PolicyFinder/policyfiles/HnE/H-440.872.HTM>
- American Academy of Pediatrics. Policy statement: HPV vaccine recommendations. Pediatrics. 2012; 129:602–605. [PubMed: 22371460]
- American College of Obstetricians and Gynecologists. Human papillomavirus vaccination. Committee Opinion No.641. Obstet Gynecol. 2015; 126:338–43. [PubMed: 26241424]
- Reagan-Steiner S, Yankey D, Jeyarajah J, et al. National, regional, state and selected local area vaccination coverage among adolescents aged 13–17 years – United States, 2014. MMWR Morb Mortal Wkly Rep. 2015; 64:784–792. [PubMed: 26225476]

15. Williams WW, Lu P, O'Halloran A, et al. Surveillance of vaccination coverage among adult populations – United States, 2014. *MMWR Surveill Summ.* 2016; 65(No. SS-1):1–36.
16. HealthyPeople.gov. 2020 Topics & Objectives. Immunization and Infectious Diseases. <http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=23#>. Retrieved May 3, 2013
17. Soon R, Dela Cruz MR, Tsark JU, Chen JJ, Braun KL. A survey of physicians' attitudes and practices about the human papillomavirus (HPV) vaccine in Hawai'i. *Hawai'i J Med Public Health.* 2015; 74:234–241.
18. Tom A, Robinett H, Buenconsejo-Lum L, et al. Promoting and providing HPV vaccination in Hawaii: barriers faced by health providers. *J Community Health.* 2016; [published online ahead of print April 2 2016]. doi: 10.1007/s10900-016-0191-9
19. Wright JD, Govindappagari S, Pawar N, et al. Acceptance and compliance with postpartum human papillomavirus vaccination. *Obstet Gynecol.* 2012; 120:771–82. [PubMed: 22996094]
20. Berenson AB, Male E, Lee TG, et al. Assessing the need for and acceptability of a free-of-charge postpartum HPV vaccination program. *Am J Obstet Gynecol.* 2014; 210:213.e1–7. [PubMed: 24280248]
21. Donken R, Knol MJ, Bogaards JA, van der Klis FRM, Meijer CJLM, de Melker HE. Inconclusive evidence for non-inferior immunogenicity of two- compared with three-dose HPV immunization schedules in preadolescent girls: a systematic review and meta-analysis. *J Infect.* 2015; 71:61–73. [PubMed: 25709084]
22. American College of Obstetricians and Gynecologists. Integrating immunizations into practice. Committee Opinion No.641. *Obstet Gynecol.* 2013; 121:897–903. [PubMed: 23635707]
23. Trick W, Linn E, Jones Z, Caquelin C, Kee R, Morita J. Using computer decision support to increase maternal postpartum tetanus, diphtheria, and acellular pertussis vaccination. *Obstet Gynecol.* 2010; 116:51–57. [PubMed: 20567167]
24. Ruffin MT, Plegue MA, Rockwell PG, Young AP, Patel DA, Yeazel MW. Impact of an electronic health record (EHR) reminder on human papillomavirus (HPV) vaccine initiation and timely completion. *J Am Board Fam Med.* 2015; 28:324–333. [PubMed: 25957365]
25. Dela Cruz MR, Tsark JU, Chen JJ, Albright CL, Braun KL. Human papillomavirus (HPV) vaccination motivators, barriers, and brochure preferences among parents in multicultural Hawaii: a qualitative study. *J Cancer Educ.* 2016; [published online ahead of print March 7 2016]. doi: 10.1007/s13187-016-1009-2
26. Cates JR, Shafer A, Carpentier FD, et al. How parents hear about human papillomavirus vaccine: implications for uptake. *The J Adolesc Health.* 2010; 47(3):305–308. [PubMed: 20708571]
27. Brewer NT, Gottlieb SL, Reiter PL, et al. Longitudinal predictors of human papillomavirus vaccine initiation among adolescent girls in a high-risk geographic area. *Sex Transm Dis.* 2011; 38(3):197–204. [PubMed: 20838362]
28. Gargano LM, Herbert NL, Painter JE, et al. Impact of a physician recommendation and parental immunization attitudes on receipt or intention to receive adolescent vaccines. *Hum Vaccin Immunother.* 2013; 9:2627–2633. [PubMed: 23883781]
29. Smith PJ, Stokley S, Bednarczyk RA, Orenstein WA, Omer SB. HPV vaccination coverage of teen girls: the influence of health care providers. *Vaccine.* 2016; 34:1604–16010. [PubMed: 26854907]
30. Berenson AB, Rahman M, Hirth JM, Rupp RE, Sarpong KO. A human papillomavirus vaccination program for low-income postpartum women. *Am J Obstet Gynecol.* 2016; [published online ahead of print February 17 2016]. doi: 10.1016/j.ajog.2016.02.032
31. Centers for Disease Control and Prevention. Human papillomavirus vaccination coverage among adolescent girls, 2007–2012, and postlicensure vaccine safety monitoring, 2006–2013 - United States. *MMWR Morb Mortal Wkly Rep.* 2013; 62:591–5. [PubMed: 23884346]

Figure 1. EMR prompt inserted into the postpartum note template

Figure 2. Comparison of pre- and post-intervention eligible postpartum visits

Table 1
Patient characteristics

	Pre-Intervention (n=173)	Post-Intervention (n=68)	p-value
Age (years): mean (SD)	22.1 (2.4)	21.9 (2.5)	0.52
Breastfeeding			0.48
Yes	140 (80.9%)	52 (76.5%)	
No	33 (19.1%)	16 (23.5%)	
Marital Status			0.88
Single	126 (73.3%)	51 (75%)	
Married	46 (26.7%)	17 (25%)	
English as Primary Language			0.016
Yes	127 (73.4%)	60 (88.2%)	
No	46 (26.6%)	8 (11.8%)	
Insurance			0.043
Public	144 (88.3%)	60 (77.6%)	
Private/Military	19 (11.7%)	8 (22.4%)	
Education			0.40
Less than High School	26 (15.4%)	6 (9.4%)	
High School graduate	86 (50.9%)	38 (59.4%)	
Some College	57 (33.7%)	20 (31.3%)	
Ethnicity			0.021
White	13 (7.7%)	10 (14.7%)	
Asian	7 (4.2%)	5 (7.4%)	
Filipino	18 (10.7%)	16 (23.5%)	
Hawaiian	25 (14.9%)	9 (13.2%)	
Micronesian/Marshallese	73 (43.5%)	16 (23.5%)	
Other Pacific Islander	20 (11.9%)	9 (13.2%)	
Other (Black, Hispanic)	12 (7.1%)	3 (4.4%)	
Religion			0.45
Catholic	38 (22.4%)	13 (21.0%)	
Christian	42 (24.7%)	12 (19.4%)	
Protestant	21 (12.4%)	4 (6.5%)	
Other	17 (10.0%)	8 (12.9%)	
No denomination	52 (30.6%)	25 (40.3%)	
Residence: Honolulu			0.25
Yes	106 (61.3%)	36 (52.9%)	
No	67 (38.7%)	32 (47.1%)	

Table 2
Vaccination status pre- and post-intervention

	Pre-Intervention (n = 173)	Post-Intervention (n=68)	p-value
Vaccination given	2 (1.2%)	18 (26.5%)	<0.001
Vaccination not given	171 (98.8%)	50 (73.5%)	

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Table 3**Effect of intervention**

	Unadjusted OR [95% CI]	Adjusted OR* [95% CI]
Intervention	30.78 [6.91, 137.19]	93.49 [15.29, 571.52]

* adjusted for age, ethnicity, insurance, and religion, with all p-values < 0.05