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Short communication

HPV vaccination series completion and co-vaccination: Pairing vaccines may matter for adolescents

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ABSTRACT

Very little is known about the effect of concurrent co-vaccination on HPV series completion. This study utilized a retrospective review of a Clinical Data Repository to assess whether concurrent vaccination had an impact on HPV vaccination series completion, and whether there were differences based on age. 3371 patients who received the HPV vaccine at a single academic medical center between the years 2009–2013 were included in this analysis. The adjusted odds ratio (aOR) for effect of concurrent vaccination on series completion for the age group 9–18 was 1.32 (95% CI 1.09, 1.60). Although not statistically significant, the aOR for effect of concurrent vaccination on completion changed direction for the 19–25 age group and was 0.44 (95% CI 0.17, 1.12). This study provides preliminary evidence that pairing the HPV vaccine with one or more co-vaccines may yield a higher HPV vaccination completion rate among adolescents age 9–18.

1. Introduction

The human papillomavirus (HPV) infection is an established risk factor for the development of several types of cancer, including cervical, vulvar, vaginal, oropharyngeal, penile, and anal cancer with prevalence peaking in young adulthood [1,2]. The quadrivalent HPV vaccine, a three series vaccination, was licensed for use in females in 2006 and males in 2009 to protect against diseases caused by HPV subtypes 6, 11, 16 and 18, and up until 2014 was the most commonly administered HPV vaccine [3]. The Advisory Committee on Immunization Practices (ACIP) recommends vaccination of girls and boys age 11–12 (acceptable range of vaccination 9–26 for females; 9–21 for all males and up to 26 for men who have sex with men or immunocompromised males) [1].

Despite the recommendations, HPV vaccination initiation and series completion rates have been dramatically lagging behind anticipated vaccination rates for both females and males. In 2012 in the United States, 53.8% of females obtained at least the first vaccine but only 33.4% obtained all three [4]. Even though vaccinating males is a newer recommendation, in 2012 the initiation percentage was 20.8% for males, with only 6.8% completing the three-series for full coverage [4].

Globally, pairing non-vaccine public health interventions along with the HPV vaccination to increase vaccine initiation and completion has yielded inconsistent results [5]. The purpose of this study was to determine if co-vaccination of another vaccine along with the HPV vaccine predicts completion of the HPV three-series among patients who received at least one dose in an academic medical center in Virginia, USA. We also wanted to determine if there was a difference in completion with co-vaccination by age (comparing adolescents vs. young adults).

2. Methods

2.1. Sample selection

This retrospective study received Institutional Review Board exemption prior to study initiation. The University of Virginia's Clinical Data Repository (CDR) was used for subject identification based on a single query. Participants were identified using the procedure codes for having received at least one HPV vaccination from 2009 to 2013. Participants from years 2009 and 2013 were followed back and forward in time respectively to ensure accurate data of completion of the series was obtained. Other variables collected included: number of HPV doses received (completion of three series variable created), age, gender, payer (private insurance,

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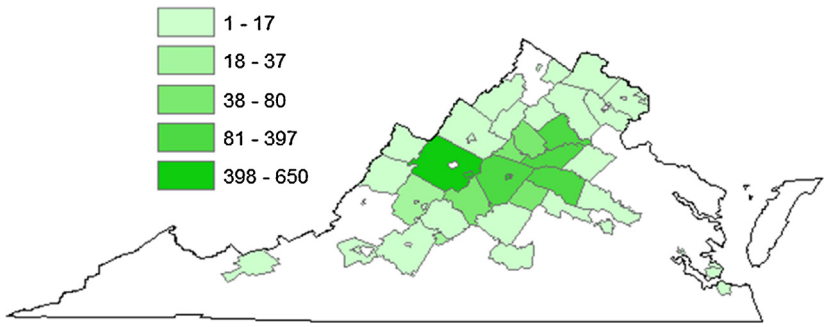

Fig. 1. Study sample region with patient counts.

Medicaid or self-pay), race (white vs. non-white), region (county), and co-vaccination at the time of first HPV vaccine administration (yes/no).

2.2. Analysis

Patients were sampled from the region shown in Fig. 1. In order to proceed with the analysis using complete data, 3 patients who lacked completion data were eliminated, as were 5 patients who lived extraneous to the region, and 3 patients without insurance data, for a total of 3371 patients with complete information. Descriptive statistics were calculated to describe all variables.

Bivariate and multivariate analyses by age and category strata were conducted using logistic regressions. For the multivariate analysis, a random effects logistic regression was conducted using the Stata version 13 procedure 'meqrlogit' [6], with the probability of completion treated as the dependent variable, concurrent vaccination and the covariates included as the predictor variables, and a random effect for each county in the region added to the linear predictor in order to control for unseen county-level contextual effects. In addition to displaying and estimating odds ratios, we also calculated marginally standardized probabilities of completion for each predictor so that risk differences could be assessed on the probability scale [7]. These probabilities were calculated by averaging the model based predicted probabilities over the sample of observations while setting the predictor's value at the same level for each observation.

Logistic regression parameters for each covariate by age strata (adolescents age 9–18 vs. young adults age 19–25) were compared using statistical tests of interaction with age category and set to equality if the null hypothesis of equality was not rejected. In order to examine potential effect modification for the effect of concurrent vaccination on completion, the statistical interactions between concurrent vaccination and each covariate in the model were individually tested.

3. Results

Overall, 3371 patients were included in this analysis and sample characteristics are described in Table 1. Only 25% of this sample completed the three-series HPV vaccine. The majority of the sample was female, white, had private insurance, and received a concurrent vaccination along with their first dose of the HPV vaccine.

Results for the bivariate and multivariate models can be found in Table 2. The adjusted odds ratio (aOR) for effect of concurrent vaccination on completion for the age group 9–18 was 1.32 (95% CI 1.09, 1.60) with 34% completion rate projected in a representative sample of cases with concurrent vaccination compared to 24% for cases without. Although not statistically significant, the aOR for effect of concurrent vaccination on completion changed direction

Table 1
Participant characteristics among those who initiated HPV vaccination at an academic medical center ($n = 3371$).

Variable	Age 9–18		Age 19–25		Overall	
	N	% Complete	*N*	% Complete	*N* (%)	% Complete
Completion						
Yes	821	–	35	–	856 (25)	–
No	2195		320		2515 (75)	
Concurrent vaccination						
Yes	2066	29	113	5	2180 (65)	28
No	949	22	242	12	1191 (35)	20
Gender						
Male	1040	20	75	8	1115 (33)	20
Female	1976	31	280	10	2256 (67)	28
Insurance						
Private	2164	27	311	9	2475 (73)	25
Medicaid	724	27	15	13	739 (22)	27
Self-pay	128	27	29	14	157 (5)	25
Race						
Non-white	593	20	95	3	688 (20)	27
White	2423	29	260	12	2683 (80)	18
Start year						
2009	338	47	79	16	417 (12)	41
2010	268	45	34	15	302 (9)	41
2011	430	31	51	4	481 (14)	28
2012	714	26	81	12	795 (24)	25
2013	1266	18	110	5	1376 (41)	17
Overall	3016	27	355	10	3371	25