



## Association of physicians perceived barriers with human papillomavirus vaccination initiation



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### ABSTRACT

Physician recommendation is a strong predictor of vaccine uptake, however their perceived barriers may prevent vaccination. Therefore, we determined the association between physicians' perceived barriers to HPV vaccination and vaccination initiation.

We surveyed pediatricians in a large network of clinics in Houston, Texas to assess their perceived barriers to vaccinating adolescents. We combined survey data with electronic medical records to determine HPV vaccination initiation over a 12-month study period (July 2014–June 2015). Patients were 11–18 year olds who had not begun the vaccination series, had a physician visit during the study period, and whose physician completed the survey. We conducted a multilevel model clustered by physician controlling for patient and physician demographics to calculate the association between physician-reported barriers and HPV vaccination initiation.

Among 36,827 patients seen by 134 pediatricians, 18.6% initiated HPV vaccination. The relative risk of initiating HPV vaccination were lower for patients whose physician reported concerns about HPV vaccine safety (RR: 0.75, 95% CI: 0.58–0.97), efficacy (RR: 0.73, 95% CI: 0.54–0.99), and the financial burden of the vaccine on patients (RR: 0.72, 95% CI: 0.58–0.88). After controlling for patient and physician characteristics, physician concern about the financial burden on patients was significantly associated with lower relative risk of initiating HPV vaccination (RR: 0.76, 95% CI: 0.64–0.90).

In this large study we observed that physician-reported barriers are associated with HPV vaccination initiation. Interventions should be implemented to educate physicians on vaccine safety, efficacy, and that there is no patient cost for CDC-recommended vaccines.

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### 1. Introduction

Persistent infection with a high-risk human papillomavirus (HPV) type is the leading cause of cervical cancer and is associated with a higher cancer risk, including anus, penis, vulva, vagina, and oropharynx (Kash et al., 2015; Reagan-Steiner et al., 2016). It is estimated that 70% of individuals acquire the HPV at some point in their lifetimes (Satterwhite et al., 2013). Despite the effectiveness of the vaccine to confer immunity against HPV types that cause most HPV-related cancers, the rates of vaccination remain suboptimal (Centers for Disease Control and Prevention (CDC), 2010). The Centers for Disease Control and Prevention (CDC) Advisory Committee on Immunization Practices recommends targeting

vaccination of 11–12-year-old girls (since 2007) and boys (since 2011), catch-up vaccination of all 13–26 year olds, and allow for vaccination as early as age 9, at the physicians discretion (Centers for Disease Control and Prevention (CDC), 2010; Markowitz et al., 2007; Petrosky et al., 2015). However, despite national recommendations, as of 2015 only 62.8% of females and 49.8% of males ages 13–17 had initiated HPV vaccination, and initiation rates vary dramatically by State (34.8% in Kentucky versus 87.9% in Rhode Island) and race/ethnicity (68.4% among Hispanics versus 59.2% among non-Hispanic whites) in the U.S. (Reagan-Steiner et al., 2016).

Much of the current literature on HPV vaccine uptake focuses on parental or adolescent factors. Mother-identified predictors of vaccination initiation include child's age and awareness of the HPV vaccine, while adolescent-reported predictors of initiation include a history of sexual activity and discussion with a physician about the vaccine (Allen et al., 2010; Bastani et al., 2011; Bednarczyk et al., 2011; Brewer et al., 2011; Guerry et al., 2011; Williams et al., 2011). One of the most influential vaccination motivators cited by parents is physician recommendation

Abbreviations: CDC, Centers for Disease Control and Prevention; EMR, electronic medical records; HPV, human papillomavirus; TCP, Texas Children's Pediatrics.

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(Dempsey et al., 2016; Gottlieb et al., 2009; Guerry et al., 2011; Vadaparampil et al., 2014; Ylitalo et al., 2013). However, physicians themselves have concerns, which often discourage them from recommending HPV vaccination to patients (Kulczycki et al., 2016).

Evidence suggests that physician concerns include safety, handling parents' negative perceptions of the vaccine, comfort level in talking to parents about the possibility their child is sexually active, a lack of preventive care visits in the eligible age group, (Bruno et al., 2014) and the financial burden HPV vaccination may impose on patients or parents (Alexander et al., 2015; Kahn et al., 2005; Keating et al., 2008; Mays and Zimet, 2004; McCave, 2010; Riedesel et al., 2005; Soon et al., 2015; Tissot et al., 2007). However, these studies often describe only physician barriers (Bruno et al., 2014; Javanbakht et al., 2012; Tom et al., 2016) or they associate the barriers with physicians' self-reported vaccination patterns (Ko et al., 2010) and do not assess the association between physician-perceived barriers and actual patient HPV vaccination uptake.

To our knowledge, none of the previously reported studies indicate whether physicians' perceived barriers are associated with the actual vaccination rates of their patients. Therefore, the purpose of this study was to determine physician-reported barriers when vaccinating patients against HPV and the association with HPV vaccination initiation among their patients using an objective measure from electronic medical records (EMR). Understanding how physician-perceived barriers influence HPV vaccination is the first step in developing clinic-based interventions targeted at pediatric physicians to increase vaccination rates.

## 2. Methods

We conducted an observational study of pediatricians ( $n = 134$ ) and their patients between 11–18 years of age ( $n = 36,827$ ). We combined patient-level data from the Texas Children's Pediatrics (TCP) EMR with physician-level data from a pediatrician survey on HPV vaccination. TCP, providing full-service care, is one of the largest networks of pediatric practices in the U.S. comprising 52 clinics in the Houston, Texas, metropolitan area, and >200 board-certified pediatricians serve a diverse patient population. Patients were eligible for the study if their physician completed the HPV vaccination survey, had not initiated HPV vaccination as of July 1, 2014, and had a physician visit between July 1, 2014 and June 30, 2015. This study was conducted as part of a larger, ongoing multilevel randomized intervention study targeting clinic systems, physicians, and patients to improve HPV vaccination rates. This collaborative effort includes the TCP, The University of Texas School of Public Health, and Baylor College of Medicine. The study was approved by the Institutional Review Board at the University of Texas Health Sciences Center at Houston.

### 2.1. Pediatrician survey

The research team conducted a survey, targeting all pediatricians practicing in the TCP network. Physicians received an email link to an online survey between August–September 2015. The survey took fewer than 30 min to complete, and physicians received a \$50 electronic gift card upon completion. The response rate was 59.8%.

The survey focused on physician experiences with the HPV vaccine and addressed organization and patient barriers that they encounter when vaccinating adolescents. For this study, we used data from physician responses to 10 survey items that asked the extent to which they believed the following represented barriers to HPV vaccination: 1) their level of knowledge of the HPV vaccine, 2) concern about parents' negative perceptions of the HPV vaccine, 3) personal discomfort talking about sexually transmitted infections with parents and patients, 4) concern about the financial burden of the HPV vaccine on patients, 5) concern about vaccine safety, 6) concern about vaccine efficacy, 7) that HPV vaccine is not required for school attendance, 8) time it

takes to discuss HPV vaccination with patients and parents, 9) difficulty ensuring that patients will complete the 3-dose HPV vaccine series, and 10) infrequent office visits made by adolescent patients. Physicians responded to each question on a 4-point Likert scale by selecting “not a barrier at all,” “a minor barrier,” “somewhat of a barrier,” and “a major barrier” (McCave, 2010). Physicians rarely selected “a major barrier” as a response, and in order for a meaningful interpretation and analysis, we combined “a minor barrier,” “somewhat of a barrier,” and “a major barrier” into one category to capture “a barrier” to immunizing patients against HPV versus “not a barrier at all.”

### 2.2. Covariates

Physician characteristics included self-report of age, sex, race/ethnicity, years since completion of residency training, patient volume (number of patients seen in a typical day), and the number of years working at TCP. We used the EMRs to identify patient characteristics, which included age, sex, parent-reported race/ethnicity, and type of health insurance (public or private/commercial).

### 2.3. Outcome variable

We determined vaccination initiation using EMRs. The study outcome measure was a binary variable (yes/no) indicating whether each patient received the first dose of the HPV vaccine during a physician visit anytime within the 12-month study period.

### 2.4. Analysis

For descriptive purposes, physician characteristics are presented by comparing two groups of physicians with vaccination initiation rates above and below the median percentage of their eligible patients who initiated vaccination during the study period (<25% versus  $\geq 25\%$ ). We present the distribution of patient characteristics by HPV vaccination initiation. Chi-square with Fisher exact were used to test the association between each patient and provider characteristic and either the median percentage of patients who initiated the vaccine during the study period or HPV vaccination initiation. To determine whether physicians' perceived barriers were associated with HPV vaccination initiation, we first conducted unadjusted, multilevel, generalized linear models with a log link function with binomial distribution and randomly varying intercepts using patient-level HPV vaccination initiation clustered by treating physician. Next, the variables that were found to be suitable for further analysis ( $p \leq 0.10$ ) were entered in a multivariable multilevel log-binomial regression model. All independent variables with at least 1 level with  $p \leq 0.05$  were retained in the final multivariable multilevel logistic regression model (Smolders et al., 2010). As a sensitivity analysis, we tested for the association between each significant physician barrier and HPV vaccination in separate models, adjusting for physician and patient demographic characteristics. These multilevel models allow for variation between patients across all groups and within each physician cluster. To characterize physician-level effects, we used a latent random variable to calculate the physician-specific probabilities of patient vaccination initiation. We also conducted sensitivity analyses to ensure that the model met the assumptions of the random-effects model. A significance level of  $\alpha = 0.05$  was selected. All analyses were conducted using SAS 9.4 software (Cary, NC).

## 3. Results

A total of 134 (59.8%) physicians completed the study survey (Table 1). The average number of study-eligible patients per physician was 275 (SD: 177.9; min 26, max 917). The majority of the physicians were younger than 49 years, saw fewer than 30 patients per day, were female, finished residency >10 years before, and had worked at the clinic for fewer than 10 years. We stratified the physicians based on

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