



## Original article

## Is There an Association Between Maternal Pap Test Use and Adolescent Human Papillomavirus Vaccination?

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## A B S T R A C T

**Purpose:** To identify the association between mother's recent receipt of a Pap test and daughter's uptake and completion of the three-shot human papillomavirus (HPV) vaccination series.

**Methods:** We used cross-sectional data from the 2008 to 2010 Behavioral Risk Factor Surveillance System from 9 U.S. states and Puerto Rico and logistic regression models to examine the association between mother's receipt of a Pap test in the past 3 years and daughter's uptake and completion of the three-shot HPV vaccination series among adolescent girls aged 9–17 years (N = 4,776).

**Results:** Approximately one-quarter of adolescent girls began the HPV vaccination series, and 13.6% completed the three-shot series. Uptake and completion were more likely among girls whose mothers had obtained a Pap test within the past 3 years—for HPV uptake, odds ratio: 1.342, 95% confidence interval: 1.073–1.692; for HPV completion, odds ratio: 1.904; 95% confidence interval: 1.372–2.721—but the relationship between mother's recent Pap test and vaccine uptake was explained by the mother's use of a personal doctor and obtaining a routine physical examination in the past year.

**Conclusions:** HPV vaccination uptake and completion were more likely among adolescent girls whose mothers obtained a recent Pap test. Interventions designed to educate mothers on the importance of HPV vaccination and to facilitate relationships between physicians and mothers may prove successful at increasing HPV vaccination among adolescent girls.

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**IMPLICATIONS AND  
 CONTRIBUTION**

This study addresses the paucity of research examining the association between mothers' cervical cancer screening behavior and actual adolescent HPV vaccination. Because of their important role in providing HPV vaccine education and recommendation to vaccinate, the results of this study can be useful to doctors who provide services to women with adolescent daughters.

The human papillomavirus (HPV) is now recognized as the major cause of cervical cancer and is the most common sexually transmitted infection in the United States [1]. HPV types 16 and 18 account for 70% of cervical cancer cases [2]. The prevalence of HPV infection among U.S. women aged 14–59 years is estimated to be 27% [3]. The most efficient and cost-effective mechanism for combating cervical cancer is preventing infection. There are two vaccines targeting HPV approved by the Food and Drug Administration for girls and women aged 9–26 years. The bivalent HPV vaccine (Cervarix, GlaxoSmithKline, Philadelphia, PA)

prevents HPV types 16 and 18. The quadrivalent vaccine (Gardasil, Merck & Co., Inc., Whitehouse Station, NJ) prevents HPV types 16 and 18, as well as 8 and 11, which account for 90% of genital warts [4]. Both vaccines are administered as a three-dose series and are routinely recommended for the prevention of cervical cancer in preteen and adolescent girls [5].

Cervical cancer rates in the United States have declined in recent years, largely because of screening and early treatment [1]. However, widespread use of the HPV vaccine has been impeded by various barriers, including lack of parental knowledge about the vaccine, lack of physician recommendation, vaccine cost, and parental fear that vaccination may condone early sexual activity [6,7]. Previous research indicates that vaccine uptake and completion in the United States are at suboptimal levels. Estimates across a wide range of geographic areas and population subgroups in the United States suggest

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that uptake among adolescent girls ranges from approximately 9% to 37% and completion ranges from approximately 2% to 28% [8–12].

A number of previous studies have examined predictors of HPV vaccination among adolescent girls. These studies have consistently found that poverty, age, maternal education, health insurance coverage, and adolescent sexual activity are all significantly associated with vaccination [8,9,11,13,14]. Several studies have also indicated that maternal health beliefs, knowledge of sexually transmitted infection, perceptions of disease risk, and mother–daughter communication predict adolescent vaccination acceptance [8,15–17] and that many adolescents make decisions about vaccination with their parents [18,19]. Studies find relatively high levels of acceptability of HPV vaccination among parents, typically motivated by a desire to protect their children's health [20–22].

Maternal acceptability of vaccination is one of the strongest predictors of adolescent acceptability [21], adolescent vaccination interest, and actual vaccine uptake [16]. Findings from previous research suggest that girls are more likely to discuss topics related to sexuality with their mothers than with their fathers [23], and mothers are more likely than fathers to select their child's doctor and take children to doctor appointments [24]. Previous research demonstrates that mothers who engage in their own preventive health behaviors are more likely to accept vaccination for their children [25,26] and that maternal communication about Pap screening is associated with adolescent Pap screening [27]. Further, mother–daughter communication about HPV vaccination is more common among mothers who have been advised by doctors to vaccinate their daughters [19]. However, much less is known about how mothers' preventive health care practices are related to actual HPV vaccination among girls. Accordingly, the present study focused on the relationship between maternal preventive health care practices and daughters' vaccination status. Specifically, we examined the extent to which mother's receipt of a recent Pap test was associated with uptake and completion of HPV vaccination among adolescent girls. We hypothesized that there would be a positive relationship between mother's receipt of a recent Pap test and daughter's uptake and completion of the HPV vaccination series.

In the only study to examine the relationship between mother's Pap test use and daughter's HPV vaccination, Chao et al. found that mothers' Pap test histories were significantly associated with daughters' likelihood of vaccination [15]. However, that study was restricted to members of a managed care organization in California. In addition, because individual-level socioeconomic indicators were unavailable, the authors relied on neighborhood-level indicators of educational attainment and household income. We expanded on this previous research using a sample of mother–daughter pairs from various states across the United States and controlling for several individual- and family-level characteristics that may be associated with both mother's use of Pap test and daughter's HPV vaccination.

In addition, having a regular doctor or other health care provider and having a routine physical checkup have been identified as the most important predictors of women's Pap test use [28,29]. Women with more interactions with health care providers have the opportunity to obtain more information about the link between HPV and cervical cancer and the importance of vaccination [30]. Accordingly, we examined whether these indicators of mother's access to health care explain the relationship between maternal Pap test use and adolescent HPV vaccination.

**Table 1**  
Distribution of sample by state and statewide % HPV uptake, HPV completion, and maternal Pap test

State	Frequency	Percentage (%)	HPV uptake (%)	HPV completion (%)	Maternal Pap test (%)
Connecticut	258	5.4	36.4	26.2	97.1
Delaware	38	.8	24.2	14.3	97.2
Kentucky	159	3.3	34.2	19.7	83.6
Oklahoma	135	2.8	20.0	10.8	83.9
Pennsylvania	911	19.1	34.5	11.2	86.4
Texas	2,748	57.5	23.1	12.3	89.9
West Virginia	119	2.5	26.4	15.9	86.9
Wisconsin	220	4.6	27.2	19.2	100.0
Wyoming	44	.9	33.1	22.0	84.6
Puerto Rico	145	3.0	21.4	12.0	100.0
Total	4,776	100			

Weighted percentages.

HPV = human papillomavirus.

## Methods

### Sample

This cross-sectional study used data from the 2008, 2009, and 2010 Behavioral Risk Factor Surveillance System (BRFSS) [31]. The BRFSS is the world's largest monthly telephone health survey, tracking adult health behaviors, health care use, and health outcomes from all 50 U.S. states, the District of Columbia, and U.S. territories since 1984. In 2008, questions about HPV vaccination for people aged  $\leq 17$  years were included as optional modules for states. One child from each sampled household was randomly selected for participation. The sampled adult within each household answered questions about the child, including his/her relationship to the child, demographic information, and HPV vaccination status. Since the HPV module was introduced in 2008, nine U.S. states (Connecticut, Delaware, Kentucky, Oklahoma, Pennsylvania, Texas, West Virginia, Wisconsin, and Wyoming) and Puerto Rico incorporated the HPV questions into their surveys. The core survey questions and HPV module questions were identical for all 10 geographies, which enabled pooling of the data. More information regarding the BRFSS survey is available at [http://www.cdc.gov/brfss/technical\\_infodata/index.htm](http://www.cdc.gov/brfss/technical_infodata/index.htm).

A distribution of respondents by state is included in Table 1. Because more than half of our respondents came from Texas, and as we were concerned that the introduction of mandated HPV vaccinations for 11- and 12-year-old girls in Texas in 2007 would bias our results, we ran supplemental analyses where we treated Texas as a fixed effect. Our results were unchanged (models not shown but available on request). We also tested the need for multilevel models and found nonsignificant state-level variance intercepts and intraclass correlation coefficients of  $<.05$ ; therefore, we elected to present the results of the more parsimonious models.

Because we were explicitly interested in the relationship between maternal use of Pap tests and daughter's HPV vaccination, the analyses were restricted to mother–daughter pairs. We used poststratification weights throughout all analyses to correct for selection, nonresponse, and nontelephone coverage bias. This study was exempted from institutional review board review by the lead author's institution.

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