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Association between Parental HPV Knowledge and Intentions to Have Their Daughters Vaccinated

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Abstract

Human papillomavirus (HPV) 16 and 18 causes 66% of cervical cancers (Dunne et al., 2014). Vaccination during adolescence can prevent HPV-associated cervical cancers, yet less than half of adolescent girls are vaccinated. This study examined the association between HPV knowledge and parental intentions to vaccinate daughters against HPV. A retrospective, cross-sectional, national data set from the 2006-2007 Health Information National Trends Survey (HINTS) was used. A multivariate multinomial logistic regression analysis was used to estimate the association between intent to vaccinate and HPV knowledge. After controlling for other covariates, parents who were knowledgeable were more likely to intend to have their daughters vaccinated compared with those who were not knowledgeable (adjusted relative risk ratio [aRRR] = 3.96, $p = .004$). Having HPV knowledge would significantly increase parents' intent for vaccination against the disease for their daughters. Health care providers should integrate HPV-related education for parents within their services, and policymakers should consider requiring HPV vaccination for school attendance.

Keywords

adolescents; HPV knowledge; parents; STIs; vaccination

The human papillomavirus (HPV) has received national attention since the vaccine Gardasil made its debut in 2006 (Stokley et al., 2014). Parents' awareness of HPV and vaccination has increased (Matthews & Matsumoto, 2014); more know about the severity of HPV, how common it is, how the infection is transmitted, the availability of a vaccine to prevent exposure to cervical cancer, and the recommended age group for vaccination (Allen et al., 2010; Chow et al., 2010; Guerry et al., 2011; Kepka, Ulrich, & Coronado, 2012). However, simply being aware of HPV does not mean parents are knowledgeable (Allen et al., 2010; Louis-Nance et al., 2012; Schmidt-Grimminger et al., 2013), which is defined by their understanding of HPV transmission, the type of cancers it causes, who is affected, diagnostic testing for it, associated risk factors, recommended age for vaccination, purpose of the

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vaccine, which strains vaccination prevents, and the number of injections required (Kepka, Coronado, Rodriguez, & Thompson, 2011; Kepka et al., 2012; Kornfeld, Byrne, Vanderpool, Shin, & Kobetz, 2013; Louis-Nance et al., 2012; Okoronkwo, Sieswerda, Cooper, Binette, & Todd, 2012). HPV awareness and knowledge are strongly associated with using the vaccine (Allen et al., 2010; Guerry et al., 2011; Hendry, Lewis, Clements, Damery, & Wilkinson, 2013; Okoronkwo et al., 2012).

Currently, 79 million Americans are infected with HPV, and roughly 14 million new cases are reported each year (Dunne et al., 2014). Furthermore, more than 80% of sexually active persons will contract HPV in their lifetime (Dunne et al., 2014; Forhan et al., 2009; Sara Test, Caskey, & Rankin, 2013). More than 150 types of HPV exist, but only four are commonly transmitted: HPV 6, 11, 16, and 18. In the United States, the estimated prevalence of these strains is 18% among girls aged 14 to 19, 45% among women aged 20 to 24, 27% among women aged 25 to 59, and 73% among all men (Reiter, Brewer, McRee, Gilbert, & Smith, 2010; Sara Test et al., 2013; Stokley et al., 2014). Adolescent girls aged 11 to 19 experience 49% of all types of HPV strains (Dunne et al., 2013). HPV 16 and 18 are known to cause 66% of all cervical cancers (Dunne et al., 2014). According to the American Cancer Society (2016), 12,990 women are diagnosed with cervical cancer each year, and 4,120 women die from the disease. Furthermore, the U.S. health care system spends US$2.3 to US$6.4 billion each year on treating and managing HPV associated cervical cancers (Kruzikas, Smith, Harley, & Buzinec, 2012).

In 2006, the Advisory Committee on Immunization Practices (ACIP) approved the three-dose HPV vaccine Gardasil for recommended use in girls at ages 11 to 12 to protect against HPV 6 and 11, and 70% of cervical cancers caused by HPV 16 and 18 (Stokley et al., 2014). In 2015, the ACIP approved a new vaccine Gardasil 9 for administration in females and males, which provides protection against nine transmitted strains and 90% of cervical cancers and anal cancers, and changed practice guidelines to routinely recommend vaccination at ages 11 and 12 among girls and boys (Petrosky et al., 2015). Catch-up vaccination is administered between the ages of 13 and 26 (Dunne et al., 2014). All three doses must be received for efficacy (U.S. Food and Drug Administration [FDA], 2014). If the three doses are administered, the vaccine has proven 98% effective in preventing HPV infection from these strains (Centers for Disease Control and Prevention [CDC], 2011). Vaccination is covered by private insurance through the Affordable Care Act and has been added to the Vaccine for Children Program covered by Medicaid (Trinidad, 2012).

Nonetheless, many adolescent girls remain unvaccinated (Kester, Zimet, Fortenberry, Kahn, & Shew, 2013; Kramer & Dunlop, 2012; Stokley et al., 2014). Many factors influence parents' intentions to vaccinate their daughters, including socioeconomic barriers, attitudes, provider recommendation, uncertainty about safety and efficacy, daughters' perceived risk, and fear of increased promiscuity among daughters (Bartolini, Winkler, Penny, & LaMontagne, 2012; Guerry et al., 2011; Kester et al., 2013; Perkins & Clark, 2013). Parents' lack of knowledge about HPV also influenced their intentions to vaccinate their daughters for HPV (Allen et al., 2010; Guerry et al., 2011; Kepka et al., 2012; Okoronkwo et al., 2012).

Provider recommendation for HPV vaccination has been found to be a strong influential factor on parents' decisions to vaccinate their children (Kester et al., 2013; Perkins & Clark, 2013; Thompson, Arnold, & Notaro, 2012). Despite the strong correlation between provider recommendation and HPV vaccination, many providers are missing opportunities to recommend the vaccine in clinical practice (Bruno, Wilson, Gany, & Aragones, 2014; Mullins et al., 2013; Ylitalo, Lee, & Mehta, 2013). Missed opportunities have also been found to largely affect HPV vaccination rates (Holman et al., 2014; Reagan-Steiner et al., 2016; Stokley et al., 2014). Although the HPV vaccine has been used in clinical practice for 10 years, vaccination rates are lagging behind nationally (Reagan-Steiner et al., 2016; Stokley et al., 2014). The CDC, National Cancer Institute along with the U.S. Department of Health and Human Services has set initiatives to improve vaccine rates among adolescents by reducing missed opportunities for vaccination in clinical practice (President's Cancer Panel, 2014).

Preventing HPV-associated cervical cancers through vaccination during adolescence can significantly reduce girls' risk of acquiring HPV 16 and 18 as young adults and the need for treatment. Muñoz and colleagues (2010) found that vaccination reduced the need for cervical cancer treatment by 42.3%, colposcopies by 19.8%, and cervical biopsy exams by 22%. One of the initiatives set forth by Healthy People 2020 aims to increase HPV vaccine completion rates among adolescents to 80% (U.S. Department of Health and Human Services, 2016). However, HPV vaccination rates are below the national goals, with initiation rates up to 63% among girls and 50% among boys, and completion rates at 39.7% and 21.6%, respectively (Reagan-Steiner et al., 2016). Increasing parents' knowledge and awareness of HPV may increase their intention to vaccinate their daughters against HPV and improve vaccination rates in the United States. The purpose of this study was to examine the association between HPV knowledge and parental intentions to vaccinate daughters (PIVD) for HPV.

Methods

Design, Data Source, and Study Sample

This study used a retrospective, cross-sectional design based on a national data set, the Health Information National Trends Survey (HINTS), 2006-2007. HINTS is a nationally representative survey that monitors “trends in the use of health information and communication technologies” (Nelson, Moser, Gaffey, & Waldron, 2009, p. 1,760). This study used HINTS 2006-2007 because it was the only data set that assessed the outcome variable, intention to vaccinate for HPV. Participants were assessed for cancer-relevant behaviors through screenings.

HINTS's probability-based sample design used random-digit dialing to conduct telephone surveys and a nationwide address list to administer surveys via mail. A subsampling screening tool, Westat's Telephone Research Center (TRC), was used to identify working residential numbers. A total of 3,767 telephone interviews were then completed, and 325 were partially completed (n = 4,092); 3,473 mail surveys were completed and 109 partially completed (n = 3,582). The final total sample was 7,674 participants (Hesse & Moser, 2007).

Next, participants' responses to the main outcome variable, parental intentions to have their daughters vaccinated against HPV, were assessed. Of the 7,674 participants in the data set, 7,240 responded to the main outcome variable. As at the time the HINTS 2006-2007 data set was collected, the HPV vaccine was only approved for adolescent girls, only responses from parents with adolescent daughters were assessed. A total of 1,392 parents met the inclusion criteria; 1,039 responded to the questions capturing the main independent variable, HPV knowledge.

Measures

Dependent Variable—The outcome variable measures parents' intentions to have their daughters vaccinated against HPV. This variable is categorical; participants' responses were captured using the following labels: *yes*, *no*, *not sure/it depends*, *refused*, and *don't know. Not sure/it depends, refused*, and *don't know* responses were recoded to generate a categorical variable coded *no* “0,” *not sure/depends* “1,” and *yes* “2.”

Main Independent Variables—The main independent variable, HPV knowledge, was measured by three questions: (a) Do you think HPV can cause cervical cancer? (b) Can one get HPV through sexual contact? and (c) Do you think HPV can go away on its own, without treatment? The three dichotomous questions were combined to assess HPV knowledge, which was coded “0” *for not knowledgeable/no* and “1” for *knowledgeable/yes*.

Covariates—Covariates examined in this study, all categorical, include gender, age, race/ethnicity, marital status, level of education, household income, employment status, and health insurance coverage.

Statistical Analysis

Descriptive statistics, bivariate analysis (chi-square), and univariate multinomial and multivariate multinomial logistic regressions were conducted using STATA/SE 13.1 (StataCorp, 2013). The study used a national secondary data set and the data were weighted to account for nonindependence within the primary sampling unit. Because the variables in this study are categorical, the use of bivariate analysis examined the associations between the independent variables and the main outcome measure. Univariate multinomial logistic regressions examined the association between intentions to vaccinate daughters for HPV and HPV knowledge with multivariate multinomial logistic regression analysis controlling for other covariates identified through stepwise regression analysis and manual inclusion informed by the literature. The unadjusted and adjusted multinomial analyses were reported using relative risk ratios (RRRs) and 95% confidence intervals (CIs), with significance set at two tails, $p < .05$.

Institutional Review Board

To assure the protection of human participants, the Institutional Review Board (IRB) at Winston–Salem State University reviewed and granted exempt status (IRB: 2986-16-0025).

Results

Descriptive Analyses

For HPV knowledge questions, a total of 1,039 individuals responded, and 88.35% ($n = 918$) were deemed knowledgeable. Most study participants expressed intentions to vaccinate their daughters (56.4%, $n = 585$). Most were aged 28 to 47 (67.7%, $n = 699$) and were women (69.8%, $n = 725$). Most were White (68.9%, $n = 714$); African Americans comprised 11.4% ($n = 118$), Hispanics 11.6% ($n = 120$), and other ethnic/racial groups accounted for 8.11% ($n = 84$). Almost 71% ($n = 734$) were married. Only 17.2% ($n = 179$) had only a high school diploma; most had some college, baccalaureate, or postbaccalaureate education (76.5%, $n = 794$). More than half (69.7%, $n = 719$) earned an income ≥ $50,000, and 68.3% ($n = 708$) indicated that they were employed. Only 14% ($n = 144$) did not have health insurance (see Table 1).

Bivariate Analyses

Table 1 depicts bivariate analysis of the association between HPV knowledge and PIVD for HPV. All percentages represent the percentage of individuals within the total sample in a particular cell; the statistical test was conducted for all categories of study characteristics and PIVD. Of the parents who were knowledgeable about HPV, 14% ($n = 164$) had no intention, 17.5% ($n = 208$) were not sure/depends, and 56% ($n = 544$) intended to have their daughter vaccinated; $F(1.61, 78.68) = 10.66$, $p = .0002$. Among those aged 28 to 47, 11.5% ($n = 133$) had no intention, 15.6% ($n = 178$) were not sure/depends, and 38.1% ($n = 387$) intended to have their daughter vaccinated; $F(4.39, 215.26) = 1.5$, $p = .0005$. Among those whose income was ≥ US$50,000, 9.8% ($n = 111$) had no intention, 13.2% ($n = 152$) were not sure/depends, and 30.2% ($n = 344$) intended to have their daughter vaccinated for HPV; $F(7.86, 385.35) = 1.97$, $p = .0498$.

Univariate/Unadjusted Multinomial Logistic Regression Model

Table 2 presents the unadjusted relative risk ratios (uRRR) in a univariate multinomial logistic regression model to determine the association between intentions to vaccinate daughters and study characteristics. Parents indicated to be HPV knowledgeable were sure (uRRR = 3.25, $p = .004$) they would have their daughters vaccinated for HPV, unlike those who were not knowledgeable. Women were less likely to say they were sure (uRRR = 0.58, $p = .07$) than men. Parents in the other race/ethnicity category were less likely to say they were not sure/depends (uRRR = 0.76, $p = .02$) or sure (uRRR = 0.71, $p = .029$) they would have their daughter vaccinated for HPV than White parents.

Those who earned a household income between US$75,000 and US$99,999 were less likely to say they were sure (uRRR = 0.85, $p = .07$) they would have their daughters vaccinated for HPV than those who earned ≤US$19,999. Parents who had health insurance were more likely to report they were not sure/depends (uRRR = 2.05, $p = .052$) than parents who did not have health insurance.

Multivariate/Adjusted Multinomial Logistic Regression Model

According to the adjusted relative risk ratios (aRRR), parents who indicated to be HPV knowledgeable were more likely to say they were sure (aRRR = 3.96, $p = .004$) they would have their daughters vaccinated for HPV than those who were not knowledgeable. However, women were less likely to say they were sure (aRRR = 0.52, $p = .021$) than men. Parents in the other race/ethnicity category were less likely to say they were not sure/depends (aRRR = 0.76, $p = .041$) or sure (aRRR = 0.74, $p = .06$) than White parents. Those earning a household income between US$50,000 and US$74,999 were less likely to say they were sure (aRRR = 0.76, $p = .067$) than those who earned ≤US$19,999.

Discussion

This study examined the association between HPV knowledge and intention to vaccinate among parents with adolescent daughters. In general, having knowledge about health-related topics enables people to make informed decisions regarding their health and leads to better patient outcomes (Ostini & Kairuz, 2014; Pop, Brînzaniuc, Sirlincan, Baba, & Chereches, 2013; Speros, 2005). Therefore, it is no surprise that parental HPV knowledge is strongly associated with intention to vaccinate (Bartlett & Peterson, 2011; Jeudin, Liveright, Del Carmen, & Perkins, 2014; Okoronkwo et al., 2012). Adolescent girls should be vaccinated for HPV, not to protect high-risk sexual behavior, but to prevent various cervical cancers (Kester et al., 2013; Kramer & Dunlop, 2012; Muñoz et al., 2010; Stokley et al., 2014). In this study, most parents demonstrated high HPV knowledge (88.35%, $n = 918$). However, men were less likely to be knowledgeable (37%, $n = 267$), which may limit their intention to vaccinate. Also, some health care providers do not discuss the HPV vaccine with parents unless asked, further limiting its administration to adolescent girls (Bruno et al., 2014; Goff, Mazor, Gagne, Corey, & Blake, 2011; Hendry et al., 2013; McCave, 2010; Mullins et al., 2013). Health care providers' recommendation for HPV vaccination is vital to improve vaccine uptake (Kester et al., 2013; Perkins & Clark, 2013; Thompson et al., 2012; Ylitalo et al., 2013). Thus, the ACIP's new guidelines for routine administration of Gardasil 9 to adolescents at ages 11 and 12 (Petrosky et al., 2015) may assist health care providers to initiate discussion for HPV vaccination and reduce missed opportunities for vaccine recommendation to adolescents.

Overall, parents who had HPV knowledge were more likely to intend to have their daughter vaccinated for HPV than those who were not knowledgeable (aRRR = 3.96, $p = .004$). This finding is consistent with Bartlett and Peterson (2011), who found that knowledge about the disease and its severity influenced parents' intentions to have their daughters vaccinated. Furthermore, Spleen et al. (2012), Thompson, Arnold and Notaro (2012), and Yeganeh, Curtis, and Kuo (2010) found that parents who were knowledgeable about the vaccine were more likely to intend to have their daughters vaccinated than those who were not knowledgeable about the vaccine.

Parents' age and gender also influenced their intentions to have their daughter vaccinated. The bivariate analysis revealed notable differences among parents aged 28 to 37 with other age groups who responded that they had no intention, were not sure/depends, or intended to vaccinate their daughters, $F(4.39, 215.26) = 1.5$, $p = .0005$. No differences were noted between male or female parents in terms of having no intent, not sure/depends, or intending to have their daughter vaccinated. However, female parents were less likely than male parents to report that they were sure (aRRR = 0.52, $p = .021$). This finding is troubling as most study participants reported being HPV knowledgeable. Askelson et al. (2010), Jeudin et al. (2014), Kepka et al. (2012), and Ramirez, Jessop, Leader, and Crespo (2014) all found that mothers tend to refuse HPV vaccination for their daughters due to concerns about vaccine safety, fears of promoting promiscuity, and the belief that vaccination was unnecessary if their daughter was not engaging in sexual activity. Louis-Nance et al. (2012) found that poor mother–daughter communication about sexuality and sexual health led mothers to be against HPV vaccination for their daughters. Mothers are frequently influenced by their husbands' perspectives, and many men oppose HPV vaccination due to fears that their daughters will engage in promiscuous behaviors (Kepka et al., 2012; Schmidt-Grimminger et al., 2013). However, several studies have refuted this claim noting that there was no association between HPV vaccination and an increase in sexual activity among girls aged 11 and 12 (Bednarczyk, Davis, Ault, Orenstein, & Omer, 2012; Jena, Goldman, & Seabury, 2015; Smith, Kaufman, Strumpf, & Lévesque, 2015).

Chao, Slezak, Coleman and Jacobsen (2009) and Lefevere et al. (2011) found that mothers who maintained routine cervical cancer screenings were more likely to intend to have their daughters vaccinated than mothers who did not; cervical cancer screenings are recommended to women every 3 years beginning at age 21 with HPV co-testing recommended at age 30 to 65 years (Moyer & U.S. Preventive Services Task Force, 2012), so they are more likely to be aware of, and knowledgeable about, HPV. The Chao et al. (2009) study used a stratified random sampling design, which strengthens the quality and generalizability of their findings. The Lefevere et al. (2011) study also used a stratified random sampling design, but it was conducted in Belgium, so its findings may be contextual, based on differences in the Belgian and U.S. health care systems. Race/ethnicity also influenced parents' intentions to have their daughter vaccinated for HPV. Parents who self-identified as of other race/ethnic groups were less likely to report that they were unsure about having their daughters vaccinated than Whites, aRRR = 0.76, $p = .041$. Other racial/ethnic groups in this study included American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, and multiracial. In contrast, Schmidt-Grimminger et al. (2013) found that parents of Northern Plains American Indian descent were less likely to have their daughters vaccinated due to a lack of HPV knowledge. Jeudin et al. (2014) noted low intent to vaccinate among Asian parents despite high HPV knowledge. These discrepancies may be the result of the study designs. Schmidt-Grimminger et al. used a convenience sample design, while Jeudin et al. conducted a literature review, with limited generalizability. While other racial/ethnic groups (85.71%) seemed comparable in HPV knowledge with Whites (88.79%), African Americans (84.75%), and Hispanics (91.67%), women in these groups experience high rates of cervical cancer, exposing an urgent need to implement educational programs in these communities (Horner et al., 2011). Furthermore, when assessing parents' awareness and knowledge of HPV, cultural practices, perceptions, and language barriers must be considered (Jeudin et al., 2014).

The bivariate analysis showed notable differences in terms of no intent, not sure/depends, or intend to vaccinate according to household income, $F(7.86, 385.35) = 1.97$, $p = .0498$.

Parents who made between US$75,000 and US$99,999 (uRRR = 0.85, p = .07) and US $50,000 and US$74,999 (aRRR = 0.76, p = .067) per year were less likely to report that they were sure about initiating HPV vaccination for their daughter than those who earned less than US$19,999 per year. Chando, Tiro, Harris, Kobrin and Breen (2013) and Kramer and Dunlop (2012) reported similar findings. Furthermore, Perkins and Clark (2013), Sara Test et al. (2013), and Tsui et al. (2013) established high intent to vaccinate among parents who lived in impoverished cities and made a yearly income that was 300% below the federal poverty level.

In the unadjusted findings, having health insurance was associated with the not sure/depends response (uRRR = 2.05, $p = .052$). In the adjusted model, health insurance was not associated with parents' intentions to have their daughters vaccinated, but parents who had insurance were more likely to have intentions to have their daughters vaccinated than parents without insurance coverage. Although having health insurance was not statistically significant in the multivariate analysis, it may have been influenced by household income. Those with an income more than 300% above the federal poverty line are eligible for private insurance, while those with lower incomes are eligible for government-assisted insurance, such as Medicaid (Sara Test et al., 2013), which provides full coverage for the HPV vaccine through the Vaccine for Children Program (Trinidad, 2012). Those with private insurance may not receive full coverage for the HPV vaccine and have to pay high out-of-pocket costs, limiting their intent to have their daughters vaccinated (Bartlett & Peterson, 2011; Goff et al., 2011; Oldach & Katz, 2012; Trinidad, 2012). Liddon, Hood and Leichliter (2012), Jeudin et al. (2014), and Thompson, Arnold and Nataro (2012) support this finding, noting that although having health insurance increased parents' intentions to have their daughter vaccinated, parents with private health insurance often had concerns about coverage for all three doses of the vaccine, which ultimately affected their intention to have their daughter vaccinated. Findings from these studies may result from the difference in immunization coverage offered by government assistance versus private health insurance plans (Tsui et al., 2013). However, under the Affordable Care Act, immunization costs are fully covered (Trinidad, 2012).

This study had several limitations: First, race/ethnic minority groups represented 31.08% of the total study sample ($n = 1,037$); however, African American representation (11.39%) was comparable with the national sample estimates (13.2%; Colby & Ortman, 2015). However, the surveys used for data collection were randomized; that is, they relied on random-digit dialing. This strategy reflects care in addressing internal validity, but the cross-sectional study design greatly compromised causal inference; hence, study findings cannot be generalized to the entire population. Second, at the time HINTS 2006-2007 data were collected, the FDA had just approved the HPV vaccine for administration (Stokley et al., 2014). Thus, HPV vaccination was relatively new, which may have had an effect on participants' self-reported responses (information bias) about their intent to have their daughters vaccinated. Third, only three questions were used to measure HPV knowledge in this study due to the availability of HPV questions in the data set.

HINTS 2006-2007 was the only data set that captured parents' intentions to have their daughters vaccinated for HPV. Because intent to vaccinate was not addressed by a valid instrument but depended on self-report, nondifferential misclassification was possible and might have biased results toward the null. Parents might have responded positively about vaccination if they perceived it to be beneficial for their daughters, irrespective of their true intent. Also, if they were aware of, and knowledgeable about, HPV, they would be in favor of vaccination. In general, parents are more favorable about vaccinating their children as a protective measure. However, some findings were counterintuitive. Slightly more than half (56.4%) of knowledgeable parents reported that they intended to have their daughters vaccinated, which is consistent with studies by Bartlett and Peterson (2011), Jeudin et al. (2014), and Okoronkwo et al. (2012). It was not clear whether their knowledge about other cervical cancers and diagnostic testing influenced their claim to HPV knowledge. Last, the survey did not contain items that could identify the participants' relationship to daughters (i.e., parent or legal guardian). For instance, grandparents might be the legal guardians of an adolescent girl, rather than her mother, father, or both, which might introduce response bias. Our study would have been strengthened if the data collected had identified the participant's relationship to the daughter.

Overall, findings from this study have several implications for promoting HPV vaccination among adolescents and increasing parents' knowledge about HPV. Educational programs should be implemented within high-risk communities and their school systems to increase both parents' and adolescents' knowledge about HPV and vaccination. They would be beneficial in health education classes offered to middle and high school students, targeting adolescents at the recommended age for vaccination (Dempsey & Schaffer, 2010). Also, interventions should be implemented to increase HPV vaccination rates among adolescent girls and boys. Interventional programs have been found to increase HPV knowledge and to address parents' attitudes and concerns about HPV and vaccination (Kepka et al., 2011; Spleen et al., 2012).

As an implication for clinical practice, rather than providing general HPV education during routine visits, health care providers should assess what parents know about HPV and vaccination and build on that knowledge to identify and to address knowledge gaps. Also, eliciting discussion about HPV and vaccination will allow providers to assess which factors influence parents' intentions to vaccinate their child and address parents' concerns appropriately. Policymakers should consider making HPV vaccination a requirement for school attendance in all 50 states to ensure adolescents are vaccinated as a means to prevent HPV-associated cancers. Currently, state legislatures are considering mandating the HPV vaccine for school attendance; however, only a few states have received approval (National Conference of State Legislatures, 2016).

This study focused on the association between parents' HPV knowledge and their intent to have their daughters vaccinated. However, significant findings shed light on race/ethnicity, income, and health insurance as factors that affect parents' intentions. Future studies should explore barriers to, and deficits in, HPV knowledge among specific racial/ethnic groups to gain further insight into HPV vaccination disparities. They may lead to interventional studies to increase HPV knowledge among targeted groups. Health insurance coverage is now provided for HPV vaccination; however, both vaccine initiation and completion rates remain low. Therefore, further research is warranted to identify effective clinical interventions that may reduce the number of missed opportunities for vaccine recommendation and administration. The use of electronic media sources and devices should be explored as a means to provide HPV education to parents and adolescents.

In conclusion, parental decision to have their adolescent girls vaccinated for HPV can be challenging for many parents. Overall, this study found that parents who were knowledgeable about HPV were more likely to initiate the process, but national rates remain low. It is important that adolescent girls are vaccinated to reduce their risk of acquiring cervical cancers associated with HPV 16 and 18, and parents must receive reliable HPV education that addresses their concerns about their daughters' care. Because this study noted a strong association between HPV knowledge and intent to vaccinate, future studies should explore communication methods and agreement among parents and daughters regarding sexual health and sexuality as potential factors influencing parents' decisions about HPV vaccination for their daughters.

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Table 1

Number, Percentage of Study Characteristics, and Percentage of the Association Between Study Characteristics and Intentions to Vaccinate Daughters, Health Information National Trends Survey (HINTS) 2007-2009 (*n = 1037*)

			Intentions to Vaccinate Daughter						
			No		Not Sure/Depends		Yes		*p*-value
Study Characteristics	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Intentions to Vaccinate Daughters									
No	196	18.9	-	-	-	-	-	-	
Not Sure/Depends	256	24.69	-	-	-	-	-	-	-
Yes	585	56.41	-	-	-	-	-	-	
HPV Knowledge, *F*(1.61, 78.68) = 10.66									
No	121	11.65	32	3.63	48	4.4	41	4.45	0.0002
Yes	918	88.35	164	14.02	208	17.52	544	55.98	
Gender, *F*(1.93, 94.49) = 2.23									
Male	314	30.22	51	5.78	78	8.82	185	27.56	0.115
Female	725	69.78	145	11.87	178	13.1	400	32.86	
Age, *F*(4.39, 215.26) = 1.5									
18-27	118	11.42	21	3.49	26	3.19	71	14.76	
28-37	320	30.98	57	5.72	76	6.77	186	20.7	0.0005
38-47	379	36.69	76	5.8	102	8.85	201	17.47	
≥48	216	20.91	40	2.57	50	2.99	125	7.7	
Race/Ethnicity, *F*(4.92, 241.32) = 1.8									
White	714	68.92	126	10.73	167	14.9	421	40.26	
African American	118	11.39	21	2.37	35	2.88	62	6.58	0.115
Hispanic	120	11.58	21	2.33	30	2.63	67	10.84	
Other	84	8.11	27	2.22	23	1.36	34	2.9	
Marital Status, *F*(3.54, 173.33) = 1.83									
Not Married	162	15.61	28	3.47	40	3.66	94	16.4	
Married	734	70.71	142	12.43	181	15.68	410	39.21	0.134
Formerly Married	142	13.68	26	1.76	35	2.6	80	4.79	

Study Characteristics	Intentions to Vaccinate Daughter								
			No		Not Sure/Depends		Yes		*p*-value
	n	%	n	%	n	%	n	%	
Level of Education, $F(5.61, 274.68) = 1.11$									
Less than High School	65	6.26	9	1.57	14	1.55	40	6.68	
High School Graduate	179	17.24	30	3.99	39	3.76	110	15.82	
Some College	344	33.14	66	7	90	9.68	188	23.21	0.357
Bachelors Degree	292	28.13	61	3.43	75	4.79	156	9.38	
Post Baccalaureate	158	15.22	30	1.7	38	2.19	90	5.27	
Household Income, $F(7.86, 385.35) = 1.97$									
US≤$19,999	65	6.26	35	3.22	50	4.17	106	13.22	
US$20,000 to US$34,999	179	17.24	18	1.89	24	2.42	63	7.19	
US$35,000 to US$49,999	344	33.14	28	2.65	26	2.1	63	9.94	0.0498
US$50,000 to US$74,999	292	28.13	45	4.69	51	4.86	92	9.74	
US$75,000 to US$99,999	158	15.22	30	2.8	46	3.68	74	5.71	
≥US$100,000	269	26.32	36	2.28	55	4.66	178	14.75	
Employment Status, $F(1.96, 96.17) = 0.14$									
Unemployed	328	31.66	58	5.61	79	6.77	191	19.99	0.869
Employed	708	68.34	138	12.08	176	15.16	392	40.4	
Health Insurance, $F(1.69, 82.74) = 0.15$									
Not Insured	144	13.95	29	3.48	27	2.33	87	12.1	0.147
Insured	888	86.05	167	14.23	224	19.5	496	48.36	

Note. HPV = Human papillomavirus.

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Table 2

Univariate and Multivariate Multinomial Logistic Regression Analysis of the Association Between HPV Knowledge and Intentions to Vaccinate Daughters, Health Information National Trends Survey (HINTS) 2007-2009 (*n = 1037*)

Intentions to Vaccinate Daughter [a]	Unadjusted						Adjusted					
	Not Sure/Depends			Yes			Not Sure/Depends			Yes		
	uRRR	pv	95% CI	uRRR	pv	95% CI	aRRR	pv	95% CI	aRRR	pv	95% CI
HPV Knowledge (No - Ref.)												
Yes	1.03	0.938	0.50, 2.12	3.25	0.004	1.47, 7.20	1.07	0.867	0.49, 2.30	3.96	0.004	1.57, 10.00
Sex (Male - Ref.)												
Female	0.72	0.295	1.47, 7.20	0.58	0.07	0.32, 1.05	0.63	0.135	0.35, 1.16	0.52	0.021	0.30, 0.90
Age (18-27 - Ref.)												
28-37	1.26	0.58	0.55, 2.88	0.89	0.759	0.41, 1.91	1.15	0.802	0.38, 3.47	1.25	0.658	0.46, 3.36
38-47	1.27	0.328	0.78, 2.08	0.86	0.494	0.55, 1.34	1.21	0.549	0.65, 2.25	1.03	0.919	0.58, 1.83
≥48	1.07	0.666	0.78, 1.48	0.90	0.461	0.68, 1.19	1.00	0.992	0.65, 1.54	0.98	0.918	0.67, 1.44
Race/Ethnicity (White - Ref.)												
African American	0.87	0.692	0.43, 1.76	0.75	0.412	0.36, 1.52	1.00	0.99	0.46, 2.19	0.76	0.506	0.34, 1.72
Hispanic	0.90	0.619	0.58, 1.39	1.12	0.621	0.72, 1.74	1.01	0.961	0.60, 1.71	1.02	0.931	0.61, 1.70
Other	0.76	0.02	0.60, 0.96	0.71	0.029	0.52, 0.96	0.76	0.041	0.58, 0.99	0.74	0.06	0.54, 1.01
Marital Status (Not Married - Ref.)												
Married	1.20	0.608	0.59, 2.41	0.67	0.248	0.33, 1.34	0.87	0.79	0.31, 2.45	0.63	0.325	0.25, 1.60
Formerly Married	1.18	0.506	0.72, 1.95	0.76	0.239	0.47, 1.21	1.05	0.866	0.58, 1.91	0.72	0.261	0.40, 1.29
Level of Education (Less than High School - Ref.)												
High School Graduate	0.95	0.936	0.30, 3.04	0.91	0.868	0.28, 2.94	1.01	0.993	0.26, 3.87	1.06	0.923	0.33, 3.36
Some College	1.18	0.549	0.68, 2.07	0.87	0.627	0.49, 1.54	1.18	0.605	0.63, 2.19	0.93	0.786	0.54, 1.60
Bachelors Degree	1.12	0.583	0.74, 1.71	0.86	0.349	0.61, 1.19	1.09	0.746	0.65, 1.80	0.85	0.392	0.59, 1.23
Post Baccalaureate	1.07	0.655	0.79, 1.44	0.92	0.499	0.71, 1.18	1.01	0.954	0.70, 1.45	0.90	0.469	0.67, 1.20
Household Income (≤$19,999 - Ref.)												
US$20,000 to US$34,999	1.02	0.965	0.34, 3.09	0.98	0.97	0.39, 2.46	0.95	0.926	0.30, 3.01	1.17	0.736	0.46, 3.01
US$35,000 to US$49,999	0.80	0.286	0.52, 1.22	0.98	0.93	0.67, 1.44	0.76	0.217	0.50, 1.18	1.03	0.851	0.72, 1.48
US$50,000 to US$74,999	0.94	0.65	0.71, 1.24	0.81	0.111	0.63, 1.05	0.86	0.375	0.61, 1.21	0.76	0.067	0.57, 1.02

Intentions to Vaccinate Daughter [a]	Unadjusted						Adjusted					
	Not Sure/Depends			Yes			Not Sure/Depends			Yes		
	uRRR	pv	95% CI	uRRR	pv	95% CI	aRRR	pv	95% CI	aRRR	pv	95% CI
US$75,000 to US$99,999	1.01	0.891	0.84, 1.21	0.85	0.07	0.72, 1.01	0.94	0.596	0.75, 1.18	0.87	0.241	0.68, 1.10
≥US$100,000	1.10	0.164	0.96, 1.27	1.11	0.089	0.98, 1.25	1.03	0.691	0.87, 1.23	1.11	0.147	0.96, 1.29
Employment (Unemployed - Ref.)												
Employed	1.04	0.879	0.62, 1.75	0.94	0.795	0.58, 1.52	0.91	0.764	0.48, 1.72	0.91	0.742	0.52, 1.59
Health Insurance (Not Insured - Ref.)												
Insured	2.05	0.052	0.99, 4.21	0.98	0.948	0.48, 2.00	2.06	0.141	0.78, 5.42	1.49	0.413	0.57, 3.91

Note. HPV = human papillomavirus; *Ref(1)*. Referent group; *uRRR* = Unadjusted relative risk ratio; *aRRR* = Adjusted relative risk ratio; pv – *p*-value.

[a] No intention is the base outcome.