Research Article

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Behavioral Correlates of HPV Vaccine Acceptability in the 2007 Health Information National Trends Survey (HINTS)

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Abstract

The development of a prophylactic vaccine to prevent infection with oncogenic subtypes of human papillomavirus (HPV) is an important step in reducing cervical cancer incidence and mortality. However, national data indicate that only 37% of 13- to 17-year-old females have initiated the vaccine series. Prior studies have examined demographic, medical history, and psychosocial variables associated with parental HPV vaccine acceptability, although few have investigated the behavioral correlates of vaccine acceptability. The primary purpose of the current study is to report on national acceptability of the HPV vaccine among U.S. adults with female children in the household and to investigate the health behavior correlates of vaccine acceptability. Data were drawn from the 2007 Health Information National Trends Survey (HINTS). The study sample comprised 1,383 adults who reported having a female child under the age of 18 in their household (52% female, 59% white; mean age = 40 years). More than half (58%) reported they would have a daughter get the HPV vaccine, 25% were not sure, and 18% would not have a daughter vaccinated. Behavioral factors significantly associated with lower acceptance of the HPV vaccine included lack of physical activity in the past month (P = 0.002), past year use of complementary or alternative therapies (P = 0.021), and no history of smoking (P = 0.005). These results suggest that behavioral health factors may be associated with vaccine acceptability and further our understanding of how behavioral patterns may contribute to the uptake of new cancer prevention strategies. *Cancer Epidemiol Biomarkers Prev; 19(2); 319–26. ©2010 AACR.*

Introduction

The primary risk factor for cervical cancer is persistent infection with oncogenic subtypes of human papillomavirus (HPV; refs. 1-4). The development of a prophylactic vaccine to prevent HPV infection represents an important step in reducing cervical cancer incidence and mortality. In 2006, the U.S. Food and Drug Administration (FDA) approved the first HPV vaccine for administration to females 9 to 26 years of age for the prevention of cervical cancer (5, 6).

Data from national and state surveys indicate that approximately one third of adolescent females have initiated the 3-shot HPV vaccine series (7-10). Because many potential vaccine recipients are <18 years of age, most HPV vaccine acceptability studies have focused on the diverse factors that may influence parental acceptability (9, 11, 12), including demographic factors (11, 13), medical history variables (9, 14), parental knowledge and awareness about HPV and cancer (15-18), and other psychosocial or attitudinal beliefs (8, 9, 15-21). Despite the number of studies that have been conducted, few have examined how various health behaviors may be associated with vaccine acceptability. Patterns of associations among multiple health behaviors (e.g., tobacco use, physical activity, fruit and vegetable intake) have been widely studied, and there is empirical evidence to suggest that health-enhancing behaviors (such as healthy diet, physical activity) are commonly associated with one another, whereas health risk behaviors (smoking, alcohol use) tend to cluster together (22-24). Further, studies have reported that those who practice healthy lifestyle behaviors are not only more likely to accept personal immunization against disease (25), but may also be more willing to vaccinate their offspring (26).

Associations between vaccine uptake and other health behaviors, such as use of complementary and alternative medicine (CAM) services, however, seem to be more complex. Although adult CAM users may be more likely to obtain vaccinations (against influenza and pneumococcal infection) themselves (27), parental CAM use has been associated with poorer vaccine uptake among their children (28, 29). In light of the growing interest and awareness of CAM use among adults in the United States (30, 31), it is important to consider whether potential associations exist among such health behaviors and HPV vaccine acceptability.

The primary purpose of the current study is to report on acceptability of the HPV vaccine among a national sample of adults with female children in the household

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and to investigate health behavior correlates of vaccine acceptability. Based on prior findings, we hypothesized that engagement in health-promoting behaviors (such as physical activity and adherence to Pap test screening) would be associated with greater parental HPV vaccine acceptability, whereas behaviors such as smoking would be associated with lower vaccine acceptability. We also hypothesized that parental CAM use would be associated with less willingness to accept HPV vaccination for one's daughter. Other potential correlates of vaccine acceptability that were identified in previous studies (11) were also examined, including relevant demographic variables, medical history factors, HPV knowledge, and cancer beliefs.

Materials and Methods

Procedure

The data for this study were drawn from the 2007 Health Information National Trends Survey (HINTS), a national probability survey of health communication and information among U.S. adults. Participants in the 2007 HINTS were recruited using a mailing sent to a random sample of addresses and via random digit dialing. Participants completed a one-time paper-and-pencil or telephone survey in English or Spanish. The household response rate to the mailed survey was 40.0% and the within-household response rate (i.e., the percentage of adults in each household who agreed to take part) was 77.4%. For the random digit dialing sample, the response rate for the initial screener was 42.4% and the response rate for the full interview was 57.2%. The 2007 HINTS utilized a complex sample survey design that included jackknife variance estimation and data weighting. Additional information about the HINTS is available elsewhere (32).

Participants

A total of 7,674 individuals were recruited to the 2007 HINTS. For the purpose of the current study, we excluded individuals who did not report having a female child under the age of 18 in their household (n = 6,282) and individuals who were missing data for the item that asked whether they would have a daughter get the HPV vaccine (n = 9). This left an available sample size of 1,383.

Measures

Demographics. Participants indicated their sex, age, race/ethnicity, level of education, income, marital status, and whether they had any form of healthcare coverage.

Medical History. Participants were asked whether they had a personal history of cancer, a family history of cancer, and if they had ever been treated for genital warts. Female respondents indicated if they had ever been told by a healthcare provider that they had an HPV infection.

HPV Knowledge and Cancer Beliefs. Participants indicated whether they had ever heard of HPV and if they had ever heard of the HPV vaccine. With regard to cancer beliefs, participants completed three items that asked about the early detection of cancer ("Cancer is an illness that when detected early can typically be cured"), overall cancer prevention ("There's not much you can do to lower your chances of getting cancer"), and cancer prevention information overload ("There are so many different recommendations about preventing cancer, it's hard to know which ones to follow"). Each item used a 4-point Likert-type response scale, with end points of "strongly disagree" and "strongly agree."

Health Behaviors. Participants answered questions about their current and former use of cigarettes, whether they participated in any physical activity or exercise in the past month, and if they used any "complementary, alternative, or unconventional" therapies in the past 12 mo. Women indicated when they last had a Pap test. Women were categorized according to whether they reported having a Pap test in the past 3 y (33).

Acceptability of HPV Vaccination for a Daughter of Age 11 to 12 Years. Participants were told that the HPV vaccine is recommended for girls ages 11 to 12 y. They were then asked, if they were to have a daughter that age, whether they would have her get the HPV vaccine. Participants answered "no," "not sure/it depends," or "yes." Individuals who did not answer yes were asked to provide the main reason they would not have a daughter get the HPV vaccine.

Statistical Analysis

For purposes of analysis, we combined responses of no and not sure/it depends for the HPV acceptability question. This created a dichotomous HPV vaccine acceptability variable, consisting of individuals who indicated that they would have a daughter get the HPV vaccine versus those who would not or weren't sure. Separately for each category of independent variables (demographics, medical history, HPV knowledge and cancer beliefs, health behaviors), we conducted a multiple logistic regression analysis to examine correlates of HPV vaccine acceptability. Predicted marginals from these regression analyses were used to show the adjusted rate of HPV vaccine acceptability for each independent variable; unadjusted acceptability rates were also obtained from crosstab analyses. To control for potential associations between the recruitment method (i.e., mailed survey or random digit dialing) and HPV vaccine acceptability, each regression also included an independent variable representing the recruitment method. All statistical analyses were conducted using SUDAAN software (version 9.0.1; Research Triangle Institute). All percentages reported in the Results section are weighted and all sample sizes are unweighted. We used a cutoff of $P < 0.05$ to determine statistical significance for all analyses.

Results

Sample Characteristics

The demographic characteristics of the sample are shown in Table 1. The sample was diverse with regard to respondent gender (52.3% female), age (mean = 40.4 years), race/ethnicity (58.9% non-Hispanic white), education, and income. More than two thirds of the sample reported being married or partnered and more than three quarters reported some form of health care coverage.

Acceptability of the HPV Vaccine for a Daughter of Age 11 to 12 Years

Participants reported their acceptability of the HPV vaccine for a daughter as follows: no, 17.6%; not sure/it depends, 24.9%; yes, 57.5%. Among individuals who did not answer yes, the most commonly reported reasons for not wanting a daughter to get the HPV vaccine were: don't know enough about the vaccine, 47.8%; worried about safety of the vaccine, 19.6%; my child is not sexually active, 8.8%; a doctor hasn't recommended it, 5.6%; she doesn't need it, 5.4%. Additional reasons included that one's daughter was too young (3.1%), more research is needed (2.7%), and holding an anti-vaccination belief (2.1%).

Correlates of HPV Vaccine Acceptability

The results of the multiple logistic regression analyses examining correlates of HPV vaccine acceptability are shown in Table 2. None of the demographic variables was associated with HPV vaccine acceptability. In an exploratory analysis, we included a sex by marital status interaction term in the multiple logistic regression analyses with HPV vaccine acceptability as the outcome variable. However, this interaction was not statistically significant ($P = 0.407$). None of the medical history variables was associated with HPV vaccine acceptability. Among the HPV knowledge and cancer belief items, individuals who strongly agreed that cancer can be cured if caught early were more accepting of the HPV vaccine than those who strongly disagreed with that statement ($P = 0.018$). With regard to health behaviors, individuals were more accepting of the HPV vaccine if they were current or former smokers ($P = 0.005$), reported engaging in physical activity in the past month ($P = 0.002$), or had not used complementary, alternative, or unconventional therapies in the past year ($P = 0.021$).

Discussion

The current study identified correlates of HPV vaccine acceptability among a diverse national sample of 1,383 adults with female children in the household. Consistent with prior research (9, 11, 12), the majority of participants (57.5%) reported being willing to vaccinate an 11- to 12-year-old daughter, but a significant minority were undecided (24.9%) or reported that they would not do so (17.6%). Despite extensive marketing and media attention, the need for more information was the most commonly cited reason for not being willing to vaccinate. In addition, approximately one in five respondents who were undecided or opposed to vaccination reported concerns about vaccine safety. Thus, the present findings suggest that respondents perceive insufficient knowledge and information about the vaccine, which contributes to the observed hesitancy toward vaccination.

Table 1. Sample demographic characteristics

	Sample %
Sex	
Male	47.7
Female	52.3
Missing (*n*)	1
Age, y (mean = 40.4)	
18-29	26.5
30-39	32.0
40-49	30.1
≥50	11.4
Missing (*n*)	9
Race/ethnicity	
Hispanic	20.4
Non-Hispanic white	58.9
Non-Hispanic black	12.6
Non-Hispanic other	8.1
Missing (*n*)	19
Education	
Less than high school	14.2
High school graduate	26.3
Some college	34.8
College graduate	24.7
Missing (*n*)	2
Income	
<$20,000	16.0
$20,000 to <$50,000	31.1
$50,000 to <$75,000	18.1
≥$75,000	34.9
Missing (*n*)	126
Marital status	
Not married/partnered	29.8
Married/partnered	70.2
Missing (*n*)	2
Health care coverage	
Not covered	21.9
Covered	78.1
Missing (*n*)	17

NOTE: $N = 1,383$. All percentages are weighted. Data source: 2007 Health Information National Trends Survey (HINTS).

Table 2. Results of multiple logistic regression analyses examining potential correlates of HPV vaccine acceptability

	AOR (95% CI)	*P**	HPV vaccine acceptability†	
			Adjusted %	Unadjusted %
Demographics				
Sex		0.585		
Male	1.10 (0.77-1.57)		58.7	60.4
Female	Ref		56.5	54.6
Age (y)		0.055		
18-29	Ref		68.3	70.0
30-39	0.57 (0.32-1.02)		55.6	55.0
40-49	0.47 (0.26-0.82)		50.7	49.6
≥50	0.63 (0.36-1.12)		57.9	56.5
Race/ethnicity		0.243		
Hispanic	0.92 (0.55-1.55)		58.5	62.4
Non-Hispanic white	Ref		60.4	58.7
Non-Hispanic black	0.65 (0.33-1.27)		50.1	52.9
Non-Hispanic other	0.52 (0.23-1.15)		44.8	48.0
Education		0.750		
Less than high school	Ref		61.2	66.8
High school graduate	0.88 (0.43-1.81)		58.3	56.7
Some college	0.87 (0.46-1.65)		58.1	58.2
College graduate	0.74 (0.38-1.42)		54.2	51.2
Income		0.115		
<$20,000	Ref		64.6	66.1
$20,000 to <$50,000	0.67 (0.37-1.21)		55.3	57.0
$50,000 to <$75,000	0.51 (0.22-1.17)		48.9	49.7
≥$75,000	0.85 (0.41-1.74)		60.9	57.6
Marital status		0.466		
Not married/partnered	Ref		59.9	63.8
Married/partnered	0.87 (0.58-1.29)		56.6	54.6
Health care coverage		0.955		
Not covered	Ref		57.2	61.5
Covered	1.02 (0.54-1.93)		57.6	56.4
Medical history				
Personal cancer history		0.803		
No	Ref		58.8	57.6
Yes	1.07 (0.62-1.85)		60.4	58.1
Family cancer history		0.453		
No	Ref		60.8	59.8
Yes	0.88 (0.64-1.23)		57.8	56.9
Treated for genital warts		0.708		
No	Ref		59.0	58.8
Yes	0.88 (0.44-1.76)		55.8	55.3
Personal history of HPV infection‡		0.635		
No	Ref		55.6	54.0
Yes	1.15 (0.63-2.12)		59.1	60.5
HPV knowledge and cancer beliefs				
Ever heard of HPV vaccine		0.144		
No	Ref		52.8	49.6
Yes	1.34 (0.90-2.02)		59.8	60.6

(*Continued on the following page*)

Table 2. Results of multiple logistic regression analyses examining potential correlates of HPV vaccine acceptability (Cont'd)

	AOR (95% CI)	*P**	HPV vaccine acceptability†	
			Adjusted %	Unadjusted %
Ever heard of HPV		0.200		
No	Ref		52.5	50.6
Yes	1.36 (0.84-2.19)		59.7	60.1
Cancer can be cured if caught early		0.018		
Strongly disagree	Ref		33.1	31.5
Somewhat disagree	2.78 (0.89-8.73)		57.3	57.1
Somewhat agree	2.45 (0.86-6.99)		54.3	54.4
Strongly agree	3.91 (1.37-11.17)		65.2	65.3
There is not much that can lower one's cancer risk		0.646		
Strongly disagree	Ref		59.4	60.4
Somewhat disagree	0.82 (0.56-1.20)		54.6	53.7
Somewhat agree	1.03 (0.68-1.56)		60.0	59.0
Strongly agree	1.05 (0.55-1.99)		60.4	64.7
Hard to know which cancer recommendations to follow		0.506		
Strongly disagree	Ref		55.1	55.1
Somewhat disagree	1.14 (0.63-2.07)		58.2	58.5
Somewhat agree	1.04 (0.61-1.78)		56.0	55.6
Strongly agree	1.31 (0.76-2.24)		61.3	61.7
Health behaviors				
Smoking status		0.005		
Never smoker	Ref		51.9	51.8
Former smoker	1.58 (1.07-2.33)		62.7	63.6
Current smoker	1.90 (1.19-3.04)		66.9	66.2
Engaged in physical activity in the past month		0.002		
No	Ref		48.8	49.8
Yes	1.67 (1.20-2.34)		61.1	60.7
Used complementary, alternative, or unconventional therapies in the past year		0.021		
No	Ref		60.1	59.6
Yes	0.64 (0.44-0.94)		49.6	51.1
Had a Pap test in the past 3 years‡		0.114		
No	Ref		42.4	42.4
Yes	1.75 (0.86-3.55)		55.6	55.5

NOTE: Data source: 2007 Health Information National Trends Survey (HINTS). Each regression analysis controlled for the mode of recruitment (i.e., mailed survey or random digit dialing). Sample sizes for the regression analyses were as follows: demographics, n = 1,225; medical history (not including personal history of HPV infection), n = 1,324; medical history (including personal history of HPV infection), n = 837; HPV knowledge and cancer beliefs, n = 1,348; health behaviors (excluding Pap test in the past 3 y), n = 1,362; health behaviors (including Pap test in the past 3 y), n = 826. Abbreviations: AOR, adjusted odds ratio; 95% CI, 95% confidence interval; Ref, reference group.

*The *P* values adjacent to each variable name represent the overall association between the variable and HPV vaccine acceptability.

†The HPV vaccine acceptability rate is shown as the percentage of individuals who indicated they would have their daughter get the HPV vaccine. Adjusted HPV vaccine acceptability rates are predicted marginals obtained from each multiple logistic regression analysis.

‡This item was answered by women only. The results shown for this item are from a multiple logistic regression analysis that included all of the other medical history factors as independent variables.

With regard to behavioral correlates, vaccine acceptability was higher among physically active individuals and individuals not reporting CAM use, as hypothesized. These findings are consistent with prior research that suggests that health-promoting behaviors (e.g., physical activity and diet) tend to co-occur (22, 24) and may be associated with vaccine acceptability (25, 26). Likewise, the present findings support the notion that parental

CAM use may be associated with poorer vaccine uptake among their children (28, 29). It has been reported that individuals who prefer CAM to conventional approaches are sometimes mistrustful of, or have had negative experiences with, conventional medical approaches and/or public health recommendations (31). Among parents who requested medical exemptions to required vaccinations for their children, the most common reasons for not vaccinating were concerns about vaccine safety (28). Recently published data on the postlicensure safety profile of the quadrivalent HPV vaccine should alleviate some parents' safety concerns given that few serious adverse events have been associated with the vaccine (34). However, in light of declining incidence and mortality rates of cervical cancer in the United States, there continues to be debate over whether even the slight risks of vaccination outweigh the possible long-term benefits (35), and the present findings may reflect ongoing parental consideration of these issues.

Contrary to our hypotheses, smokers reported greater acceptability of the HPV vaccine. It is possible that former and current smokers have a heightened awareness of cancer and/or the cancer-related risks of secondhand smoke (36-38), and therefore, they may be more willing to engage in behaviors that offer protection to their daughters. Smoking is also more prevalent in subgroups with lower educational attainment (39), and some prior studies have reported lower education to be associated with greater HPV vaccine acceptability (13). It should be noted, however, that the association between smoking and vaccine acceptability remained significant even after education level was included in the model.

In addition to behavioral factors, the current analysis also included demographic, medical history, and attitudinal variables that have previously been reported to be associated with HPV vaccine acceptability. Surprisingly, although three behavioral factors were associated with HPV vaccine acceptability in the present study, not one of the demographic variables or medical history variables was associated with vaccine acceptability. Prior studies have also reported inconsistent findings with respect to demographic background and prior medical history (9, 14, 40), perhaps suggesting that personal health beliefs and behaviors may be more closely related to vaccine acceptability than one's background or prior experiences. For example, with respect to health beliefs, participants who strongly agreed that cancer can be cured if it is caught early reported greater acceptability of the HPV vaccine. These findings suggest that the assessment of health behaviors and personal beliefs about cancer can help inform our understanding of individuals' decisions regarding the uptake of cancer prevention strategies for their children.

The strengths of the current study include the use of a diverse national sample and standardized procedures. Although there have been a number of HPV vaccine acceptability studies conducted previously, few have included data from a national sample and thus, the present findings serve as an important barometer of public opinion. Additionally, the majority of prior studies were conducted before the vaccine's approval for use by the FDA and the subsequent proliferation of vaccine marketing to both adults and children. However, the present findings should be considered in the context of several limitations. First, the study asked about willingness to vaccinate as opposed to assessing actual vaccine uptake rates. Second, study respondents may not have been the parents or legal guardians of the female children in the household. Third, given the manner in which the sample was selected and how the relevant questions were stated, it is acknowledged that although all study respondents had female children living in the household, some respondents had girls of age 11 to 12 and some did not. Therefore, for those respondents who did not have a child in that age group, the question to which they were responding was a hypothetical one, whereas for those respondents who did have a child in that age group, the question may have captured "actual" willingness rather than hypothetical willingness. Although our inability to distinguish between actual and hypothetical willingness in this study may limit how we can attribute these findings, the present findings may be informative with respect to actual behavior. Presumably, the respondents with girls ages 11 to 12 years (or older) would have described their actual willingness very well. Therefore, although a subgroup of respondents would have answered the item according to their hypothetical willingness to vaccinate a daughter, data from the current study may more closely approximate actual behavior than earlier studies, due to the fact that this sample was partially composed of those who have already made their decisions and were reporting on their actual willingness to engage in this behavior. Finally, the study was limited to items included in the HINTS survey and did not contain other potential correlates, such as items regarding physician recommendations for HPV vaccination. Findings from a recent study suggest that only 50% of physicians always recommend the HPV vaccine for 11- to 12-year-old girls (41), and therefore, the absence of a physician's recommendation may be contributing to the fact that almost half of the study respondents were undecided or not willing to vaccinate an 11- to 12-year-old daughter.

In sum, these results suggest that despite extensive media attention, there is a clear need for additional education and provision of information regarding the potential benefits and risks of the HPV vaccine. In the perceived absence of such information, behavioral factors may influence, to some extent, vaccine acceptability. The present results suggest that individuals who reported past year use of CAM and a lack of physical activity were less willing to adopt this prevention strategy for their daughters. However, the present data also indicate that behavioral patterns are likely to be quite complex, given that former and current smokers were more willing to vaccinate their daughters compared

with nonsmokers. Therefore, additional research is needed to further our understanding of how existing health habits may contribute to uptake of HPV vaccination and other cancer prevention strategies.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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