Determinants of U.S. Parental Attitudes and Behavior towards Preventing Cancer in Young Girls through Vaccine

Analysis of a National Survey on Human Papillomavirus Vaccine Use

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ABSTRACT

Introduction: Human papillomaviruses (HPV) cause a large burden of disease and mortality in the United States every year. A vaccine protecting against four of the major disease-causing strains was approved for use in 2006 and recommended for girls 11 – 12, but vaccination use remains at the discretion of the parent or guardian in most States. Studies suggest that utilization of the vaccine is low and parents and guardians perceive barriers to vaccinating their daughters, but national utilization, knowledge and attitudes are not known.

Methods: Data from the 2008 National Health Interview Survey were analyzed to obtain national estimates of the proportion of age-eligible females who have been vaccinated and the main reasons why a parent or guardian would not vaccinate their child. We also assessed the effects of race, socioeconomic status, education, insurance type, and other determinants on vaccine use and knowledge using logistic regression.

Results: 14.9% of age-eligible females (ages 9 – 26) and 18.7% of female children 9 – 17 had received at least one dose of the vaccine by 2008. 67.1% of parents or guardians of female children 9 – 17 had heard of the vaccine. Black and Asian race, uninsured status, and lower family education level were associated with decreased odds of female children having received the vaccine. Any minority race, uninsured status, poverty status, and lower education were associated with decreased odds of parent or guardian knowledge of the vaccine.

Conclusion: The results of this study support legislation to increase utilization of the vaccine, improve public knowledge, and reduce racial and socioeconomic disparities related to HPV and the vaccine.

INTRODUCTION

Human papillomavirus (HPV) is a common sexually transmitted disease that causes staggering morbidity and mortality worldwide. It is the most common sexually transmitted virus in the United States (Centers for Disease Control and Prevention, 2010) (Forhan, et al., 2009), and persistent infection of HPV can cause cervical cancer and is etiologically associated with anal, oropharyngeal, penile, vaginal and vulvar cancers (Gillison, et al., 2000) (Chaturvedi, 2010). HPV is also associated with most cases of genital warts (Garland, et al., 2009).

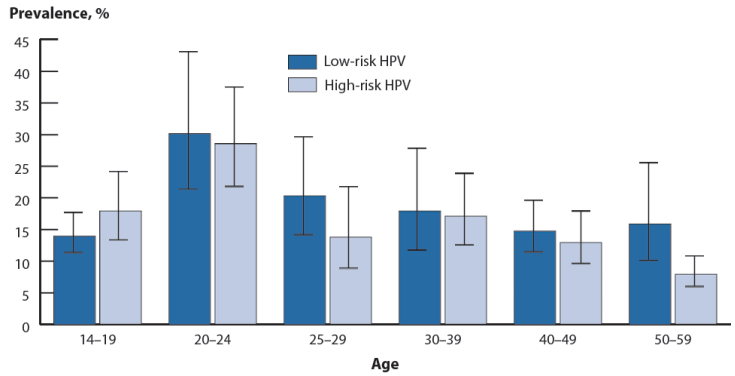
Proven associations with cancers and genital warts elevate HPV into a public health threat in the United States. Two vaccines have been approved by the Federal Food and Drug Administration (FDA) for females 11 – 26 and males 9 – 26 and are shown to be efficacious in preventing the HPV-related cancers and genital warts (Medeiros, Rosa, da Rosa, Bozzetti, & Zanini, 2009). After the first vaccine was approved in 2006, it gained a flurry of positive and negative attention in the media, among the medical community and among public health officials (Habel, Liddon, & Stryker, 2009). Initial excitement over the prospects of the vaccine caused many State legislatures to consider requiring the vaccine for females for middle school-entry, but public backlash appears to have delayed much of this legislative effort at this stage. Currently, a school requirement for females only exists in Virginia (girls entering 6th grade) and the District of Columbia (girls before the age of 13), despite the fact that at least 24 States considered legislation for this requirement between 2006 and 2008 (National Conference of State Legislatures, 2010). Aside from Virginia and the District of Columbia, use of the vaccine at the recommended ages of 12 – 13 remains at the discretion of the parent or guardian and family

Box 1 Epidemiology of HPV and HPV-related illness

Although most HPV infections cause no symptoms and are self-limited, persistent exposure to HPV infection can cause cervical cancer in women as well as other types of genital cancer, genital warts and oropharyngeal cancers in both men and women (Chaturvedi, 2010). One seroprevalence study found that HPV strains were prevalent in 32.5% of females and 12.2% of males in 2003-2004, with 6.5 to 17% prevalence of the four high- and low-risk strains (Markowitz, Sternberg, Dunne, McQuillan, & Unger, 2009). Another seroprevalence study reported the overall prevalence of high- and low-risk strains in females as 15.2% and 17.8% respectively, with the largest prevalence of both types being the largest in females 20-24 years (see Figure) (Dunne, Unger, Sternberg, McQuillan, Swan, & Markowitz, 2007). There are 40 strains of sexually transmitted HPV, but these four strains are responsible for the majority of HPV-related illness. HPV Types 6 and 11 are responsible for an estimated 90% of genital warts, while HPV Types 16 and 18 are responsible for 70% of cervical cancer and 86-95% of the other HPV-related cancers (Garland, et al., 2009) (Gillison, et al., 2000).

An estimated 6.2 million new HPV infections occur every year among 14 – 44 year olds (Weinstock, Berman, & Cates, 2004). Overall, an estimated 10,846 cases of cervical cancer, 4,753 cases of non-cervical cancers among men, and 4,128 cases of non-cervical cancers among women is caused by HPV annually in the U.S. (Chaturvedi, 2010). Risk of cervical cancer and subsequent death is highest among low-income, minority populations (Freeman & Wingrove, 2005).

Prevalence of high-risk and low-risk HPV types among females 14 to 59 years of age from a national survey, 2003–2004



NOTE: Error bars indicate 95% confidence intervals. Both high-risk and low-risk HPV types were detected in some females.
SOURCE: National Health and Nutrition Examination Survey (Dunne, Unger, Sternberg, McQuillan, Swan, & Markowitz, 2007)**Error! Bookmark not**

physician for girls and boys up to 18. Virginia and the District of Columbia allow exemptions for parents wishing to opt out for a variety of reasons, so parental discretion remains a large factor in ultimate uptake of the vaccine across all States and Districts. Studies suggest that uptake of the vaccine is low in the United States; however no existing studies exploring HPV vaccine utilization and its determinants are generalizable to the entire U.S. population. A 2008 study of 325 parents or guardians of 9 – 17 year old male (37) or female (288) children in medical and community settings in Georgia and South Carolina found that 13% had received the HPV vaccine, unadjusted for age and sex (Horn, Howard, Waller, & Ferris, 2009).

A 2009 study of girls aged 9 – 17 in a U.S. military treatment facility showed that 23% had started the vaccination series (Berry-Caban & Buenaventura, 2009).

Some U.S. based studies have also explored barriers to vaccine uptake in a specific sample population. A 2007 study of 262 women from an urban, hospital based clinic found that insurance coverage of HPV vaccination, the belief that one's parents, partners and clinicians approved of the vaccine, and a history of abnormal Pap tests predicted uptake of the vaccine (Conroy, et al., 2009). A 2007 systematic review of 1995 – 2007 HPV and HPV vaccine acceptability studies found 28 studies with sample sizes ranging from 20 to 840. The review found that among these samples, vaccine acceptability was higher when people believed the vaccine was effective, the individual's doctor recommended it, and the individual thought that HPV infection was likely (Brewer & Fazekas, 2007). A 2009 study explored differences in vaccine knowledge among rural black (91) and white (47) women, finding that white respondents were significantly more likely to have heard of HPV, had higher knowledge of HPV, and think that cervical cancer would be a serious threat to their daughters' health (Cates, Brewer, Fazekas, Mitchell, & Smith, 2009). This study did not find a difference in intention to vaccinate their daughters.

Box 2 Vaccine recommendations and safety

Two prophylactic HPV vaccines have been developed, a bivalent vaccine that protects against Types 16 and 18, and a quadrivalent vaccine directed against Types 6, 11, 16 and 18. The FDA licensed Gardasil® (Merck and Co., Inc, Whitehouse Station, NJ), the quadrivalent vaccine, in June 2006 for females aged 9-26 in the United States.

In response to the FDA approval of the vaccine, the Advisory Committee on Immunization Practices (ACIP) recommended the vaccine series for females 11-12 years old, and catch-up vaccination for females 13-26 years old (Centers for Disease Control and Prevention, 2007). ACIP listed several reasons for this recommendation in the United States. First, clinical trials suggested that Gardasil® is safe and effective for adolescents. Second, high antibody titers were achieved after vaccination in the 11-12 age groups. Third, data on HPV prevalence, the probability of acquiring an HPV infection shortly after sexual debut, and age of sexual debut in the United States suggest administering the vaccine to females at those ages will be most effectiveness on the population level (Centers for Disease Control and Prevention, 2007). In late 2009, ACIP voted to update those recommendations to include males 9 – 26 to reduce their likelihood of acquiring genital warts, and to include the newly-licensed bivalent vaccine Cervarix® (GlaxoSmithKline Biologicals, Rixensart, Belgium) as an option for vaccination (Centers for Disease Control and Prevention, 2009). The Centers for Disease Control and Prevention (CDC), along with the FDA, have continued to assert the safety of the vaccines as more data become available and the vaccines are administered around the world (Slade, et al., 2009) (Centers for Disease Control and Prevention, 2010).

Obtaining baseline estimates on utilization, knowledge and attitudes of the HPV vaccine in subsets of the U.S. population is important for informing policies and programs whose purposes are to decrease rates of HPV-related cancers and genital warts and provide support to individuals with barriers to uptake to ensure equality of use. Given parents and guardians currently hold full discretion over use of the vaccine for the recommended ages of 11-12, parental knowledge and attitudes on the vaccine is important to designing these policies. Health disparities from HPV-related mortality and morbidity already exist in the U.S. (Freeman & Wingrove, 2005). For research and modeling purposes, it will be useful to know whether these health disparities are likely to increase, based on current trends of HPV vaccine uptake.

In 2008, the National Health Interview Survey added a series of supplementary questions on HPV and the vaccine. Gardasil®, the quadrivalent vaccine, was the only vaccine approved for use in the United States at that time. Additionally, at that time the vaccine was only approved for females, so males were not asked questions about the HPV vaccine. We analyzed this publically available data to estimate national vaccine uptake among U.S. females, its determinants, and knowledge and attitudes on HPV and the vaccines of parents and guardians of girls aged 9 – 17. Determinants explored were race, poverty ratio, education, age, type of insurance, and indicators of health-seeking behavior.

METHODS

SURVEY DESIGN

The National Health Interview Survey is a cross-sectional, multistage probability sample survey conducted annually by the CDC through its National Center for Health Statistics and designed to represent the civilian, noninstitutionalized population of the U.S. (Centers for Disease Control and Prevention: Division of Health Interview Statistics, 2009). The interviewed sample in 2008 included 28,790 households, yielding a total of 74,236 persons. Of that sample, 1,583 were female adults aged 18 – 26 and 2,205 were female children aged 9 - 17 who were asked questions on HPV and the vaccine. Data for children were collected by proxy response from a knowledgeable adult in the family. Data were collected between January and December 2008.

The conditional response rate for the sample of children was 85.6%, calculated by dividing the number of completed child interviews by the total number of eligible children. Respondents in the sample are weighted according to design and ratio adjustments and further modified to 2000 Census control totals for sex, age, and race/ethnicity. From each family visited for the survey, one sample child and one sample adult is randomly selected. For children and those adults not home during the interview, information for the survey is provided on the individual's behalf by a knowledgeable adult (18 years and older) residing in the household.

OUTCOMES

The primary outcome in the study was the percentage of all age- and gender-eligible individuals (females 9 – 26) who had received at least one dose of the HPV vaccine. Secondary outcomes were defined as the proxy respondent (parent or guardian) for the female child 9 – 17 having ever heard of a vaccine for cervical cancer, the all female children 9 - 18 having received at least one dose of the HPV vaccine, and the proxy respondent's reported main reason why the female child 9 – 17 would not receive the vaccine. The relevant questions in the sample child survey were phrased in the following manner. A) "A vaccine to prevent the human papillomavirus (pap-uh-LOW-muh-vi-rus) or HPV infection is available and is called the HPV shot, cervical cancer vaccine, or GARDASIL®. Before this survey, have you ever heard of the HPV shot or cervical cancer vaccine?" B) "Did [fill: sample child name] ever receive the HPV shot or cervical cancer vaccine?" C) "What is the MAIN reason you would NOT want [fill: sample child name] to get the vaccine?" The latter was assessed on child proxy respondents who had reported the child had not received the vaccine and had reported "No" or "Don't know" to

whether they would receive the vaccine if their doctor recommended it. The relevant question in the sample adult survey (for women 18 – 26) was phrased in the following manner. "Have you ever received the HPV shot or cervical cancer vaccine?"

STATISTICAL ANALYSES

Data were analyzed using STATA statistical software version 11.0 (STATA press, College Station, Texas).

Proportions of all females 9 – 26 who responded positively to having received the vaccine were obtained to estimate the overall utilization of the vaccine in the U.S. among women of eligible ages. We excluded children under 9 and adults over 26 from the universe of females eligible for the vaccine to correspond with ACIP guidelines. Proportions of main reasons for children not getting the HPV vaccine were also obtained and weighted.

Further analysis was then performed on secondary outcome measures from questions asked of parents/guardians of female children to gauge racial, socioeconomic, educational, insurance-related, age-related, and health-seeking behavior-related differences on vaccine utilization and knowledge. Outcome variables were dichotomized as yes or no. Observations with responses "refused," "not ascertained," or "don't know" for dichotomous outcome variables were excluded from the logistic regression analysis. 48 of 2,415 (2.0%) observations in the sample for having ever heard of the HPV shot or cervical cancer vaccine were excluded and 82 of 2,415 (3.4%) observations in the sample for having ever received the HPV vaccine were excluded based on

this criterion. All observations were weighted to obtain population-level estimates of the effects of these determinants. Characteristics of respondents for outcome variables of parents/guardians of 9 to 17 year old children ever having heard of the vaccine and parents/guardians of 9 – 17 year old children ever having received the vaccine were compared using Pearson's chi squared test for categorical and dichotomous variables, and t-tests of comparison of mean age.

Multiple logistic regressions were used on sample child outcome variables of ever having heard of the HPV shot or cervical cancer vaccine and ever having received the HPV shot or cervical cancer vaccine to analyze adjusted predictor variables among the parents and guardians of this subset of the population.

RESULTS

Overall, the sample included 3,788 females aged 9 – 26 who would be eligible for the vaccine based solely on gender and age, which was then weighted and scaled to the national level. Outside of the age-eligible population of females in the sample, two sample children 8 years old were reported as being vaccinated and 36 sample adults ages 27 – 59 reported having been vaccinated. The overall proportion of vaccinated individuals among all females 9 – 26 in the United States by 2008, about two years after the vaccine was approved, is 14.9%.

Table 1 lists the reasons reported by parents/guardians for not vaccinating their 9 – 17 year old daughters despite a doctor recommendation. The top three reasons reported were, "does not need the vaccine" (21.4%), "don't know enough about the vaccine" (17.6%), and "not sexually active"

(14.7%). "Too expensive," "my spouse/family member is against it," and "don't know where to get vaccine" were reported as main reasons for only a small percent of people.

Table 1: Main reason why parent/guardian is not willing to vaccinate their 9 – 17 year old daughter, weighted to U.S. population, 2008

	Percent
Does not need vaccine	21.4%
Don't know enough about the vaccine	17.6%
Not sexually active	14.7%
Worried about safety of vaccine	14.5%
Too young for vaccine	9.9%
Other	6.8%
Doctor didn't recommend it	5.5%
Don't know	4.8%
Too expensive	1.6%
My spouse/family member is against it	2.0%
Don't know where to get vaccine	0.6%
Already has HPV	0.2%
Refused	0.1%

An estimated 67.1% of U.S. parents or guardians with children 9 – 17 years old have heard of the HPV vaccine. Table 2 lists descriptive characteristics of parents/guardians of female children 9 – 17 having heard or not heard of the vaccine. Significant differences exist between subpopulations in the United States defined by race, insurance type, poverty ratio, education level, and the child having received a flu shot in the past year. Mean age of the child, among female children 9 – 17, was not statistically different between the group that had heard of the vaccine and the group that had not.

Table 2: Descriptive characteristics of female children 9 – 17 by parent/guardian knowledge of the HPV vaccine, weighted to U.S. population, 2008

	Heard of vaccine	Not heard of vaccine	p-value
Overall proportion	67.1%	32.9%	
Race			<0.001
Hispanic	51.6%	48.4%	
Non-Hispanic white	75.4%	24.6%	
Non-Hispanic black	60.1%	39.9%	
Non-Hispanic Asian	51.9%	48.1%	
Other	50.5%	49.6%	
Insurance type			<0.001
Government-sponsored	59.9%	40.1%	
Private or employment based	73.3%	26.7%	
Uninsured	47.6%	52.4%	
Missing insurance type	25.9%	74.1%	
Ratio of income to poverty threshold			<0.001
Below 100%	49.2%	50.8%	
100 - 199%	63.5%	36.5%	
200 - 399%	70.6%	29.4%	
Over 400%	75.1%	24.9%	
Highest level of education in the family			<0.001
High school or less	59.3%	40.7%	
College degree or higher	75.6%	24.4%	
Age, mean (se)	12.9 (0.13)	13.1 (0.09)	
Received a flu shot in the last 12 months			0.02
Yes	73.8%	26.2%	
No	65.5%	34.5%	

Table 3 lists descriptive characteristics of female children 9 – 17 by vaccinated or not vaccinated. Of all female children 9 – 17 in the U.S., an estimated 18.7% have received at least one dose of the vaccine in 2008. Significant differences exist between subpopulations defined by insurance type, age of the child, and the child having received a flu shot in the past year. Poverty ratio was highly uncorrelated with having been vaccinated by 2008. Differences between family education level and racial group were slightly above the 0.05 significance level.

Table 3: Descriptive characteristics of female children 9 – 17 having received or not having received at least one dose of the HPV vaccine, weighted to U.S. population, 2008

	Vaccinated	Not vaccinated	p-value
Overall proportion	18.7%	81.3%	
Race			0.08
Hispanic	16.6%	83.4%	
Non-Hispanic white	20.1%	80.0%	
Non-Hispanic black	17.1%	82.9%	
Non-Hispanic Asian	10.0%	90.0%	
Other	36.4%	63.6%	
Insurance type			0.01
Government-sponsored	22.1%	77.9%	
Private or employment based	18.9%	81.1%	
Uninsured	9.1%	91.0%	
Missing insurance type	0.0%	100.0%	
Ratio of income to poverty threshold			0.54
Below 100%	21.3%	78.7%	
100 - 199%	16.4%	83.6%	
200 - 399%	17.2%	82.8%	
Over 400%	19.8%	80.2%	
Highest level of education in the family			0.07
High school or less	16.7%	83.3%	
College degree or higher	20.8%	79.2%	
Age, mean (se)	14.4 (0.14)	12.7 (0.08)	
Received a flu shot in the last 12 months			<0.001
Yes	35.3%	64.8%	
No	14.5%	85.5%	

Table 4 reports the unadjusted and adjusted odds ratios of subpopulations of parents and guardians in the U.S. having heard of the vaccine. Racial group, education level, being uninsured, and the child having received a flu shot in the past year were statistically significantly related to the odds of parents/guardians having heard of the vaccine after adjusting for other predictors. Odds of parents/guardians of Hispanic or black female children 9 – 17 having heard of the vaccine were approximately half that of parents/guardians of white female children 9 – 17

in 2008 (p-value <0.001). Odds of parents/guardians of Asian female children 9 – 17 were the most reduced from odds of parents/guardians of white female children.

Table 4: Results of logistic regression analyses for parent/guardian of female child 9 – 17 knowledge of the HPV vaccine, weighted to U.S. population, 2008

	Unadjusted Odds Ratio		Adjusted Odds Ratio	
	OR	p-value	OR	p-value
Race (as compared to non-Hispanic white)				
Hispanic	0.35	<0.001	0.48	<0.001
Non-Hispanic black	0.49	<0.001	0.55	0.001
Non-Hispanic Asian	0.35	<0.001	0.32	<0.001
Other	0.33	0.02	0.36	0.05
Insurance type (as compared to private or employment-based)				
Government-sponsored	0.54	<0.001	0.93	0.73
Uninsured	0.33	<0.001	0.53	0.004
Missing insurance type	0.13	<0.001	0.15	0.05
Ratio of income to poverty threshold (as compared to Over 400%)				
Below 100%	0.32	<0.001	0.65	0.09
100 - 199%	0.58	0.002	1.05	0.82
200 - 399%	0.80	0.13	1.09	0.58
High school degree or lower (as compared to college degree or higher)	0.47	<0.001	0.62	0.002
Age, 1 year	1.02	0.36	1.03	0.31
Received a flu shot in the last 12 months	1.48	0.02	1.67	0.004

Unadjusted and adjusted odds ratios of vaccination by subpopulations in the U.S. are reported in Table 5. Black and Asian female children 9 – 17 had significantly reduced odds of having received the vaccine by 2008 as compared to white female children of the same age, insurance type, poverty ratio, family education, and flu shot utilization. Hispanic female children did not show a significant difference in odds from white female children. Government-sponsored health insurance did not show significantly reduced odds of being vaccinated, but children in uninsured families had approximately half the odds of having been vaccinated than children in families

with private or employment-based insurance. Poverty ratio was not a predictor of odds of being vaccinated. Highest level of education in the family was related to the odds of being vaccinated, in favor of having a college degree or higher, after adjusting for other predictors. The odds of having been vaccinated increased significantly with each year increase in age, and the odds of being vaccinated for HPV were 350% higher for children who had received a flu shot in the last 12 months than children who had not, after adjusting for the other predictors.

Table 5: Results of logistic regression analyses for female child 9 – 17 vaccinated, weighted to U.S. population, 2008

	Unadjusted Odds Ratio		Adjusted Odds Ratio	
	OR	p-value	OR	p-value
Race (as compared to non-Hispanic white)				
Hispanic	0.79	0.24	0.82	0.38
Non-Hispanic black	0.82	0.30	0.63	0.03
Non-Hispanic Asian	0.44	0.20	0.36	0.01
Other	2.28	0.17	1.71	0.44
Insurance type (as compared to private or employment-based)				
Government-sponsored	1.22	0.26	1.31	0.26
Uninsured	0.43	0.008	0.47	0.04
Missing insurance type	omitted	N/A	omitted	N/A
Ratio of income to poverty threshold (as compared to Over 400%)				
Below 100%	1.08	0.68	1.37	0.28
100 - 199%	0.80	0.23	1.07	0.80
200 - 399%	0.88	0.53	1.24	0.31
High school degree or lower (as compared to college degree or higher)	0.76	0.07	0.67	0.02
Age, 1 year	1.30	<0.001	1.34	<0.001
Received a flu shot in the last 12 months	3.20	<0.001	3.50	<0.001

DISCUSSION

In this section, we interpret the main findings of the study and consider available policy alternatives for States, which have jurisdiction over many of the policy options related to vaccines in the U.S.

In 2008, utilization of the HPV vaccine was lower than other vaccines in the U.S. This study finds that HPV vaccine coverage among age-eligible females in the U.S. is less than 15%. Although this proportion is low in comparison, the HPV vaccine had been approved for less than 18 months when data collection for the survey began. The proportion of all age-eligible females younger than 17 is 18.7%, similar to the proportion estimated when including females 18 – 26 years old. HPV vaccine is most effective and therefore recommended for receipt prior to sexual debut, however these findings suggest that a similar proportion of young adults decided to vaccinate. The close proportions of utilization may suggest that populations similar in health-seeking behavior decided to vaccinate against HPV soon after FDA-approval, although this study did not look at descriptive characteristics of vaccinated women 18 – 26.

There are some limitations to the reported utilization rate of the HPV vaccine for use in future research. For the purposes of this study, a child or adult having received at least one dose of the vaccine was used as a proxy for utilization of the vaccine. The full vaccine schedule requires three doses, so there is uncertainty as to whether the outcome measure can correctly predict the individual's full immunity to the four HPV strains from the vaccine. This limitation could have

implications for using these results as a proxy estimate for percent of the population that is no longer at risk for HPV-related illness.

Reported parent and guardian attitudes towards and knowledge of the vaccine suggest a need for increased public education on HPV and the vaccine. Of parents and guardians of female children who decided not to vaccinate their child even though a doctor recommended it, the top three main reasons reported were that their child does not need the vaccine, they don't know enough about the vaccine, and their child is not sexually active. Given the HPV vaccine has been proven effective for protecting against four strains of HPV and is most effective before sexual debut, these reasons suggest that the public lacks full understanding of HPV and the vaccine. Although studies that have examined the extent to which the media covered these topics show that a large number of mass media stories reported on this topic before and after the vaccine was approved, the public may require more specific information on the vaccine and the risks of HPV from a credible source before making the decision to vaccinate. Additionally, about one-third of parents or guardians of female children 9 – 17 have never heard of the vaccine, suggesting those mass media reports did not reach all populations or were ignored or misunderstood. These findings support implementing a targeted public education campaign on HPV and the vaccines, for which some States have considered and passed legislation in recent legislative sessions. However, most States that have passed this type of legislation target parents of middle-school aged females only. Current evidence now points to a high burden of HPV-related illness among males as well. Education campaigns should promote the use of the vaccine among both sexes.

Incidence and mortality rates from cervical cancer are higher among black women than white women, despite higher cervical cancer screening rates among the former (Newmann & Garner, 2005). This study reveals that parents and guardians of black females 9 – 17 are less likely to have heard of the vaccine and are less likely to have received it. These disparities also exist among Asian children for receiving the vaccine, and Hispanic and Asian children for parent/guardian knowledge of the vaccine. Where social disparities with cervical cancer already exist, differential utilization of a vaccine to protect against cervical cancer and other HPV-related cancers may only increase these disparities.

There are three major policy solutions that may alleviate health disparities. First, a public education campaign that is culturally sensitive and targets hard-to-reach populations may improve voluntary participation. Second, increasing financing options for the vaccine may decrease cost as a barrier. Although this study found that cost was not a main reason parents and guardians would not vaccinate their child, studies targeting low-income or minority populations have found cost to be a barrier for some people (Conroy, et al., 2009). Finally, States or smaller jurisdictions can mandate vaccination. This strategy has been used widely in the U.S. to improve vaccine coverage, with the required vaccination being linked to public school attendance. Studies have shown that overall Hepatitis B vaccination coverage improved, as well as narrowed the gap in coverage between racial and ethnic groups in middle schools once individuals were subject to laws requiring vaccination for school-entry (Averhoff, Linton, Peddecord, Edwards, Wang, & Fishbein, 2004) (Morita, Ramirez, & Trick, 2008).

The findings in this study support the argument for legislation action by States or lower jurisdictions to increase vaccine coverage, close disparities and improve public knowledge so as to reduce the burden of HPV-related illness in the U.S.

Works Cited

Averhoff, F., Linton, L., Peddecord, K., Edwards, C., Wang, W., & Fishbein, D. (2004). A middle school immunization law rapidly and substantially increases immunization coverage among adolescents. *Am J Public Health* , 94(6):978-84.

Berry-Caban, C., & Buenaventura, J. (2009). HPV vaccination coverage among adolescents aged 9 to 17 years in a United States military treatment facility. *Int J Adolesc Med Health* , Oct-Dec; 21(4): 567-70.

Brewer, N. T., & Fazekas, K. I. (2007). Predictors of HPV vaccine acceptability: a theory-informed, systematic review. *Preventive Medicine* , 45: 107–114.

Cates, J. R., Brewer, N. T., Fazekas, K. I., Mitchell, C. E., & Smith, J. S. (2009). Racial differences in HPV knowledge, HPV vaccine acceptability, and related beliefs among rural, southern women. *The Journal of Rural Health* , 25(1): 93 - 97.

Centers for Disease Control and Prevention. (2009, December 1). *ACIP Provisional Recommendations for HPV Vaccine*. Retrieved April 20, 2010, from http://www.cdc.gov/vaccines/recs/provisional/downloads/hpv-vac-dec2009-508.pdf

Centers for Disease Control and Prevention. (2010, February 5). *Human Papillomavirus (HPV)*. Retrieved April 20, 2010, from http://www.cdc.gov/hpv/

Centers for Disease Control and Prevention. (2007). Quadrivalent Human Papillomavirus Vaccine: Recommendations of the Advisory Committee on Immunization Practices. *MMWR* , 56(Early Release):1-24.

Centers for Disease Control and Prevention. (2010, March 10). *Reports of Health Concerns Following HPV Vaccination*. Retrieved April 24, 2010, from http://www.cdc.gov/vaccinesafety/Vaccines/HPV/gardasil.html

Centers for Disease Control and Prevention: Division of Health Interview Statistics. (2009). *National Health Interview Survey Public Use Data Release: NHIS survey description.* Hyattsville, MD: National Center for Health Statistics.

Chaturvedi, A. K. (2010). Beyond Cervical Cancer: Burden of Other HPV-Related Cancers Among Men and Women. *Journal of Adolescent Health* , 46:S20-S26.

Conroy, K., Rosenthal, S. L., Zimet, G. D., Jin, Y., Bernstein, D. I., Glynn, S., et al. (2009). Human Papillomavirus Vaccine Uptake, Predictors of Vaccination, and Self-Reported Barriers to Vaccination. *Journal of Women's Health* , 18(10): 1679 - 86.

Dunne, E., Unger, E., Sternberg, M., McQuillan, G., Swan, D. P., & Markowitz, L. (2007). Prevalence of HPV infection among females in the United States. *JAMA* , 297(8):813-9.

Forhan, S. E., Gottlieb, S. L., Sternberg, M. R., Xu, F., Datta, S. D., McQuillan, G. M., et al. (2009). Prevalence of sexually transmitted infections among female adolescents aged 14 to 19 in the United States . *Pediatrics* , 124(6):1505-12.

Freeman, H., & Wingrove, B. (2005). *Excess cervical cancer mortality: A marker for low access to health care in poor communities.* Rockville, MD: National Cancer Institute, Center to Reduce Cancer Health Disparities.

Garland, S. M., Steben, M., Sings, H. L., James, M., Lu, S., Railkar, R., et al. (2009). Natural history of genital warts: analysis of the placebo arm of 2 randomized phase III trials of a quadrivalent human papillomavirus (types 6, 11, 16 and 18) vaccine. *The Journal of Infectious Disease* , 199: 805 - 14.

Gillison, M., Chaturvedi, A., & Lowy, D. (2008). HPV prophylatic vaccines and the potential prevention of noncervical cancers in both men and women. *Cancer* , 113(10 Suppl):3036-46.

Gillison, M., Koch, W., Capone, W., Spafford, M., Westra, W., Wu, L., et al. (2000). Evidence for a causal association between human papillomavirus and a subset of head and neck cancers. *J Natl Cancer Inst* , May 3;92(9):709-20.

Habel, M., Liddon, N., & Stryker, J. E. (2009). The HPV Vaccine: a content analysis of online news stories. *Journal of Women's Health* , 18(3): 401-407.

Horn, L., Howard, C., Waller, J., & Ferris, D. G. (2009). Opinions of parents about school-entry mandates for the human papillomavirus vaccine. *Journal of Lower Genital Tract Disease* , 14(1) 2010: 43-48.

Markowitz, L. E., Sternberg, M., Dunne, E. F., McQuillan, G., & Unger, E. R. (2009). Seroprevalence of Human Papillomavirus Types 6, 11, 16 and 18 in the United States: National Health and Nutrition Estimation Survey 2003-2004. *The Journal of Infectious Diseases* , 200:1059-67.

Medeiros, L., Rosa, D., da Rosa, M., Bozzetti, M., & Zanini, R. (2009). Efficacy of human papillomavirus vaccines: a systematic quantitative review. *Int J Gynecol Cancer* , 19(7): 1166-76.

Morita, J., Ramirez, E., & Trick, W. (2008). Effect of a school-entry vaccination requirement on racial and ethnic disparities in hepatitis B immunization coverage levels among public school students. *Pediatrics* , 121(3):e547-52.

National Conference of State Legislatures. (2010, April). *HPV Vaccine: State Legislation and Statutes*. Retrieved April 24, 2010, from http://www.ncsl.org/IssuesResearch/Health/HPVVaccineStateLegislation/tabid/14381/Default.aspx

Newmann, S. J., & Garner, E. O. (2005). Social inequities along the cervical cancer continuum: a structured review. *Cancer Causes and Control* , 16(1):63-70.

Slade, B. A., Leidel, L., Vellozzi, C., Woo, E. J., Hua, W., Sutherland, A., et al. (2009). Postlicensure safety surveillance for quadrivalent human papillomavirus recombinant vaccine. *JAMA* , 302(7): 750 - 757.

Weinstock, H., Berman, S., & Cates, W. J. (2004). Sexually transmitted diseases among American youth: incidence and prevalence estimates. *Perspect Sex Reprod Health* , 36:6-10.