

# Race and Sexual Behavior Predict Uptake of the Human Papillomavirus Vaccine

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**Objective:** To identify predictors of human papillomavirus (HPV) vaccination initiation by girls at high risk for HPV infection. **Method:** Participants were 2,098 girls enrolled in the ongoing Pittsburgh Girls Study, who were between the ages of 12 and 15 years in 2008, and their primary caregivers. The study was conducted in the 2 years after the deployment of the first HPV vaccine approved by the U.S. Food and Drug Administration. Primary caregivers were asked about HPV vaccine uptake. Girls were interviewed about pubertal development and sexually intimate behavior. **Results:** Approximately 60% of the girls had initiated the HPV vaccine in the past year. Among the hypothesized predictors of initiation, African-American race decreased the likelihood and level of sexually intimate behavior in the previous year increased the likelihood of uptake. Controlling for receipt of public assistance, African-American girls were close to 40% less likely to be vaccinated than European-American girls. **Conclusion:** Racial disparities in use of preventive interventions such as the HPV vaccine exist. Lack of information about public financing of the vaccine, timing of vaccination relative to sexual activity, and perceptions of preventive value may limit uptake among those at highest risk for infection and negative sequelae from infection. Further research to probe knowledge and attitudes toward HPV vaccination and the impact of the media on vaccine initiation and uptake may reveal specific targets of intervention.

**Keywords:** human papillomavirus, vaccine uptake, race, sexual activity

Human papillomavirus (HPV) is a common sexually transmitted infection that is associated with cervical cancer (Bosch, Lorincz, Munoz, Meijer, & Shah, 2002). More than 25% of women 14–59 years old are infected with HPV (Dunne et al., 2007). In 2006, the U.S. Food and Drug Administration (FDA) approved the first vaccine developed to prevent genital warts, precancerous lesions, and cervical cancer caused by four types of HPV, which was heralded as a significant advance in preventive health care for females. The current U.S. guidelines for the HPV vaccination are to target girls 11–12 years old and previously unvaccinated girls 13–26 years old regardless of sexual experience (Markowitz et al., 2007).

Sociodemographic factors are associated with HPV infection and cervical cancer. African-American women are at greater risk for HPV infection (Shikary et al., 2009), incidence of cervical cancer (Schairer, Brinton, Devesa, Ziegler, & Fraumeni, 1991), and morbidity resulting from cervical cancer (Hébert et al., 2009). Lower income is also associated with HPV infection and cervical cancer (Shikary et al., 2009). Efforts, therefore, to investigate uptake of the HPV vaccine in populations at high risk for HPV infection and cervical cancer are critical to addressing disparities

in health outcomes for members of racial minorities and those living in poverty.

To date, several studies have been conducted on vaccine acceptability and a few on correlates of initiation or uptake. Using a convenience sample of Caribbean-American and African-American adolescents attending a medical clinic and their parents, Read, Joseph, Polishchuk, and Suss (2010) reported that interest in the HPV vaccine was twice as high among sexually active compared to nonsexually active adolescents. Beliefs about health and sexuality, and African-American race are also correlates of low acceptability (Scarinci, Garcés-Palacio, & Partridge, 2007). Among the recent studies testing correlates of vaccination initiation, perceived barriers to vaccination (Reiter, Brewer, Gottlieb, McRee, & Smith, 2009), and area and family level poverty (Pruitt & Schootman, 2010) decreased the likelihood of initiation. Few investigators have had sufficient representation of African-American adolescents in nonclinical settings, or representative populations with adequate response rates to test hypotheses about race effects. In addition, many of the factors identified in the existing literature, such as race and poverty, and age, puberty, and sexual activity, may share explained variance in vaccine initiation. Thus, adequately powered studies are needed to parse the unique effects of hypothesized correlates of HPV vaccine initiation.

The present study addresses these gaps in the literature. Two years after FDA approval of the first HPV vaccine, caregivers of girls in the Pittsburgh Girls Study (PGS; Keenan et al., 2010), a longitudinal study funded by the National Institutes of Health on the development of behavioral and emotional problems, were administered questions about vaccine initiation. Approximately half of the girls in the PGS are African American and the sample was selected to overrepresent families living in low-income neigh-

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borhoods. Because data have been collected annually, *predictors* of vaccine initiation could be identified. Thus, the PGS provides a unique opportunity to generate information critical to evaluating the successful delivery of a preventive intervention for an illness that disproportionately affects minority populations.

## Method

### Sampling

A stratified, random household sampling, with oversampling of households in low-income neighborhoods, was used to identify girls who were between the ages of 5 and 8 years. Neighborhoods in which at least 25% of the families were living at or below the poverty level were fully enumerated (i.e., all homes were contacted to determine if the household contained an eligible girl), and a random selection of 50% of the households in all other neighborhoods were enumerated during 1998 and 1999. The enumeration identified 3,118 separate households in which an eligible girl resided. From these households, families who moved out of state and families in which the girl would be age ineligible by the start of the study were excluded. When two age-eligible girls were enumerated in a single household, one girl was randomly selected for participation. Of the 2,992 eligible families 2,875 (96%) were successfully recontacted to determine their willingness to participate in the longitudinal study. Of those families, 85% agreed to participate, resulting in a total sample size of 2,451.

### Interviews

In-home interviews were conducted annually beginning in 2000 when the girls were between the ages of 5 and 8 years. Girls and their caregivers were interviewed in their homes separately by trained interviewers who administered questionnaires on laptop computers. For the present study, predictors of vaccine initiation were assessed in 2008 when the girls were between 13 and 16 years of age, and the assessment of vaccine initiation in the following year when they were between 14 and 17 years of age. Approval for all study procedures was obtained from the University of Pittsburgh Institutional Review Board.

### Measures

Caregivers reported whether girls had received at least one dose of the vaccine. Caregivers identified their daughters as African American or African American and another race (57.9%), European American (41.2%), or Asian American (0.9%). Asian-American girls were excluded from the present analyses due to underrepresentation.

The Adolescent Sexual Activity Index (Hansen, Paskett, & Carter, 1999) was administered to the girls to assess sexually intimate behaviors ranging from spending time alone with a boy to sexual intercourse. Internal consistency of the 11-item measure for this sample was high ( $\alpha = .88$ ). Five items measure presexual behaviors (including holding hands and hugging), three items measure fondling, and three items measure genital contact. These three groups of items were used to measure stage of sexual behavior, so that an endorsement of a single item at the highest

stage (presexual, fondling, genital contact) determined the highest level of sexual behavior.

Pubertal development was assessed via self-ratings performed with the aid of schematic drawings of secondary sexual characteristics (Morris & Udry, 1980). Slightly more than 2% were rated as being at Tanner Stages I–II, 9% were rated as being at Stage III, 42.2% at stage IV, and 45.5% at Tanner Stage V. Age of the girl was also included because pubertal development and level of sexually intimate behavior are associated with age.

Poverty was operationally defined as caregiver's report of receipt of public assistance including participation in the Women, Infants, and Children Program, food stamps, Medicaid insurance, and/or Temporary Assistance to Needy Families.

Logistic regressions were computed to test the effects of race, age, poverty, pubertal status, and sexual behavior on vaccine initiation in the following year, using PASW Statistics 18 (PASW Statistics 18). All analyses were conducted with weighted data to correct for the oversampling of the low-income neighborhoods. Given the large sample size, significant differences are reported for  $p$  values less than .01.

## Results

Of the 2,098 participants interviewed in 2008, 1,320 (62.9%) reported that their daughters had received the HPV vaccine in the past year, 739 (35.2%) stated that their daughters had not received the vaccine, 38 (1.8%) were unsure, and 1 (0.05%) refused to answer the question. The latter two groups were excluded from further analyses, as were two Asian-American girls, yielding a total of 2,057 families for testing predictors of initiation. Descriptive statistics for the hypothesized predictors for the analyzable sample are presented in Table 1.

African-American race, sexually intimate behavior, and age were significant predictors of vaccine uptake; receipt of public assistance and pubertal development were not (see Table 2). African-American girls were 35% less likely to have received the vaccine than European-American girls, and likelihood of vaccine uptake increased by approximately 36% with each increase in level

Table 1  
*Descriptive Statistics for Hypothesized Predictors*

Predictors	<i>n</i>	%
African-American race	1053	51.2
Receipt of public assistance	672	33.3
Age (years)		
12	508	24.7
13	537	26.1
14	507	24.7
15	504	24.5
Pubertal Development ( <i>n</i> = 1,966)		
Tanner Stage I–II	52	2.5
Tanner Stage III	210	9.9
Tanner Stage IV	892	42.2
Tanner Stage V	962	45.5
Sexually Intimate Behavior ( <i>n</i> = 1,978)		
None	580	27.2
Presexual	1209	56.7
Fondling	219	10.3
Genital contact	124	5.8

Table 2  
*Univariate Tests of Predictors of HPV Vaccine Uptake*

Correlate	Wald	OR	95% CI	p
African-American race	21.25	0.65	[0.54, 0.78]	<.001
Receipt of public assistance	0.12	0.97	[0.80, 1.17]	.634
Age	18.77	1.20	[1.10, 1.30]	<.001
Pubertal development	1.81	1.04	[0.98, 1.11]	.353
Sexually intimate behavior	25.47	1.36	[1.20, 1.54]	<.001

Note. Significance tested by separate logistic regression for each predictor. OR = odds ratio; CI = confidence interval.

of sexually intimate behavior and by 20% with each increase in age in years.

When tested simultaneously, and while controlling for receipt of public assistance, both race, odds ratio (OR) = 1.61, 95% confidence interval (CI) [1.32–1.96],  $p < .001$ , and level of sexually intimate behavior in the previous year, OR = 1.27, 95% CI [1.11–1.46],  $p < .001$ , were significant predictors of initiation, but age was not, OR = 1.09, 95% CI [0.99–1.20],  $p = .07$ . The interaction of race and sexually intimate behavior on initiation also was tested, but no significant effect was observed.

## Discussion

The present study is one of the first to explore predictors of HPV vaccination in a well-characterized, representative sample of high-risk adolescent girls in the 2 years after FDA approval of the HPV vaccine. More than half of caregivers reported that their daughters 13–16 years old had been vaccinated. Among the hypothesized predictors of uptake, African-American race decreased the likelihood and level of sexually intimate behavior in the previous year increased the likelihood of uptake. Controlling for receipt of public assistance, African-American girls were close to 40% less likely than European-American girls to be vaccinated. Thus, racial disparities in preventive health, in the form of HPV vaccination, persist. Given the increased risk for cervical cancer among African-American women (Schairer et al., 1991) and the likelihood for such cancer to lead to death (Hébert et al., 2009), this is a gap in delivery of preventive health that needs to be closed.

The association between engaging in sexually intimate behavior and vaccine uptake may not be surprising, but it is problematic. In the present study, for every increase in level of sexually intimate behavior, there was a 36% increase in the likelihood of vaccination, controlling for age, pubertal status, and race. It is predictable that caregivers of young girls, and perhaps the girls themselves, would be less likely to pursue vaccination for a sexually transmitted infection in the absence of sexual behavior. This link between timing of sexual activity and caregivers' perceptions of risk for infection works against the need to protect girls most effectively by vaccinating *before* risk of exposure. Thus, information on the frequency and rapidity with which HPV can be contracted once an individual becomes sexually active may not be communicated efficiently to caregivers or to the girls themselves. Understanding the high rate and ease of transmission of HPV may be as important a component in education as are efficacy and safety of the vaccine.

## Study Limitations

A number of limitations should be noted. First, there was no verification of caregiver report of vaccine initiation. Although we provided an option for those who were unsure (close to 2% reported being unsure), data suggest that parental recall of vaccinations is more likely to suffer from false negatives than false positives, although error rates for HPV appear to be among the lowest (Dorell, Jain, & Yankey, 2008). Second, because we did not collect data on uptake of other vaccinations, we do not know whether our findings are specific to HPV uptake. Finally, we did not contact participants within 6 months to determine whether the series was completed. Predictors of completion are equally important to identify.

## Conclusion

The rate of uptake in the present study is far below the Centers for Disease Control and Prevention's 90% target. The fact that populations at highest risk for cervical cancer are the least likely to have received the vaccine requires consideration of alternative methods for communication and accessibility. Mandatory vaccination prior to entry in middle school has been suggested as a means of overcoming barriers (Zimet, Shew, & Kahn, 2008). This may be a way to create more equal access to information about HPV infection and vaccination, and ultimately reduce racial disparities in HPV infection, incidence of cervical cancer, and morbidity resulting from cervical cancer.

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