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An Opportunity for Cancer Prevention During Preadolescence and Adolescence: Stopping Human Papillomavirus (HPV)-Related Cancer Through HPV Vaccination

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A B S T R A C T

Objective: We conducted a descriptive study of the correlates of refusal and acceptance of human papillomavirus (HPV) vaccination by rural parents of preadolescent and adolescent children. We hypothesized that the correlates of parents who allow their children aged 9 to 13 years to get the HPV vaccine and those of parents who do not allow vaccination would differ significantly.
Methods: This cross-sectional study was implemented during the school years 2009–2011 in the elementary and middle schools of three rural counties in Georgia. Parents were recruited at school functions to complete an anonymous validated survey.
Results: Parents who chose to vaccinate their children or intended to vaccinate were twice as likely to be from a race other than African American and 2.7 times more likely to have a religion other than Baptist. Using stepwise logistic regression and after adjustment for race and religion, we found that parents who had vaccinated or intended to vaccinate had significantly higher scores on perceived barriers (1.02 times more likely to vaccinate) and lower scores on perceived benefits (1.01 times more likely to vaccinate) (model $p < .001$).
Conclusions: The results suggest that healthcare providers in rural areas can increase HPV vaccine uptake and reduce HPV-related cancers by using a multifaceted approach to educating their patients within the context of the patients' cultural values, geographic location, and economic situation. Such an approach could dispel misinformation and increase vaccine uptake.

IMPLICATIONS AND CONTRIBUTION

The findings imply that a multifaceted approach is essential to preventing HPV-related cancer. Social determinants of rural health (geography, economy, and culture) must be recognized when educating parents about HPV vaccination. In addition, emphasizing the benefits of HPV vaccination as a cancer preventive can increase HPV vaccine uptake in rural areas.

Human papillomavirus (HPV) infection is etiologically linked to cancers of the cervix, anus, oropharynx, penis, vagina, and vulva [1]. Current incidence data indicate that HPV infection may be associated with 96%–99% of cervical cancers [1–3], 90%–93% of anal cancers [1,4], 12%–63% of oropharyngeal cancers [1,5], 36%–40% of penile cancers [1,6], 40% of vaginal cancers [1,7], 40%–51% of vulvar cancers [1,8], and 500,000 cases of cervical cancer worldwide [1]. Cancers related to HPV infection impose an enormous health burden of more than $3.7 billion annually in the United States [9]. As incidence rates of HPV-related cancers of the anus, oropharyngeal cavity, and vulva continue to increase, preventing these types of cancers is crucial, especially for adolescents living in rural areas who may have limited or no access to primary healthcare or prevention services [10].

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The HPV vaccine is a healthcare breakthrough and an essential element of health promotion in pediatric and adolescent healthcare for boys and girls [11]. The Centers for Disease Control and Prevention and the Advisory Committee on Immunization Practices recommend vaccinating girls and boys as early as 9 years of age with the recommended age range being 9 to 26 years [12]. In the isolated communities where our research was conducted, preadolescents and adolescents cannot be vaccinated without parental consent. An opportunity to reduce HPV-related cancer was clear after the principal investigator (PI) reviewed vaccine rates in rural Georgia counties and found that the HPV vaccine rate was less than 18% [13].

Georgia has the highest estimated rate of new cancer cases, including cervical cancer, in the southeastern United States [14]. Despite prevention measures, cervical cancer rates are rising [15]. After the United States Food and Drug Administration (FDA) approved the HPV vaccine in 2006, several studies of parental acceptance of the HPV vaccine noted that acceptance was associated with two factors: (1) parents' knowledge of, attitude toward, and trust in healthcare providers; and (2) parents' belief in a causal relationship between HPV infection and cervical cancer [16,17]. But these studies focused on parents with daughters only. Nonetheless, the results imply that parents' resistance to vaccinating daughters against HPV is attributable in large part to concerns that it will lead to or encourage early sexual activity, promiscuity, or irresponsibility [18,19]. This initial suggestion has been refuted by current research showing no link between getting the HPV vaccine and behavioral disinhibition [19–22]. The research findings by the Advisory Committee on Immunization Practices support the premise that limited information about sexual and reproductive health in rural communities can foster mistrust among parents and, as a consequence, may contribute to healthcare disparities [16,23–25]. Although populations in rural areas may be more static and stable, they are not immune to HPV infection.

Recent evidence suggests that HPV vaccine series initiation among boys may be as low as 2% nationally, and this rate is likely to be much lower in rural areas, as the series initiation rate among females in rural Georgia is barely half the national average [26,27]. The limited time since the approval of the HPV vaccine for boys has precluded accurate measurement of series initiation rates among males in rural Georgia. Further, at the initiation of our study, no research had investigated HPV vaccine acceptance by parents/caregivers of boys in rural areas. Therefore, in November 2010, after the FDA approved the HPV vaccine for boys, we began collecting data on parents/caregivers with sons and subsequently their willingness to vaccinate their sons and daughters with the HPV vaccine.

We focused our research on parents with both girls and boys living in the rural isolated counties of Burke, Lincoln, and Screven counties in Georgia, where the rates of HPV-related cancers (e.g., cervical cancer and cancers of the head, neck, and throat) are higher than those in urban areas, and the confluence of social determinants of health is discrete from urban areas [14]. This decision was made because most research on parents' acceptance of the HPV vaccine was completed before the vaccine was licensed, and it focused predominantly on women living in accessible urban areas because the original focus was on preventing cervical cancer [23,28–30]. Thus, our research focuses on parents in rural communities whose children are at disproportionately high risk for HPV-related disease and inadequate healthcare. Because earlier studies on parents' acceptance of the HPV vaccine did not include rural residents, our study fills a large gap in scientific knowledge. We hypothesized that we would find marked differences by race or ethnicity among these rural parents who chose to vaccinate or intended to vaccinate their boys and girls aged 9 to 13 years. Using the theoretical concepts in the Health Belief Model, we hypothesized that there would also be differences in the perceived severity of HPV infection, perceived vulnerability to HPV infection, perceived benefits of HPV vaccination, and perceived barriers to HPV vaccination [31].

Methods

We used a descriptive cross-sectional design, surveys, and quantitative analysis. The participants were parents or caregivers of children aged 9 to 13 years old residing in rural areas and attending elementary or middle school during the 2009–2011 school years. The study's sample size was based on the number of children enrolled in the elementary and middle schools in three rural isolated counties (Burke, Lincoln, and Screven counties in Georgia) that have a low median income and with an enrollment of at least 50% African Americans. Table 1 shows the student enrollment in these schools (not the exact number of parents who would qualify to participate) and the numbers of surveys collected from parents who qualified to be included in the survey. To be included in the survey, respondents had to be a parent or primary caregiver (such as a foster parent or relative) responsible for girls or boys aged 9 to 13 years. They also had to reside in the counties of interest, speak and read English, and be at least 18 years of age.

Study procedures

Our study was conducted from September 2009 through April 2011. Because school superintendents understood the importance of this study and the requirements of the Family Educational Rights and Privacy Act, school superintendents kept all parent and student information anonymous [37]. The PI met with each school principal to explain the study and its implementation, and had many face-to-face meetings and phone conferences with school superintendents, school principals, community leaders (e.g., church pastors), parents, and school nurses. All were given detailed information about the study, and they gave written letters of support to the PI [32,33].

After meeting with school superintendents, principals, and school nurses, the PI met with each school's clerical staff to explain the study procedures. The PI explained the recruitment guidelines and criteria for parents to be included in the study and gave clerical staff an example of the information letter for parents. This information letter included the study's purpose, instructions on how to participate, a description of an incentive to participate (gift card to a local grocery store), information on Emory University's institutional review board, and contact

Table 1
Enrollment and parental surveys completed: Study of human papillomavirus vaccine uptake in three rural Georgia counties, 2009–2011

County	Enrollment	Surveys completed
Burke	780	230
Screven	380	176
Lincoln	307	113
Total	1,467	519

information for the PI. In addition, flyers approved by Emory University's institutional review board were posted at the participating schools before data collection.

Events at which data were collected differed from school to school and from county to county; they included Parent-Teacher Association meetings, athletic events, parent-teacher conference days, holiday functions, and concerts. If parents decided to participate, they were directed to a private area and handed a copy of the information letter for parents so they could review information and make the decision to complete the survey or decline to take it. A trained research assistant using computer-assisted personal interviewing survey software on a laptop computer asked parents the questions and entered their answers into the computer-assisted personal interviewing software program [34].

Measures

The theoretical framework guiding this study was selected because it was developed to study behaviors related to vaccination. The Health Belief Model (HBM) identifies determinants of health-related behavior for a specific health behavior, like vaccinating a child. In addition, the HBM postulates four factors that account for health-related behavior: perceived vulnerability to a threat (like HPV infection), perceived severity of HPV infection or consequences of not being vaccinated, perceived benefits of being vaccinated, and perceived barriers to being vaccinated (Figure 1) [31]. Using the HBM, we developed survey items to assess relevant constructs in the model. The survey, the Parental HPV Survey, was validated by using 28 Likert scale coded responses (1 = disagree to 5 = agree) for the parents of 200 girls. The results of the Parental HPV Survey validation and reliability analyses, which are being published elsewhere [35], yielded an overall Cronbach's alpha of .957: .80 for perceived vulnerability, .89 for perceived severity, .85 for perceived benefits, and .92 for perceived barriers (Table 2).

After the survey items were validated, we collapsed the 200 responses into dichotomous responses of 0 = no/disagree and 1 = yes/agree so they could be merged with the data collected later. For the rest of the surveys, we offered only one of two possible responses (yes or no; agree or disagree). This decision to dichotomize the responses was based on the pattern distributions observed in responses of parents of the initial 200 girls. In addition, two items were added to the later version of the survey, and two somewhat redundant items related to cost and expense were merged. This merged dataset of 519 (200 from the validation survey and 319 later) has 25 items instead of the original 28. Table 2 lists the final items for each of the four constructs and compares Cronbach's alphas (which are also the Kuder-Richardson-20 measures of internal consistency for dichotomously scored items) between the original Likert scale dataset for 200 girls and the updated merged dichotomously scored dataset for the final 519 [36,37]. So, theoretically, the higher the score on the subscale (perceived vulnerability to HPV infection, perceived severity of HPV infection, perceived barriers to HPV vaccination, and perceived benefits to HPV vaccination), the more likely the parent had vaccinated the child or would vaccinate the child.

Dependent variables

Vaccine uptake was measured by one survey item with a dichotomous response that asks whether the parent/guardian had his or her child vaccinated (or was in the process of completing the three-shot vaccine series) or intended to have his or her child vaccinated (Yes) or not (No).

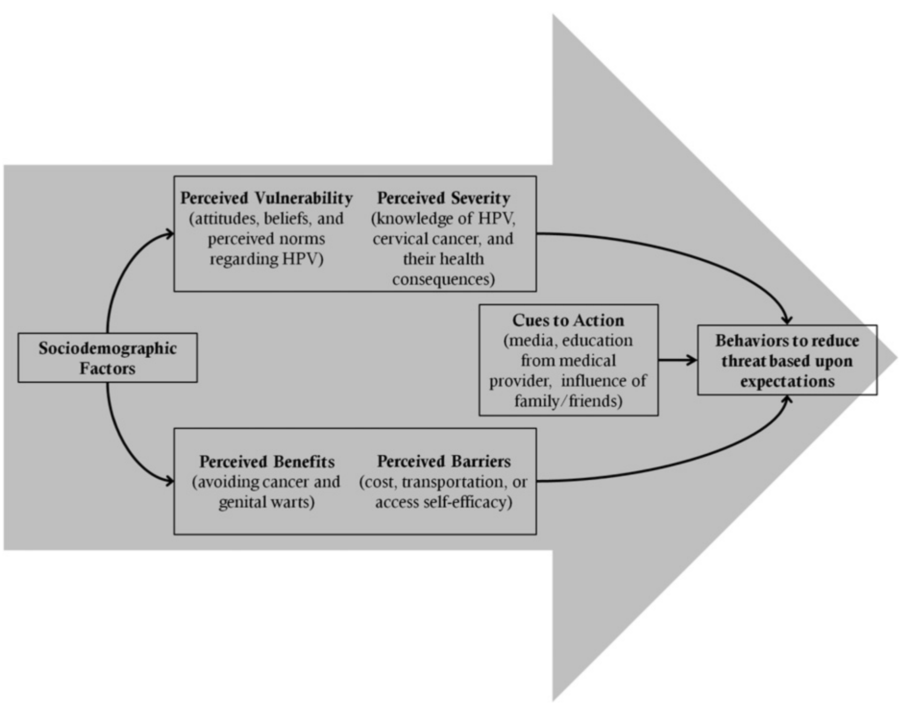

Figure 1. Health belief model with parental human papillomavirus (HPV) survey item examples mapped to constructs that predict HPV vaccination: Study of HPV vaccine uptake in three rural Georgia counties, 2009–2011.

Table 2
Items and reliability coefficients of four theoretical constructs in the parental human papillomavirus (HPV) survey: Study of HPV vaccine uptake in three rural Georgia counties, 2009–2011

Theoretical construct • Specific items (responses coded 0 = no/disagree; 1 = yes/agree)	Original scale validation 5-point Likert scale (reference, n = 200)	Total (N = 519)	Lincoln (n = 113)	Screven (n = 176)	Burke (n = 230)
Perceived vulnerability	.80	.613	.332	.667	.618
• HPV is a sexually transmitted disease					
• Using condoms can prevent HPV					
• Genital warts are caused by HPV					
• People with HPV might not have symptoms					
• HPV makes you unable to have children					
Perceived severity	.89	.610	.495	.637	.624
• I worry that my child might get HPV					
• HPV can cause cervical cancer					
• Treatment for HPV is painful					
• Required vaccinations protect children from getting disease from unvaccinated children					
• I understand exactly what the HPV vaccine is for					
• Having genital warts makes it very difficult to find a sexual partner					
Perceived benefits	.85	.574	.130	.647	.639
• Children should only get vaccinated for serious diseases					
• I am more likely to trust vaccinations that have been around awhile					
• Vaccinations are getting better all the time because of research					
• Healthy children do not need vaccinations					
• A vaccine against HPV could prevent future problems for my child					
• Giving my child a new vaccine is like performing an experiment on them					
• Most people I know think vaccinating children with the HPV vaccine before they are teenagers is a good idea					
• A teenager should be able to get the HPV vaccination without a parent's consent					
Perceived barriers	.92	.532	.424	.627	.549
• If this new HPV vaccine was available when my child (daughter) was an infant, they would be vaccinated against HPV infection					
• Shots are very painful for my child so I would rather not vaccinate him/her					
• If the new HPV vaccine is not required, I will not vaccinate my child (daughter)					
• I understand that the HPV vaccine is very expensive so I will not vaccinate my child[a]/I think that even if the vaccine is expensive I will be able to vaccinate my daughter[b]					
• Generally I do what my doctor recommends so I will vaccinate my child (daughter)					
• When I make a decision to vaccinate my child my mind is made up[a]/When I decide to get my daughter vaccinated I believe I will be able to get her vaccinated; in other words, I feel confident I can get my daughter vaccinated[b]					

[a] Wording used in the study whose results are presented here.
[b] Wording used in the original validation study completed through the support of the Robert Wood Johnson Foundation.

Independent variables

Summary scores were calculated for each of the four subscales (constructs) as the percentage of agree/yes items out of the total number of items in each subscale. For example, a perceived vulnerability score of 40 indicates that the individual agreed with two of the five items in this subscale. These survey item scores were examined as potential correlates for parents' intention to have children aged 9 to 13 vaccinated with the HPV vaccine. These four constructs or subscale scores were summarized and divided for comparison by the two response groups: parents intending to or having had their children vaccinated (Yes) and parents who do not intend or have not had their children vaccinated (No).

Data analysis

Before analysis, all data were reviewed for completeness, outliers, and violation of assumptions. Descriptive statistics were calculated for all variables, with sample sizes and missing data noted. Parents who intend to or have had their children vaccinated were compared with parents who do not intend or have not had their children vaccinated. The demographics and construct scores of the three counties were also compared. We used *t* tests and analysis of variance F tests for all continuous variables and χ^2 tests for all categorical variables. Demographic variables with significant *t* test, F test, or χ^2 test results relative to vaccination outcome as well as the four HBM constructs were included in a final logistic regression model. The final logistic regression model used a two-step sequential process using likelihood ratio variable selection methods to down-select the best set of predictive measures within each of two blocks: an initial block for the significant demographic variables followed by a second block of the four HBM constructs.

Limitations and difficulties in conducting the study

Phase 1 data collection through mailed surveys in the fall 2009 produced lower than expected results. Parent and school official feedback implied that parents mistrusted calling into a 1–800 number and answering even an anonymous survey over the phone. So, the PI gave health promotion presentations in local churches to increase visibility and community engagement. In Phase 2 data collection methods, during spring 2010 of the 2009–2010 school year, data collection procedures were modified to include face-to-face interaction, pen-and-pencil surveys, and the choice to complete the survey on a secured research laptop. Although the response rate was only 35% based on student enrollment in the elementary and middle schools of the target counties, this rate is likely an underestimate, inasmuch as student enrollment figures do not directly equate to the exact number of parents qualified to participate (Table 1). In addition, other studies have also noted that rural areas have close-knit social networks, which exert a significant influence on adaptation of health promotion activities [38,39]. However, mistrust of healthcare providers and new healthcare interventions persist, particularly among African Americans in rural areas [40].

Results

The final dataset has data on 519 subjects. Sample sizes for each variable are in Tables 3 and 4 along with all summary statistics for the total sample and for each of the two groups defined by whether parents indicated that they would get their child the HPV vaccine.

Demographic results yielded the following: parents or caregivers who completed the surveys were mostly female (82.0%), African American (77.3%), and self-identified as Baptist (76.4%). Most had a family income of less than $30,000.00 annually (61.0%) and were married (56.8%) (Table 3). Parents or caregivers who completed the surveys were aged from 19 to 89 years: 41 years on average (SD = 9.97). The children whose parents or caregivers completed the PHPV survey were 11.4 years old on average (SD = 1.48). Households represented in the survey had from no to seven girls in the family: 1.8 girls on average (SD = 1.02); from no to 6 boys: 1.0 boys on average (SD = .78) (Table 4)

Of the 519 parents who completed the survey, 343 (66.1%) indicated that they will not or had not vaccinated their child, 169 (32.6%) indicated that they will or had vaccinated their child, and 7 (1.3%) did not respond to this question. Parents intending to or having had their children vaccinated (yes) had more boys ($t = -2.16$, $df = 509$, $p = .03$) (Table 4), were mostly mothers ($\chi^2 = 5.25$, $df = 1$, $p = .02$), not African American ($\chi^2 = 25.81$, $df = 1$, $p < .001$), not Baptist ($\chi^2 = 41.79$, $df = 1$, $p < .001$), and better educated ($\chi^2 = 13.71$, $df = 1$, $p < .001$) (Table 3).

Overall average agreement scores were as follows: perceived vulnerability 40.4% (SD = 31.4), perceived severity 45.6 (SD = 29.1), perceived benefits 43.8 (SD = 24.9), and perceived barriers 32.9 (SD = 23.7). The only significant difference between the vaccination and no-vaccination groups was in perceived barriers ($t = -2.304$, $df = 510$, $p < .001$) (Table 4). Table 5 shows that the vaccination rate was highest in Burke county (46.1%), followed by Screven (32.2%) and Lincoln (8.0%) counties. These rates appear to be associated with the significant differences between the counties' cultural and demographic makeup. Burke had the lowest percentage of African Americans and Baptists, fewest girls per household, and most boys per household. Burke County also had the highest percentage of parents at the higher levels of education and income as well as more parents who were married or in long-term relationships. Each county had significant differences with regard to sex of parent surveyed, sex of child vaccinated, and parent's age. Similarly, the counties had significant differences in scores on the subscales of perceived vulnerability, perceived severity, and perceived benefits (Table 6). However, Lincoln's vaccination rate was so low (8.0%) that this county's data may not be sufficient to adequately test trends in vaccination for these variables.

The final logistic regression model further investigated the relationship between the demographic variables, the four HBM constructs, and whether a parent had or intended to vaccinate their child. Numbers of boys per household, and parent's age, race, religion, and level of education were all significantly associated with whether a parent had or intended to have a child vaccinated (Tables 3 and 4). These five variables were considered in the first block of the regression model using forward likelihood ratio variable selection to retain the best predictors in this block. All four HBM constructs (or subscales) were considered in the second block of the logistic regression model using forward

Table 3
Parental demographics (overall and by parents' intention to vaccinate) study of human papillomavirus (HPV) vaccine uptake in three rural Georgia counties, 2009–2011

	Total		Child vaccinated				χ^2 test	Point estimate Odds ratio (ref category) [95% CI]
			(No)		(Yes)			
	n	%	n	%	n	%		
Sex of parent								
Male	92	18.0	71	20.7	21	12.4	$\chi^2 = 5.258$, $df = 1$, $p = .022$	1.84 (female) [1.09, 3.11]
Female	420	82.0	272	79.3	148	87.6		
Sex of child								
Male	123	24.0	81	23.6	42	24.9	$\chi^2 = .095$, $df = 1$, $p = .758$	.94 (female) [.61, 1.44]
Female	389	76.0	262	76.4	127	75.1		
Race								
African American	395	77.3	287	83.9	108	63.9	$\chi^2 = 25.816$, $df = 1$, $p < .001$	.34 (African American) [.22, .52]
Other	116	22.7	55	16.1	61	36.1		
Religion								
Baptist	389	76.4	289	85.0	100	59.2	$\chi^2 = 41.797$, $df = 1$, $p < .001$	.26 (Baptist) [.17, .39]
Other	120	23.6	51	15.0	69	40.8		
Education level								
Some high school or High school	297	58.2	218	63.9	79	46.7	$\chi^2 = 13.719$, $df = 1$, $p < .001$	2.02 (some college+) [1.39, 2.94]
Some college	213	41.8	123	36.1	90	53.3		
Income level							$\chi^2 = .605$, $df = 1$, $p = .437$ (≤$30K vs. >$30K)	1.16 (>$30K) [.80, 1.70]
$15,000 or less	142	28.3	95	28.4	47	28.1		
> $15,000 to $30,000	164	32.7	113	33.8	51	30.5		
> $30,000 to $45,000	80	16.4	62	18.6	20	12.0		
> $45,000 to $60,000	56	11.2	28	8.4	28	16.8		
> $60,000 and greater	57	11.3	36	10.8	21	12.6		
Marital status								
Married or long term relationship	291	56.8	191	55.7	100	59.2	$\chi^2 = .561$, $df = 1$, $p = .454$	1.15 (married/LTR) [.79, 1.68]
Single, divorced or widowed	221	43.2	152	44.3	69	40.8		
Know someone who has had an STD								
Yes	198	44.0	130	45.3	68	41.7	$\chi^2 = .540$, $df = 1$, $p = .462$	.86 (Yes) [.59, 1.28]
No	252	56.0	157	54.7	95	58.3		

Table 4
Family demographics and four theoretical constructs, by parents' intention to vaccinate: Study of human papillomavirus (HPV) vaccine uptake in three rural Georgia counties, 2009–2011

	Total		Child vaccinated				*t* test	Mean difference [95% CI]
			(No)		(YES)			
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)		
Parent's age	495	40.98 (9.97)	325	40.99 (10.22)	164	41.15 (9.61)	$t = -.169$, $df = 487$, $p = .866$	−.16 [−2.05, 1.72]
Child's age	418	11.39 (1.48)	288	11.36 (1.49)	128	11.45 (1.47)	$t = -.511$, $df = 414$, $p = .609$	−.08 [−.39, .23]
Number of female children	517	1.79 (1.02)	342	1.79 (0.98)	169	1.75 (1.09)	$t = .489$, $df = 509$, $p = .625$	.05 [−.14, .24]
Number of male children	517	1.00 (.78)	342	.95 (.67)	169	1.11 (.96)	$t = -2.165$, $df = 509$, $p = .031$	−.16 [−.30, −.02]
Four constructs								
Perceived vulnerability	513	40.4 (31.4)	338	41.5 (31.9)	169	38.7 (30.6)	$t = .938$, $df = 505$, $p = .349$	[−3.05, 8.61]
Perceived severity	516	45.6 (29.1)	341	44.4 (29.8)	169	48.5 (27.8)	$t = -1.545$, $df = 357.065$, $p = .123$	[−9.41, 1.13]
Perceived benefits	516	43.8 (24.9)	341	43.5 (25.8)	169	44.8 (23.2)	$t = -.577$, $df = 368.506$, $p = .564$	[−5.78, 3.15]
Perceived barriers	518	32.9 (23.7)	343	28.9 (23.1)	169	40.3 (22.8)	$t = -2.304$, $df = 510$, $<.001$	[−15.72, −7.22]

likelihood ratio variable selection after adjustment for the demographic measures retained in Block 1.

Race and religion were the best two demographic predictors within the first block (Table 7) and had large effect sizes with odds ratios greater than 2. After adjustment for race and religion (which are still significant with large odds ratios, Block 2 Table 7), perceived benefits and perceived barriers were both significant constructs (correlates) for vaccination. Adding these two constructs to the model did improve the prediction of HPV vaccination (Block 2 $\chi^2 = 20.231$, $df = 2$, $p < .001$). It should be noted that although perceived benefits score was significant ($p = .025$) the odds ratio (.988) was less than 1, which is not intuitive, given that the average perceived benefits score for parents who had/will get their child vaccinated (44.8) was higher than for parents who had not/will not get their child vaccinated (43.5) (Table 4). However, these group differences were not significant ($p = .564$, Table 4) when considering perceived benefits by itself. In the logistic regression model, the odds ratio for perceive benefits was significant ($p = .025$) only conditional upon (adjusting for) the effects of race, religion, and perceived barriers. Although significant, the effect size for perceived benefits, an odds ratio of .988, is minimal—a 1% increase in perceived benefits only reduces the probability of a parent getting their child the vaccine by (1 - .988)*100% = 1.2 %, which is a very small effect size. It should also be noted that when considered by itself without any covariates or other predictors, the odds ratio for perceived benefits in the logistic regression model is 1.002 and is not significant ($p = .577$), which agrees with the results presented in Table 4.

Discussion

Recent evidence suggests that HPV vaccine series initiation among girls is still low nationally, 48%, and for boys may be as low as 2% nationally, and this rate is likely to be much lower in rural areas, inasmuch as the series initiation rate among females in rural Georgia is barely half the national average [26,27]. Several factors combine to make protecting ethnic minorities (especially those living in rural areas) from HPV-related infection a public health priority: (1) the increasing number of people from ethnic minority populations living in the United States; (2) their high rates of cervical cancer; and (3) the increasing prevalence of HPV-related cancers among men [10].

To eliminate HPV-related cancers through HPV vaccination, it is essential to recognize the factors involved in parents' decision whether to permit their children to get the HPV vaccination [13,41]. Most research on parents' acceptance of the HPV vaccine was completed before the vaccine was licensed, and that research focused predominantly on women living in urban areas because the original focus was on preventing cervical cancer [23,28–30]. Although the findings from these studies are valuable, they cannot be assumed to show how willing rural parents with preadolescent and adolescent girls or boys would be to have their children get the vaccine. Furthermore, women from minority ethnic populations residing in rural areas have cervical cancer at disproportionately higher rates than do white women [42–44]. It is well documented that large populations of African Americans and Hispanics in the United States experience healthcare disparities and have limited access to basic primary care, which limits their opportunities to get an HPV vaccination [17,45–47]. Researchers of rural parents found that the parents who experience healthcare disparities have children who also experience healthcare disparities, especially in reproductive health [48,49]. In communities where healthcare disparities exist, study results imply that African-American parents may have lower acceptability of the HPV vaccine than do other racial

Table 5
Demographics and intention to vaccinate, by county: Study of human papillomavirus (HPV) vaccine uptake in three rural Georgia counties, 2009–2011

	Lincoln (n = 113)	Screven (n = 176)	Burke (n = 230)	Test for differences
Intend to vaccinate (yes)	8.0%	32.2%	46.1%	$\chi^2 = 49.650$, $df = 2$, $p < .001$
Parent's sex (male)	36.3%	7.4%	16.6%	$\chi^2 = 39.724$, $df = 2$, $p < .001$
Child's sex (male)	32.7%	9.7%	30.0%	$\chi^2 = 29.347$, $df = 2$, $p < .001$
Race (African American)	100.0%	81.8%	62.7%	$\chi^2 = 62.990$, $df = 2$, $p < .001$
Religion (Baptist)	100.0%	74.7%	66.2%	$\chi^2 = 48.410$. $df = 2$, $p < .001$
Education (≤ high school grad)	86.7%	51.7%	48.9%	$\chi^2 = 48.902$, $df = 2$, $p < .001$
Income (< $30K per year)	72.1%	60.8%	56.0%	$\chi^2 = 8.093$, $df = 2$, $p < .017$
Marital status (married/LTR[a])	45.1%	49.4%	68.6%	$\chi^2 = 23.082$, $df = 2$, $p < .001$

[a] Long-term relationship.

Table 6
Family demographics and four theoretical constructs, by county: Study of human papillomavirus (HPV) vaccine uptake in three rural Georgia counties, 2009–2011

	Lincoln (n = 113)	Screven (n = 176)	Burke (n = 230)	Test for differences
	Mean (SD)	Mean (SD)	Mean (SD)	
Parent's age	42.2 (11.5)	38.1 (7.7)	42.6 (10.3)	F = 11.242, *df* (2,494), $p < .001$
Child's age	11.5 (1.5)	11.4 (1.6)	11.3 (1.4)	F = .587, *df* (2,417), $p = .556$
Number of female children	2.0 (1.1)	2.0 (.9)	1.6 (1.0)	F = 8.880, *df* (2,516), $p < .001$
Number of male children	.9 (.3)	.9 (.8)	1.1 (.9)	F = 6.993, *df* (2,516), $p = .001$
Four constructs				
Perceived vulnerability	55.2 (25.1)	29.1 (29.8)	41.5 (32.3)	F = 26.149, *df* (2,512), $p < .001$
Perceived severity	58.1 (22.5)	38.6 (28.8)	44.7 (30.4)	F = 16.478, *df* (2,515), $p < .001$
Perceived benefits	55.4 (15.7)	36.1 (25.7)	43.9 (25.9)	F = 22.340, *df* (2,515), $p < .001$
Perceived barriers	31.6 (20.8)	32.5 (25.4)	33.8 (23.8)	F = .359, *df* (2,517), $p = .698$

groups [50]. However, there still remains a significant lack of empirical data on the predictors of HPV vaccine acceptance or refusal across racial groups in rural areas [50,51].

We found that in these isolated rural counties, parents had low levels of HPV knowledge, as reflected by low scores on perceived vulnerability to HPV infection and perceived severity of HPV infection. Existing literature on perceived benefits of the HPV vaccine also implies that knowledge about the vaccine, and specifically what it is used for, are essential to drive vaccine uptake [52]. Corroborating other studies, we found that encouragement from spouses or partners increases vaccine uptake [53,54]. However, our results did not indicate that "what others might think" was a barrier for those who chose not to vaccinate. This is an important finding for providers practicing in remote or isolated counties, where social norms play an important role in when or where families obtain access to healthcare [50].

After adjustment for race and religion, we found that perceived benefits and perceived barriers were significant predictors of vaccination for both girls and boys. This finding is similar to the findings of other studies that identify perceived benefits as a strong predictor of HPV vaccination, and these parents and young adults understood exactly what the HPV vaccine was for and had access to healthcare services or a healthcare provider [55,56].

Most pediatricians face the daily challenge of working with families that are cautious or unconvinced about the safety of any vaccine. But with HPV vaccine uptake so low in rural areas, healthcare providers have a unique opportunity to focus on parents and caregivers who deem vaccines as safe and necessary for the health of their children. Current literature supports the significance of parent/child discussions as a way to educate both parents and children about HPV transmission and the poor outcomes associated with HPV infection, a medium that can be used by providers to effectively increase HPV vaccination during interactions with parents and adolescents [57]. The ethnic, religious, educational, and cultural makeup of three rural counties in this study also appeared to be highly associated with HPV vaccination rates for both boys and girls, and awareness of the role of these social, geographic, and cultural factors can help promote the effectiveness of providers' discussions with parents and adolescents.

Zacharyczuk [58] urges primary care practitioners to use a multifaceted approach to increasing vaccine uptake, and this may be particularly important in rural isolated populations. Our findings support this approach and indicate that perceived benefits and barriers are enmeshed with both race and religion when rural parents make the decision to vaccinate their preadolescent or adolescent with the HPV vaccine. Thus, we recommend a screening protocol for parental perceived benefits of HPV in conjunction with evaluating parents' perceived vulnerability or perceived severity in order to facilitate provider-parent discussions and increase vaccine uptake. Before to seeing the healthcare provider, support staff can screen patients to ascertain

Table 7
Logistic regression model: Study of human papillomavirus (HPV) vaccine uptake in three rural Georgia counties, 2009–2011

Measure	Block 1			Block 2			[95% CI]
	β	SE β	Odds ratio (*p* value)	β	SE β	Odds ratio (*p* value)	
Race[a,b] (0 = African American; 1 = other)	.748	.236	2.113 (.002)	.683	.239	1.980 (.004)	[1.239, 3.165]
Religion[a,b] (0 = Baptist; 1 = Other)	1.116	.230	3.054 (<.001)	.979	.236	2.663 (<.001)	[1.677, 4.229]
Perceived benefits (higher % agree Items)				−.012	.005	.988 (.025)	[.978, .999]
Perceived barriers[b] (higher % agree Items)				.024	.005	1.024 (< .001)	[1.013, 1.035]
Constant	−1.165	.125	.312 (< .001)	−1.413	.233	.244 (< .001)	
Block χ^2, *df* (*p* value)	48.564, 2 (< .001)			20.234, 2 (< .001)			
Model χ^2, *df* (*p* value)	48.564, 2 (< .001)			68.798, 4 (< .001)			
−2 log likelihood (−2LL)	593.602			573.368; [deviance $\chi^2 = 20.234$, $df = 2$, $p < .001$]			
Nagelkerke R	.128			.177			
Correctly classified	68.0%			71.4%			

Stepwise selection (forward likelihood ratio method) used to select variable to keep within each block.
Block 1: Demographic variables: number of male children, parent's gender, race, religion, education.
Block 2: Four theoretical constructs: perceived vulnerability, severity, benefits, barriers.
AA = African American; CI = confidence interval; *df* = degrees of freedom; *p* = probability; SD = standard deviation; *t* = Student's *t* test.
[a] Religion and race were significantly associated (85% of Baptists were African American; 52.1% of other religions were African American; $\chi 2 = 57.032$, df = 1, $p < .001$).
[b] Perceived barrier scores were significantly lower for African American (AA) than for other races: (AA: mean = 31.4 (SD = 23.9); other races: mean = 38.2 (SD = 22.1); $t = -2.749$, $df = 515$, $p = .005$) and for Baptists (Baptists: mean = 31.2 (SD = 3.2); other religions: mean = 39.1 (SD = 24.0); $t = -3.262$, $df = 513$, $p = .001$).

their HPV knowledge, their familiarity with HPV vaccine, and their access to healthcare resources for vaccination. Armed with that information (and personal knowledge of previous patient-provider interactions), healthcare providers can begin educating parents about HPV transmission, HPV-related cancers, and HPV vaccination for both girls and boys.

A good time to begin a discussion about HPV with parents is when other mandated vaccines such as hepatitis B are being given to their children. To be successful, however, healthcare providers must respect the parents' cultural, religious, and moral views, which theoretically predict their likelihood of accepting or rejecting the HPV vaccine. By focusing on perceived barriers and benefits and on parents' level of knowledge about HPV, healthcare providers can have frank conversations with parents in order to facilitate the parents' informed decision making about the HPV vaccine. Building bonds of trust through open discussion can have a substantial effect on the health of pediatric patients in rural areas by reducing their risk for HPV-related cancer as adults.

Many children and adolescents raised in rural communities are poor and may not have access to social, economic, or educational opportunities to develop self-worth and independence [59–63]. This lack can put them at risk for HPV infection because they seek social status in other ways, including sexual risk taking. Healthcare providers serving these children and adolescents face constant challenges to ensuring that their patients receive all the vaccinations they need. Discussions about HPV vaccination with parents must be thorough and must address parents' fears that stem from inadequate information and misinformation. Experts agree that the parents who refuse vaccines (not only the HPV vaccine) cite safety and efficacy concerns as primary reasons to refuse any vaccine [51]. Ultimately, the decision to vaccinate lies in the hands of the parent or caregiver. However, when parents of children aged 9 to 13 years who reside in underserved rural areas seek primary healthcare, the healthcare provider should take the opportunity to discuss the HPV vaccine with the parents, taking into consideration the parents' religious beliefs and level of education. Such discussions, if conducted well and as often as needed, would increase HPV vaccine uptake. Future health policy should include HPV vaccination as one of the routine series of preadolescent and adolescent vaccinations for both girls and boys.

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