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Black mother's intention to vaccinate daughters against HPV: A mixed methods approach to identify opportunities for targeted communication

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Abstract

Objective.—The cervical cancer disparity continues to exist and has widened between Black and non-Hispanic White women. Human Papillomavirus (HPV) vaccines could potentially reduce this disparity, yet remain under-used among Black female adolescents. We investigated psychosocial and cultural factors associated with Black mothers' intentions to vaccinate their daughters against HPV, and explored views toward a HPV vaccine mandate.

Methods.—In this quantitative dominant, mixed methods study, cross sectional surveys ($n = 237$) and follow-up semi-structured interviews ($n = 9$) were conducted with Black mothers of daughters. A 2-step logistic regression determined factors associated with Black mothers' intention. Thematic content analysis determined emerging themes.

Results.—Perceived susceptibility ($p = .044$), perceived barriers ($p < .001$), and subjective norms ($p = .001$) were significant predictors of maternal HPV vaccination intentions. Follow-up interviews provided insight into factors influencing mothers' intentions. Mothers with low intentions did not perceive their daughter to be currently sexually active or in near future, thus, not

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Data statement

Due to ethical considerations, supporting data cannot be made openly available. Participants did not consent to data sharing of the anonymized survey data.

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Conflict of interest statement

The authors declare there are no conflicts of interest.

at HPV risk. Pediatricians were identified as the most influential person on maternal decision-making if there was a pre-existing relationship. However, many mothers had not received a pediatricians' recommendation for their daughters. Barriers influencing mother's decision-making include knowledge, daughters' age, and mistrust in pharmaceutical companies and physicians. Mothers were not in favor of the HPV vaccine mandate.

Conclusions.—Findings demonstrate the need to develop and evaluate physician-led interventions on HPV and vaccine importance, and engage these mothers in intervention development to build trust between physicians, researchers, and Black mothers to improve HPV vaccine uptake in Black female adolescents.

Keywords

Cervical cancer; Health disparities; HPV; HPV vaccine; Health promotion; Mixed methods

1. Introduction

The Human Papillomavirus (HPV) is the most common sexually transmitted infection [1] associated with significant adverse sequelae [2]. While women do not bear a higher incidence of HPV infection compared to men [3], there is a higher burden of some HPV-related diseases with cervical cancer being the most common [4]. Black women are disproportionately impacted in incidence and mortality from cervical cancer compared with non-Hispanic White women [5]. The vaccine, Gardasil 9, is a primary prevention tool against HPV. Similar to other populations, vaccination rates among Black female adolescents lag significantly behind the national recommendation of 80% of female adolescents completing the regime [6]. In 2015, Black female adolescents compared with non-Hispanic White female adolescents were slightly higher in initiation (66.9% vs. 65.9%) and completion (40.8% vs. 37.1%) rates. This warrants great concern as vaccination rates in Black adolescents are substandard compared to the national recommendation of 80%. This leaves many female adolescents susceptible to cervical cancer [7].

Barriers to vaccination in adolescents include parental knowledge, attitudes, and beliefs surrounding HPV and the vaccine [8–12]. The impact of culture on HPV vaccination has been explored inconsistently [13–15], leaving incongruent findings and unanswered questions. Religiosity, collectivism, racial pride, present-time orientation, and future-time orientation are important cultural variables expressed by Black women in urban environments (see Table 1 for description) [16]. However, no studies have examined the influence of these cultural components on Black parents' mothers' vaccination intention, the key decision-makers in their daughter's vaccination status [8].

The purpose of this mixed methods study was to examine the role attitudes (perceived susceptibility, perceived severity, perceived benefits, perceived barriers), subjective norms, and distal variables (culture: spirituality, culture: collectivism, culture: racial pride, culture: present-time orientation, culture: future-time orientation, HPV knowledge, personal experience, and information sources) have on Black mothers' HPV vaccination intentions. Research questions were: (1) What factors predict Black mothers' intentions to vaccinate their girls aged 9 to 12 years against HPV?; and (2) How do the factors identified in the

quantitative phase influence maternal intentions to get their girls aged 9 to 12 years vaccinated? The overall objective is to identify intervention targets for culturally-relevant, theory-based interventions to increase HPV vaccination rates in Black female adolescents.

2. Materials and methods

2.1. Conceptual framework

Theory of Reasoned Action (TRA) [17] and Health Belief Model (HBM) [18] were adapted as the conceptual framework for this study. TRA posits if a mother has high or positive intentions to vaccinate her daughter against HPV, she has increased likelihood to vaccinate. Mothers' attitudes toward HPV vaccination and their social normative perceptions of their daughter being vaccinated influence their intentions. TRA further suggests distal variables (i.e., culture: spirituality, culture: collectivism, culture: racial pride, culture: present-time orientation, culture: future-time orientation, demographics, personal experience, HPV knowledge, and information sources) indirectly influence intention through attitude and social norms [17].

HBM explains the likelihood a mother will get her daughter vaccinated against HPV. This theory suggests mothers are more likely to vaccinate if: they perceive their daughter is susceptible to HPV, long-term outcomes (e.g., cervical cancer) of HPV are severe, and perceived benefits of vaccinating one's daughter against HPV outweigh perceived barriers [18]. These constructs reflect the attitudinal component of the TRA.

2.2. Research design

We employed a sequential, explanatory mixed methods design to investigate factors associated with Black mother's intentions to vaccinate their daughters against HPV. Researchers first collected and analyzed quantitative data (survey), then used the results to design a follow-up qualitative phase (semi-structured interviews) to explain initial quantitative results [19]. The University of Alabama at Birmingham Institutional Review Board approved this study.

2.3. Research site and participants

This study was conducted in Alabama where cervical cancer rates (i.e., incidence and mortality) are higher than the national average, and Black women have higher rates compared with non-Hispanic White women [20]. Mothers were defined as primary caregivers (care for and make medical decisions) to their children. Inclusion criteria were: (1) female, (2) Black, (3) have a daughter aged 9 to 12, and (4) Alabama resident. Community sites (i.e., churches, pediatric clinic, children sports events, sorority meetings) identified in the literature and community gatekeepers (i.e., pastors, lead pediatrician(s), coaches, and chapter presidents) [21,22] helped recruit a convenient sample. Participants for the qualitative phase were mothers who: (1) met the survey inclusion criteria; (2) completed the survey; and (3) agreed to participate in follow-up interviews.

2.4. Quantitative (phase 1)

2.4.1. Study design—We used a cross-sectional, mixed mode (online and face-to-face) survey design to administer the Human Papillomavirus Vaccination Survey for Black Mothers with Girls Aged 9 to 12 (HPVS-BM) [23]. Surveys were distributed in-person or online if one lacked time or requested a survey link for circulation. Initial low survey response rates resulted in statewide survey distribution, resulting in collecting 280 surveys.

2.4.2. Survey development—HPVS-BM was developed using items and scales designed to explore the TRA and HBM constructs in the literature. Questions were adapted and validated using content expert review, cognitive interviews, and pilot testing. Content review was used to ensure content of survey items were accurate and valid. This process was a two-phased process involving 7 reviewers. Reviewers first qualitatively evaluated item content and structure, then they qualitatively rated the items on the degree of importance. A content validity ratio was calculated using quantitative results, and those items with a 0.60 or higher were retained. Two rounds of cognitive interviews (5 participants each) were conducted with Black mothers with daughters between the ages of 9 to 12. These interviews provided insight on survey directions, questions, and format. Last, the pilot testing was conducted among 43 Black mothers (18 face-to-face; 25 online) to ensure instructions and questions were comprehensible and determine psychosocial properties of the instrument. Collectively, these processes ensured the instrument was theoretically and culturally-relevant to our target population. A full description of the survey development process can be found at Cunningham-Erves et al. [23].

2.4.3. Measures—Section one contained questions on parental demographics (education, age, income, marital status, zip code, race, number of children), child demographics (ages of daughters between 9–12, oldest daughter between 9–12, daughters' insurance coverage (e.g., All Kids-“low cost health insurance for children under 18”), type of information received on HPV vaccine, and most trusted information source for HPV vaccine. Other questions include mother's personal experience with HPV. Section two consisted of questions on theoretical constructs (intention, knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, subjective norms, culture: present-time orientation, culture: future-time orientation, culture: collectivism, and culture: spirituality). These eleven measures are summarized in Table 2 along with internal consistency reliability of each measure.

2.4.4. Data collection and analysis—Community settings were contacted for survey distribution via a community liaison. On the day of issuance, participants provided written consent. Prior to analysis, a series of recodes were conducted. For example, HPV vaccination intention was recoded into positive or high intention (likely to vaccinate or already vaccinated), and negative or low intention (did not plan to or unsure about vaccination). Mean scores was calculated for scales used in analysis. Ineligible participants and participants with missing data ($n = 43$) were removed for a final sample of 237. Of these, fourteen surveys were collected online and 223 were collected face-to-face. Chi-square and independent samples t -test analyses identified factors associated with mother's intention. To identify predictors of HPV vaccination intention, significant factors identified

in the chi-square and independent samples t-test analyses were entered into a 2-step logistic regression [24]. In Step 1, demographic variables (daughter's age and type of information) that served as control variables were included in the benchmark logistic regression model to estimate the influence of demographic variables on the probability of intention. In Step 2, theoretical constructs (culture: future-time orientation, perceived susceptibility, perceived barriers, perceived benefits, and subjective norms) were included in the model to capture the added influence of the theoretical framework on the probability of intention. A p -value $< .05$ was considered statistically significant. Statistical Package for Social Sciences (SPSS) version 19 software was used to analyze the data.

2.5. Qualitative (phase 2)

2.5.1. Interview protocol development—To obtain a deeper understanding of Black mothers' views toward HPV vaccination, significant factors from Phase 1 were used to inform the interview questions. The design of the 11-item interview protocol further explored Black mothers' HPV vaccination intentions informed by TRA and HBM constructs significant and non-significant in the quantitative phase. Table 3 provides examples of how we transformed quantitative survey items into qualitative interview questions. Additionally, we wanted insight on mothers' views toward a HPV vaccine school mandate as deemed important in context of the research problem, which was not explored in the quantitative phase. The interview protocol was pilot tested with three participants from the quantitative phase.

2.5.2. Data collection—We conducted semi-structured interviews with nine of 20 mothers purposefully selected from the quantitative phase: five with higher intentions and four with lower intentions. The other 11 mothers selected for interviews either opted not to participate or could not be contacted. The first author, who is trained in qualitative research, conducted the semi-structured interviews via phone if mothers provided consent and time availability. Interviews were audio-recorded and notes taken by the researcher.

2.5.3. Data analysis—Audiotaped interviews were transcribed verbatim. Two researchers, including the first author, coded transcripts independently using inductive thematic analysis [25]. The research team reviewed the transcripts and researcher's notes to assist with generation of codes and themes. We established inter-coder agreement at the recommended 90% [25]. Within-case and cross-case analyses were used to better understand the role of different factors within and across two intention groups [26]. Final themes and codes were organized in a matrix to display mothers' views related to their intent for vaccinating their daughters [26]. Analysis was conducted using NVivo version 10 software. Thick, rich descriptions augmented reporting qualitative results [25].

3. Results

3.1. Characteristics of the population

Many mothers had a college or post-graduate degree (40.5%), a daughter with health insurance (96.3%), and income less than \$40,000 (56.5%). Thirty-five years was the median age for mothers. Over a third of mothers had an experience with HPV. A higher percentage

of mothers had lower intentions toward vaccination (56% either did not plan to vaccinate, or were unsure about vaccination) than higher intentions (44% either likely to vaccinate, or had already vaccinated).

3.2. Quantitative results

3.2.1. Participant characteristics by vaccination intention—Table 4 reports participant characteristics by vaccination intention. There was a significant difference in vaccination intention by type of information mothers received ($n = 237$, $p < .001$) and daughters age ($n = 237$, $p = .018$). Mothers reported lower vaccine intentions for their daughters aged 10 (31.6%) compared to those with daughters aged 9 (20.3%). Mothers who received both positive and negative or mostly negative information had lower intentions to vaccinate (42.1%) compared to those who had not heard anything (25.6%). There was no significant differences in vaccination intention by mother's age ($n = 237$, $p = .622$), income ($n = 237 = 1$, $p = .752$), personal experience with HPV ($n = 237 = 1$, $p = .257$), education ($n = 237$, $p = .622$), daughter's health insurance status ($n = 237$, $p = .287$), and preferred information source ($n = 237$, $p = .074$) (see Table 4).

3.2.2. Theoretical constructs by HPV vaccination intention—Results of independent samples *t*-test yielded significant differences between HPV vaccination intention and *Perceived Susceptibility*, *Perceived Benefits*, *Perceived Barriers*, *Subjective Norms*, and *Culture: future-time orientation*. Mothers with higher *Perceived Barriers* scores had low HPV vaccination intention ($p < .001$), while parents with higher *Perceived Susceptibility*, *Perceived Benefits*, *Subjective Norms*, and *Culture: future-time orientation* scores had high HPV vaccine intention ($p = .007$, $p = .001$, and $p < .001$, respectively). These variables were entered into the logistic regression model to assess the predictive power of factors influencing mother's intention (Table 5).

3.2.3. Logistic regression results—In Step 1 of the logistic regression analysis, heard positive information was associated with intention ($OR = 4.42$, $p < .001$). In Step 2, perceived susceptibility ($OR = 1.52$, $p = .044$), perceived barriers ($OR = 0.26$, $p < .001$), and subjective norms ($OR = 2.10$, $p = .001$) were associated with intention (see Table 6). To gain further insight into the role these factors play in vaccination decision-making for Black mothers with different intentions, qualitative interview data were collected and analyzed in Phase 2 of the study.

3.3. Themes - qualitative findings

Seven qualitative themes with related subthemes, as guided by TRA and HBM, emerged for each participant and across participants in two intention groups. Of the seven themes, the paper will highlight four themes. The themes reflect the factors found significant in the quantitative phase—interpersonal influences, perceived susceptibility, and subjective norms. We also describe the theme, perceptions of vaccine uptake recommendations and a mandate, which was explored in the qualitative phase only. In this paper, we do not discuss the non-significant themes (role of knowledge, personal experiences, and cultural influences) since: (1) they were insignificant in the quantitative phase, and (2) we only explored these factors to gain a better understanding of their insignificance.

3.3.1. Interpersonal influences (subjective norms)—Majority of mothers (five out of nine) cited their child's physician as the main influence on their vaccination decision. Mothers with high intentions (three out of five) had positive relationships with their daughters' physician. Other mothers with high intentions were awaiting a recommendation from their daughter's pediatrician before getting their daughters vaccinated. Two mothers with high intentions reported the influence of family and friends as well as community members. Those with low intentions did not trust their child's doctor (two out of four) or did not receive a physicians' recommendation (two out of four). Overall, these mothers were influenced in their decision-making by individuals they trusted and had established relationships. The majority of these mothers had close relationships with their daughters' physicians, and perceived they would not recommend anything that would harm their daughters.

3.3.2. Barriers of vaccine—All mothers reported barriers to HPV vaccination; however, they cited different barriers. Lack of or limited knowledge was commonly mentioned by mothers; yet, those with high intentions still planned to vaccinate their daughters whereas those with low intentions needed more information. For information source, many had not received information about the vaccine from their daughter's pediatrician or did not trust the information from them. Furthermore, some mothers (two with low intentions and three with high intentions) did not want information from pharmaceutical companies due to mistrust. Mothers' knowledge on research involving human subjects and pharmaceutical products created mistrust in receiving information from pharmaceutical companies and physicians, indirectly influencing their intentions.

Only one of the four mothers with low intentions accepted the Advisory Committee on Immunization Practices age recommendation of 11–12 years for HPV vaccination [27], whereas all mothers with high intentions accepted it although believing their daughters were not sexually active. Another barrier cited by all mothers was unknown effects of the vaccine. Mothers felt the vaccine was new and its long-term risks unknown.

Two mothers, one with low intentions and one with high intentions, indicated “employment influence” as a potential barrier. A mother with low intentions worked as a research assistant. She found the vaccine did not cover strains affecting Black women. Another mother worked in a clinical setting, receiving positive information on the HPV vaccine. Yet, she had concerns about the vaccine's safety. These experiences made mothers knowledgeable about HPV and the vaccine, indirectly influencing their vaccination intentions.

3.3.3. Perceived susceptibility—Susceptibility, the third most common theme, emerged among mothers with high intentions (five out of nine). All mothers recognized children in general were becoming sexually active at younger ages and perceived them at HPV risk. However, four mothers with low intentions did not perceive their daughters susceptible to HPV since they were not sexually active. They believed they could revisit vaccination later. Ultimately, mothers with low intentions did not believe their daughters were susceptible to HPV, while those with positive (high) intentions recognized their daughters could be at risk.

3.3.4. Vaccine uptake recommendations—This theme highlights mothers' views on the recommended age for vaccination and a HPV vaccine mandate. Two mothers with high intentions perceived the age recommendations and a HPV vaccine mandate ensures all school children are protected. However, four mothers (three with high intentions, one with low intentions) believed a HPV vaccine mandate impinges upon their parental rights and religious beliefs. Mothers felt they should make this decision for their child. Also, mothers felt they could not support the recommended age or school mandate for vaccination because of their limited knowledge of the vaccine. Two mothers varying in intentions believed more information on the vaccine could change their views. For age recommendation, one mother with high intentions felt it was better to vaccinate her daughter prior to getting older and able to participate in the decision-making. All mothers except two differing in intentions did not understand the rationale for the age recommendation. Hence, they perceived their daughters were too young to get vaccinated.

4. Discussion

This study yielded insightful findings about factors influencing Black mothers' intentions to vaccinate their daughters against HPV and views of a HPV vaccine mandate. Similar to past research, a strong recommendation from their daughters' pediatrician is the most important facilitator in their decision-making around their daughter getting the vaccine [21], and the most preferred information source [28]. However, some mothers had not received information on the HPV vaccine from their daughter's pediatrician, creating apprehension in vaccinating their daughters. Lack of a physicians' recommendation for Black adolescents to get the HPV vaccine is prominent in the literature [8,29]. Other influential factors to emerge were family, friends, and spiritual leaders. Past research indicates that the approval of family and friends plays a role in vaccinating adolescents for HPV [30].

Susceptibility was also a significant predictor of Black mothers' vaccination intentions. All mothers with low intentions did not perceive their daughters to be sexually active or at HPV risk. They felt their daughters were "normal" and would not be sexually active in the near future. Mothers with high intentions felt their daughters were susceptible to HPV, yet had different views on the age they would become susceptible. Similar studies, inclusive of Black parents, found increased perception of a child contracting HPV increases likelihood of them getting vaccinated [12].

Last, we found perceived barriers influenced mother's intentions. Particularly, daughter's age and sexual activity status, maternal knowledge deficiencies, and lack of or mistrust in a physician's recommendation were commonly expressed. Mothers, particularly those with low intentions, did not understand the rationale for the recommended age being 11–12 years. They did not perceive their daughter to be sexually active then or in the near future. In contrast, mothers with positive (high) intention did perceive their daughters could be at HPV risk. There are literature surrounding age recommendation of the vaccine and "sexually active" status of adolescents as barriers to HPV vaccination is inconsistent [11,31]. Improving parents' understanding of the rationale for the recommended age of HPV vaccination is a possible mechanism to improve HPV vaccine rates [32].

All mothers demonstrated knowledge deficiencies about the vaccine on different levels. Mothers with low intentions either heard a lot or too little information about the vaccine, which influenced their intentions. Mothers with high intentions received basic information about HPV and the vaccine (e.g., HPV causes cervical cancer and the vaccine prevents against cervical cancer). Similarly, Constantine and Jerman identified knowledge deficiencies on HPV, and the vaccine and its' side effects as predictors of HPV vaccine acceptance in a sample of parents in Western U.S. [33]. Past research indicates improving knowledge alone does not improve HPV vaccine rates [34,35]; hence, educational interventions may not be enough.

Some mothers indicated lack of or mistrust in a physicians' recommendation and pharmaceutical companies, creating vaccine hesitancy and/or low intentions to vaccinate. Research suggests mistrust in physicians and pharmaceutical companies delay vaccination [8,36]. Findings are not surprising as poor research experiences have a long-standing influence on Black participation in research and use of "new" products created by research [15].

Vaccine uptake recommendation was explored in the qualitative phase only. Majority of mothers, except two with low intentions, accepted the recommended vaccine age of 11–12 years with limited knowledge of the rationale. However, only two mothers (one with high intentions and one with low) supported the HPV vaccine mandate. Majority perceived the school requirement impinging on parental rights, or they lacked information to support policy development. Similarly, Ferris, Horn, & Waller reported majority of parents not supporting the HPV vaccine mandate [37].

4.1. Implications

We offer several points of intervention to improve Black mothers' intentions to vaccinate their daughters. It is important to develop and implement interventions driven by pediatricians (subjective norms), engaging Black mothers in discussion surrounding HPV and the vaccine. Similar to past studies, effective parent-clinician communication (e.g., a discussion promoting HPV vaccination as standard care) should occur [10]. Interventions should include education on adolescent sexual behaviors and the rationale for HPV vaccination at the recommended ages of 11 to 12 years. This should improve parental perceived susceptibility of their daughter to HPV. This is important since all mothers with low intentions in our study perceived their daughters were: (1) not susceptible to HPV due to sexual inactivity; and (2) too young for vaccination. Furthermore, parents need information on the vaccines' purpose, "active" ingredients, benefits, and side effects to address perceived barriers to HPV vaccination.

Similar to Horn et al. [38], strategies should build trust between parents, physicians, and pharmaceutical companies. During strategy development, all key stakeholders (e.g., parents and adolescents) should be engaged for community buy-in as patient/community engagement is an effective strategy in promoting a health behavior [39]. These strategies address the most salient factors, laying the foundation for parents to feel more confident with these individuals. This could benefit their daughters' health long-term.

Although culture was not statistically significant in influencing vaccination intention, all mothers were worried about the future of their daughters' health (i.e., cultural component: future-time orientation) through differential lens. Mothers with high intentions wanted to protect their daughter against cancer in the future, and mothers with low intentions were concerned about the future of their daughter's health after getting vaccinated. This is unsurprising as literature suggests cultural concerns relating to the vaccine should be addressed during patient-provider discussions [40]. Pediatricians should monitor safety data provided by the vaccine adverse event reporting system to inform parents of any adverse reactions and the rate at which they occur. These strategies could potentially alleviate mothers' concerns regarding the HPV vaccine and improve vaccine intentions and uptake.

4.2. Limitations

This study is not without limitations. We used a convenience sample of Black mothers; thus, findings cannot be generalized outside Alabama. We did not focus on males who are key players in HPV transmission. The survey was self-report, possibly indicative of self-report and social desirability biases. There is also potential for response bias. Mothers may not fully be aware of this topic; therefore, they may not fully understand the purpose of HPV vaccination. Personal history related to HPV was measured as personal history for self and others. Hence, it can be driven by an experience not the mother's own. Use of the sequential mixed methods design creates a time lapse between quantitative and qualitative phases, possibly accounting for low-response rate in the qualitative phase. Furthermore, survey response rates were not monitored due to online and in-person distribution.

5. Conclusion

Future research should validate the study findings by enrolling a larger number of Black mothers across other geographical areas to compare and refine factors influencing mothers' intentions. They should also include adolescent males and then compare these results with other ethnic groups to ensure the study results are not common across other groups. These studies can inform healthy policy recommendations to improve utility of the HPV vaccine among Black female adolescents. Ultimately, we believe the steps and strategies utilized to address Black mothers' intentions for HPV vaccination are reliable and can be successfully replicated on other disparities-related research topics.

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Abbreviations:

HPV	Human Papillomavirus
HPVS-BM	Human Papillomavirus vaccination survey for black mothers with girls aged 9 to 12

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HIGHLIGHTS

- Mothers misunderstand the link between HPV and cancer.
- Majority of mothers did not support a HPV vaccine mandate.
- Mothers need information on vaccine safety and age recommendations.
- A physicians' recommendation is the primary influence on vaccination intention.
- Findings suggest fostering engagement of mothers to create HPV vaccine education programs.

Table 1

Cultural dimensions of the African American community.

Source: Lukwago, Kreuter, Bucholtz, Holt, Clark,, 2001.

Dimension	Description
Religiosity	"A range of dimensions from church attendance and prayer to participation in religious ceremonies, spirituality, and beliefs about God as a causal agent"
Collectivism	"The belief that the basic unit of society is the family or group, not the individual"
Racial pride	"Holding positive attitudes about one's race"
Present-time orientation	"A person's tendency to think and act according to consequences that are primarily immediate"
Future-time orientation	"A person's tendency to think and act according to consequences that are more distal"

Table 2

Summary of measures.

Scale	Theory	# of items	Scale measurement	Derivation of score	Cronbach's alpha (α)
Intention	TRA	1	Binary	n/a	n/a
Subjective norms	TRA	5	5-pt Likert Scale based on Likelihood	Mean score	0.85
Perceived susceptibility	HBM	4	5-pt Likert Scale based on agreement	Mean score	0.86
Perceived severity	HBM	3	5-pt Likert Scale based on agreement	Mean score	0.84
Perceived benefits	HBM	4	5-pt Likert Scale based on agreement	Mean score	0.84
Perceived barriers	HBM	10	5-pt Likert Scale based on agreement	Mean score	0.78
Culture: present-time orientation	TRA	4	4-pt Likert Scale based on agreement	Mean score	0.86
Culture: future-time orientation	TRA	5	4-pt Likert Scale based on agreement	Mean score	0.70
Culture: collectivism	TRA	5	4-pt Likert Scale based on agreement	Mean score	0.85
Culture: spirituality	TRA	9	4-pt Likert Scale based on agreement	Mean score	0.90
Knowledge	TRA	10	True/False/Unsure	Mean score	0.75

Note: A greater intent of mothers to vaccinate their daughters against HPV is indicated by higher scores. TRA stands for Theory of Reasoned Action and HBM stands for Health Belief Model.

Table 3

Examples of developing interview questions from survey results.

Applied theory	Construct	Sample survey (Quan) item	Sample interview (Qual) protocol item
TRA	Distal variable (knowledge)	Only women get HPV.	What do you know about HPV and cervical cancer?
TRA	Distal variable (personal experience)	Have you, or anyone close to you, ever had HPV, an abnormal Pap smear (pap test), genital warts, and/or cervical cancer?	What personal experiences have you had with HPV?
TRA	Subjective norms	If your doctor recommends the HPV vaccine, how likely is it that your child will get it?	How have other people you know influenced your decision to vaccinate/not vaccinate your daughter against HPV?
TRA	Distal variable (culture)	I often think about how my actions today will affect my health when I am older.	What role, if any, has your cultural experience played in your decision to vaccinate/not vaccinate your daughter against HPV?
TRA	Perceived barriers	I don't trust the information on the HPV vaccine provided by the physician.	What challenges, if any did you/do you face when deciding to vaccinate/not vaccinate your daughter now?
TRA	Perceived benefits	The HPV vaccine is a good way to protect my daughter's health.	In your opinion, what benefits, if any, would there be by to vaccinate/not vaccinate your daughter against HPV?

Note: TRA stands for Theory of Reasoned Action and HBM stands for Health Belief Model.

Table 4

Differences in demographics by HPV vaccination intention.

	Negative HPV vaccination intention (did not plan to or unsure about vaccination)	%	Positive HPV vaccination intention (likely to vaccinate or already vaccinated)	%	p-Value
Mother's age					
19–39	78	58.6	64	61.5	.652
40+	55	41.4	40	38.5	
Daughter's age					
9	27	20.3	35	33.7	.018*
10	42	31.6	19	18.3	
11	33	24.8	19	18.3	
12	31	23.3	31	29.8	
Income					
\$40,000	74	55.6	60	57.7	.752
\$40,001	59	44.4	44	42.3	
Personal experience					
Yes	53	39.8	34	32.7	.257
No/I don't know	80	60.2	70	67.3	
Mother's education					
GED/high school	31	23.3	30	28.8	.622
Some college (1–3 years)	46	34.6	34	32.7	
College (4+ years)/post-graduate	56	42.1	40	38.5	
Insurance of daughter					
Medicaid/all kids	70	55.1	49	48.0	.287
Health insurance through guardian	57	44.9	53	52.0	
Type of information					
Mostly positive	43	32.3	60	57.7	<.001*
Positive & negative/mostly negative	56	42.1	34	32.7	
Haven't heard anything	34	25.6	10	9.6	
Preferred information source					
Physician	103	77.4	90	86.5	.074
Other	30	22.6	14	13.5	

Note: Statistical significance was set at $p < .05$, and statistically significant differences are denoted with an asterisk (*).

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Table 5

HPV vaccination intention and associated theoretical factors: independent samples *t*-test.

Characteristic	HPV intention						<i>t</i>	<i>p</i> -Value
	High intention			Low intention				
	M	SD	n	M	SD	n		
Knowledge	0.57	0.28	104	0.51	0.31	133	1.408	<i>p</i> = .161
Perceived susceptibility	2.38	0.88	104	2.08	0.75	133	2.729	<i>p</i> = .007 *
Perceived severity	3.93	0.91	104	3.88	0.85	133	0.478	<i>p</i> = .633
Perceived benefits	3.78	0.75	104	3.46	0.68	133	3.382	<i>p</i> = .001 *
Perceived barriers	2.42	0.57	104	2.83	0.50	133	-5.821	<i>p</i> < .001 **
Subjective norms	3.73	0.79	104	3.12	0.77	133	5.988	<i>p</i> < .001 **
Culture: collectivism	3.37	0.55	104	3.24	0.49	133	1.828	<i>p</i> = .069
Culture: spirituality	3.36	0.52	104	3.28	0.50	133	1.181	<i>p</i> = .239
Culture: present-time orientation	1.62	0.64	104	1.68	0.62	133	-0.715	<i>p</i> = .475
Culture: future-time orientation	3.16	0.47	104	2.97	0.46	133	3.052	<i>p</i> = .003 *

Note: Statistical significance was set at *p* < .05, and statistically significant differences are denoted with an asterisk (*). Statistical significance was set at *p* < .01, and statistically significant differences are denoted with an asterisk (**). Low intention refers to those who did not plan to or unsure about vaccination while High intention are those who are likely to vaccinate or already vaccinated.

Table 6

Logistic regression predicting self-reported mothers' HPV vaccination intention of daughters aged 9 to 12 years

Characteristic	Odds ratio (OR)	Wald	<i>p</i>	Confidence interval
<i>Model 1</i>				
Demographic				
Daughters age				
9 years	1.17	0.18	.675	0.561, 2.44
10 years	0.49	3.27	.071	0.230, 1.06
11 years	0.53	2.50	.114	0.243, 1.16
12 years	Ref			
Type of information				
Heard positive information	4.42 *	12.489	<.001	1.934, 10.08
Heard negative information	2.01	2.660	.103	0.868, 4.66
Haven't heard anything	Ref			
<i>Model 2</i>				
Daughters age				
9 years	1.00	0.00	.991	0.423, 2.339
10 years	0.50	2.47	.116	0.206, 1.190
11 years	0.50	2.40	.121	0.204, 1.204
12 years	Ref			
Type of information				
Heard positive information	2.41	3.52	.061	0.962, 6.061
Heard negative information	2.06	2.27	.132	0.804, 5.283
Haven't heard anything	Ref			
Distal variable				
Culture: future-time orientation	1.79	2.70	.100	0.894, 3.562
Attitude				
Perceived susceptibility	1.52 *	4.05	.044	1.011, 2.287
Perceived benefits	1.08	0.10	.749	0.663, 1.772
Perceived barriers	0.26 *	13.66	<.001	0.129, 0.533
Subjective norms	2.10 *	10.25	.001	1.333, 3.302

Note. OR indicates the likelihood of high intentions of vaccinating their daughter against HPV. Significant predictors are $p < .05$ (*).