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Health Care Decision Making by Mothers for their Adolescent Daughters Regarding the Quadrivalent HPV Vaccine

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Abstract

Study Objective—In this study we sought to understand the predictors of a mother's decision (behavior) to vaccinate her daughter with the initial dose of the HPV vaccine.

Design—This prospective, cross sectional study involved a convenience sample of 68 mother-daughter dyads recruited to test the hypothesis that the Theory of Planned Behavior (TPB) variables (attitudes toward vaccine, perception of others' opinions, and perceived difficulty in obtaining vaccine) would explain a mother's decision to consent for her daughter to receive the first dose of the HPV vaccine.

Main outcome measures—Mothers and daughters independently completed survey instruments that measure the variables of the TPB (attitude, subjective norms, and perceived behavioral control). Instruments also included measures of parenting style and conflict.

The study was registered with [clinical trials.gov](http://clinicaltrials.gov) NCT00807898

Conflict of Interest

Dr Hertweck is a speaker for Merck Pharmaceutical.

Results—The mother’s intention to vaccinate was predicted by her attitude ($B=.41$, $p<.001$), subjective norms ($B=.33$, $p=.002$) and perceived behavioral control ($B=.24$, $p=.005$). The pathway connecting intention to the decision (yes or no) to vaccinate was significant ($B=.41$, $p<.001$). Squared multiple correlations for intention and decision, respectively, were .68 and .12. The mothers who chose to vaccinate their daughter did not differ on any of the demographic variables from those who chose not to vaccinate but had had significantly different scores on attitude, subjective norms, and intention but not perceived behavioral control.

Conclusions—The TPB model demonstrates potential influences on a mother’s intention to choose to initiate the HPV vaccination series for her daughter. Influences of attitude, subjective norms and perceived control are potential targets for interventions and tailored social marketing to improve vaccine acceptance

Keywords

Human Papillomavirus vaccine; Medical decision making; Theory of Planned Behavior

Introduction

Human papillomavirus (HPV) is the causative agent for cervical cancer. Since 2006 a quadrivalent (HPV4) vaccine for young women 9–26 years has been available to protect against four types of human papillomavirus (HPV; Types 6, 11, 16 and 18), and to prevent some types of cervical cancer. Similarly since 2009, a bivalent HPV vaccine has been available to prevent cervical cancer due to HPV types 16 and 18. When the vaccine is given to young women less than 18 years of age, parental permission is required. The permission is usually provided by the young woman’s mother¹. Although The Advisory Committee on Immunization Practices (ACIP) recommends an HPV vaccine for routine immunization of females 11 through 12 years of age,² vaccination rates continue to be low.^{3, 4}

Understanding predictors of a mother’s behavior (i.e., decision for her minor daughter to receive the initial HPV vaccine) will inform interventions that seek to increase the number of young women who receive the vaccine. Health behavior theories, such as the Theory of Planned Behavior (TPB), indicate factors and mechanisms that predict health decisions and activities. The TPB indicates that behavioral intentions directly determine behavior⁵. In this study, for example, a mother’s intention for her daughter to receive the vaccine directly predicts her behavior, i.e., the decision for her daughter to receive the vaccine. Intentions are determined by integrating attitudes about the consequences of behavior, subjective norms regarding perceived social pressure to perform or not perform a certain behavior, and perceived behavioral control regarding how difficult performing the behavior would be and if the behavior is perceived to be under the person’s control. A mother’s intention to choose HPV vaccination for her daughter is the primary determinant of the adolescent receiving the HPV vaccine and the mother’s intentions are determined by her behavioral, normative, and control beliefs.⁶

Therefore, how does a mother make the decision for her daughter to receive the vaccine? (Figure 1) First, the mother must be aware of the benefits of the vaccine⁷. Though mothers may hear about the vaccine from drug company advertisements, news stories, brochures,

family, friends, and schools, the source of information that most frequently leads to vaccination is when information related to vaccine comes from a health care provider⁸. This information helps to formulate the mother's behavior attitude. Subjective norm, or the idea that family and friends would find the vaccination to be acceptable, is another important factor impacting the mother's decision to vaccinate her daughter.⁹⁻¹¹ A third factor influencing the decision is the mother's perceived difficulty of getting the vaccine for her child..

We hypothesize that the Theory of Planned Behavior (Behavioral attitude, subjective norm and perceived control) will explain a mother's behavior, i.e., decision to choose the initial HPV vaccine for her daughter and by use of targeted questionnaires in conjunction of an assessment of vaccination status we will can evaluate what TPB variables predict a mother's decision to choose the first HPV vaccine for her daughter.

Materials and Methods

This prospective and cross sectional study included mothers and their adolescent daughters between the ages of 13 and 17 years to study the hypothesis that the Theory of Planned Behavior would explain a mother's intention and behavior (i.e., decision to vaccinate) regarding her adolescent daughter and the HPV vaccine. Inclusion criteria included a signed consent of a mother and an assent of her 13–17 year old daughter, being English speaking, having not previously received the HPV vaccination series and non-pregnant status of the adolescent. Adolescents older than 18 are emancipated to make independent health decisions (dependent upon insurance status) and were not included in the study.

Sample and Procedures

A sample size of 68 mother-daughter dyads was chosen to ensure sufficient power to detect a medium effect size ($f^2 = .15$) with $\beta = .20$ and $\alpha = .05$ in the primary hypothesis. We postulated that the three primary variables of the TPB would be moderately correlated with the intention to vaccinate.

The first 78 mother daughter pairs to meet inclusion criteria were enrolled in the study. This convenience sample was recruited from two sources. The first recruitment source consisted of new patients to a pediatric and adolescent gynecology practice. New patients were contacted by telephone by the research project coordinator to determine interest in study participation and to determine eligibility before their health care visit. The research project coordinator met with interested qualifying mothers at their provider visit and obtained adolescent assent and maternal consent. The second source consisted of maternal-daughter pairs recruited by an advertisement placed in *U of L Today*, a daily e-newsletter that is sent to all University of Louisville students, staff, and faculty. Mothers interested in study participation and who met eligibility requirements were sent email copies of assents and consents to sign. The study was approved by the university's Human Subjects Protection Program...

Surveys used established instruments (Gerend Acceptability Scale, Gerend Intention Scale, Parenting Style Index) and contained questions to measure aspects of TPB (attitudes,

subjective norms, perceived behavioral control) as well as questions to assess parenting style, and conflict resolution and were administered on a computer to mothers and daughters. A description of the instruments used in survey and what aspects of TPB they assessed is included in Table 1. Examples of questions that assess for each variable of TPB are listed in Table 2.

In the medical practice, the mother and daughter completed respective questionnaires concurrently in a private consultation room, under direct observation by a graduate research assistant. Given the sensitive nature of some of the questions, it was determined that respondents should be allowed to skip items that made them uncomfortable. A chart review in conjunction with follow up phone calls was conducted six months after the initial survey to determine whether the vaccine decision had been made and if the daughter had begun the vaccine sequence. Both the mother and the daughter were paid a stipend of \$25.00 (total of \$50.00 for both) for answering questions.

For the mothers and daughters who were recruited from the community, each completed surveys separately using customized links via an internet survey company (Survey Monkey). Participants were asked to avoid discussing survey content, until each had completed their portion of participation. The mothers and daughters could also choose to answer paper instruments. These were collected by research assistants, and entered into Survey Monkey, in order to maintain consistency in format, during data analysis. Telephone calls were made six months after the survey was completed to determine vaccine status.

Data analysis

To answer which variables predict a mother's decision to choose the HPV vaccine for her adolescent daughter, path analysis was performed in two steps (Figure 1). In the initial step, following the TPB model, the mother's responses to behavioral attitude, subjective norms, and perceived behavioral control were linked to intention and then intention and perceived behavioral control was linked to the behavior (HPV vaccine), and co-variances of the variables were assessed. Two error variables were included as well to capture additional variance in intention and behavior. Fit indices were checked for the model and the standardized coefficients were captured. Analysis of variance was used to answer the second research question related to differences between mothers who chose and did not choose the HPV immunization.

Results

Seventy-eight mother-daughter dyads were evaluated, six were from the private practice office and the remainder recruited from U of L today advertisement. Because of variations in the data set, adolescent data available for evaluation included 5 of the six adolescents from the private population and 67 from general U of L recruitment. Adult data available for evaluation included 5 of 6 from the private population and 69 from the general U of L recruitment.

In both groups, the mothers (mean age=44 years) were mainly white (74%) or black (22%), all were at least high school educated, and most were married (65%). Their daughters (mean

age =15 years) were mainly in grade 9 or lower (70%), and 35% reported being in a relationship. Ninety percent of subjects had private insurance.

Table 3 lists the questions and average responses that measure maternal intention, attitude, subjective norms, and behavioral control.

At the six month follow-up, 16 mothers chose to vaccinate their daughter and 49 chose not to vaccinate. Whites were just as likely to receive the vaccine as non-Whites (Chi-square = .39, $p=.74$). There was no significant difference in age between those who accepted the vaccine and those who did not ($f(1, 61) = 1.57, p=.22$). Both completed similar years of education (2 to 4 years of post high school education). There was no association between type of insurance and choice to vaccination (chi-square = 1.24, $p=.74$), religion preference (mode was Christian; chi-square = 4.47, $p=.61$) or employment (mode was full-time employment; chi-square = 4.31, $p=.23$).

Table 4 compares their average scores of the theory of planned behavior variables (e.g., Behavior Attitude, Subjective Norms, and Perceived Behavioral Control). Due to missing data, only 65 subjects had all of the information necessary to calculate the four aggregate scores used in the path analysis models. List-wise deletion of subjects with missing data was completed before final analysis.

Mothers who did and did not choose for their daughter to have the vaccine had significantly different scores on attitude, subjective norms, and intention but not perceived behavioral control.

The mother's intention to vaccinate was predicted by her behavior attitude ($B=.41, p<.001$), normative beliefs ($B=.33, p<.001$) and perceived behavioral control ($B=.24, p<.001$). The pathway between intention and the decision was significant ($B=.41, p<.001$), while perceived behavioral control did not directly influence the decision ($B=-.13, p>.20$). The basic path analysis (see Figure 2) was a good fitting model (CMIN/DF=.87; RMSEA=.000).

A second structural equation model (Figure 3) was constructed to test whether parenting style and dyad relationship variables further influenced intention to vaccinate. Two subscales from the Parenting Style Index (involvement and psychological autonomy granting (PAG) and two from the Interaction Behavior Questionnaire (appraisal of daughter and appraisal of the dyad) were added to the initial model. Pathway coefficients between these four subscales and Intention to choose to vaccinate were assessed. None of these additional factors further predicted intention beyond the three TPB variables: Involvement ($B=-.02$) psychological autonomy granting ($B=.06$), appraisal of daughter ($B=.04$) and appraisal of dyad ($B=-.14$), although the model remained good-fitting (CMIN/DF=.796, RMSEA=.000).

Discussion

This research is the third study that has utilized the TPB in acceptability of the HPV vaccine. It is the first study to assess the TPB variables with the actual decision to initiate the vaccine sequence. Further, this study examines interpersonal factors relating to the dyad that might

have influenced the decision. Our results indicate that the Theory of Planned Behavior useful in explaining decision to vaccinate and the mother's attitudes and beliefs predict the intention and final decision.

Askelson and coworkers utilized the TPB to evaluate physicians' willingness to vaccinate girls against HPV and the importance of subjective norms and perceived behavioral control. In that study, a random survey of 207 physicians was completed. Intention to vaccinate was driven by subjective norms as provided by guidelines or standards of practice by important professional and general referent groups and perceived behavioral control thus indicating that public health efforts to encourage physicians to adopt the human papillomavirus vaccine should focus on subjective norms such as those provided by professional organizations¹².

Another study by Askelson assessed mothers' intentions to vaccinate their daughters against HPV using the TPB along with examining the mother's experience with sexually transmitted infections (STIs), beliefs about the vaccine encouraging sexual activity, and perception of daughters' risk for HPV and their relationship to intention. This study included a random sample of mothers in a rural Midwestern state to whom a survey was mailed regarding their intent to vaccinate. Similar to our data, both attitudes and subjective norms were strong predictors of a mother's intention to vaccinate. Interestingly, in that study, mother's risk perceptions, experience with STIs, and beliefs about the vaccine encouraging sexual activity were not related to intention. Unfortunately, mothers' perceptions of the daughter's risk were surprisingly low¹³. This may have reflected a lack of education on the mother's behalf regarding the high prevalence of HPV and/or its connection to cervical and other cancers.

Our study adds to the data on TPB in determining vaccine acceptability. In addition to surveying questions to assess mother's behavior, we also have data regarding which patients did ultimately receive the vaccine. This information indicates that the mother's intention to vaccinate was predicted by her higher behavior attitude, normative beliefs and perceived behavioral control, whereas, the decision to vaccinate was not well explained by perceived behavioral control and intention. This study serves to corroborate the findings of Askelson that in order to facilitate HPV vaccination we need to explore ways to influence mothers' attitudes and to uncover the referent groups to which mothers refer for vaccination behavior.

A weakness of our study is the limited and convenience population that was surveyed. It is also possible that study results could vary if our sample size had been large enough to analyze responses by subgroup. For example, are mothers of particular age or ethnic group of adolescent girls more influenced by a specific TPB or relationship variable? It would be helpful to have subgroup information so that future marketing could be tailored for effectiveness by subgroup. Future research studies should include a larger sample size.

In conclusion, the theory of planned behavior model demonstrates multiple potential influences on a mother's decision to choose to initiate the HPV vaccination series for her daughter. All influences of behavior, societal norms and perceived control are potential targets for family teaching interventions and tailored social marketing. This is the first study to use TPB to compare mother's intention to vaccinate with the actual vaccination initiation.

Further study will be needed to determine how well this model applies to various family types, diverse cultures and nationalities and longitudinal studies. Cervical cancer can be a preventable disease and clinical healthcare providers are well positioned to lead that charge by continuing to encourage HPV immunization rates in adolescent girls.

Acknowledgments

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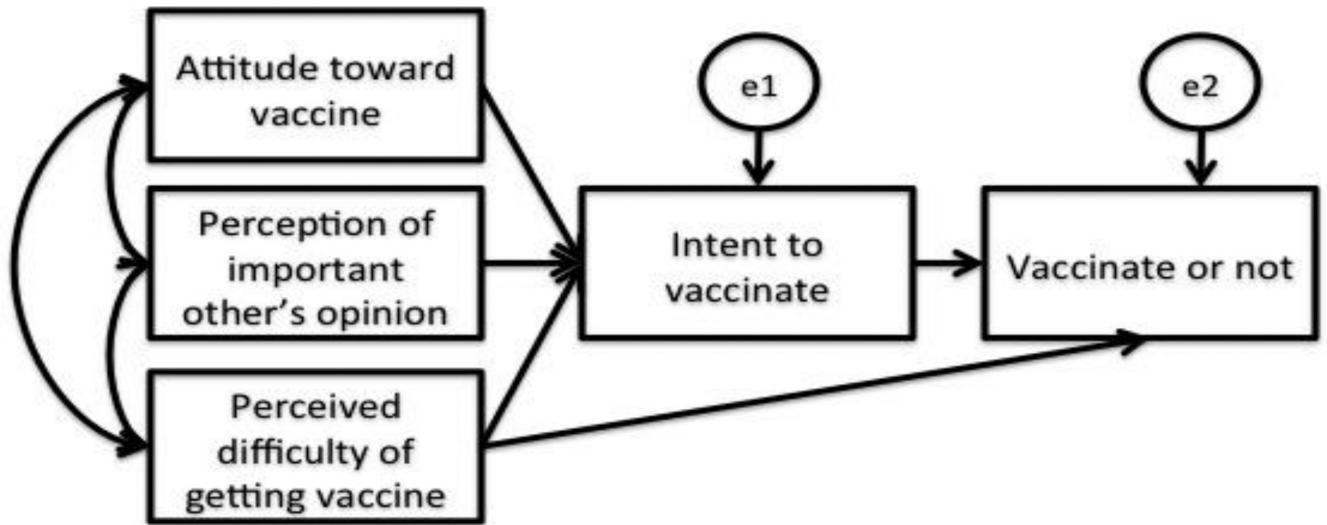


Figure 1. Theory of Planned Behavior variables (Behavioral Attitude, Subjective Norm, Perceived Behavioral Control) will explain intention to vaccinate and decision to vaccinate

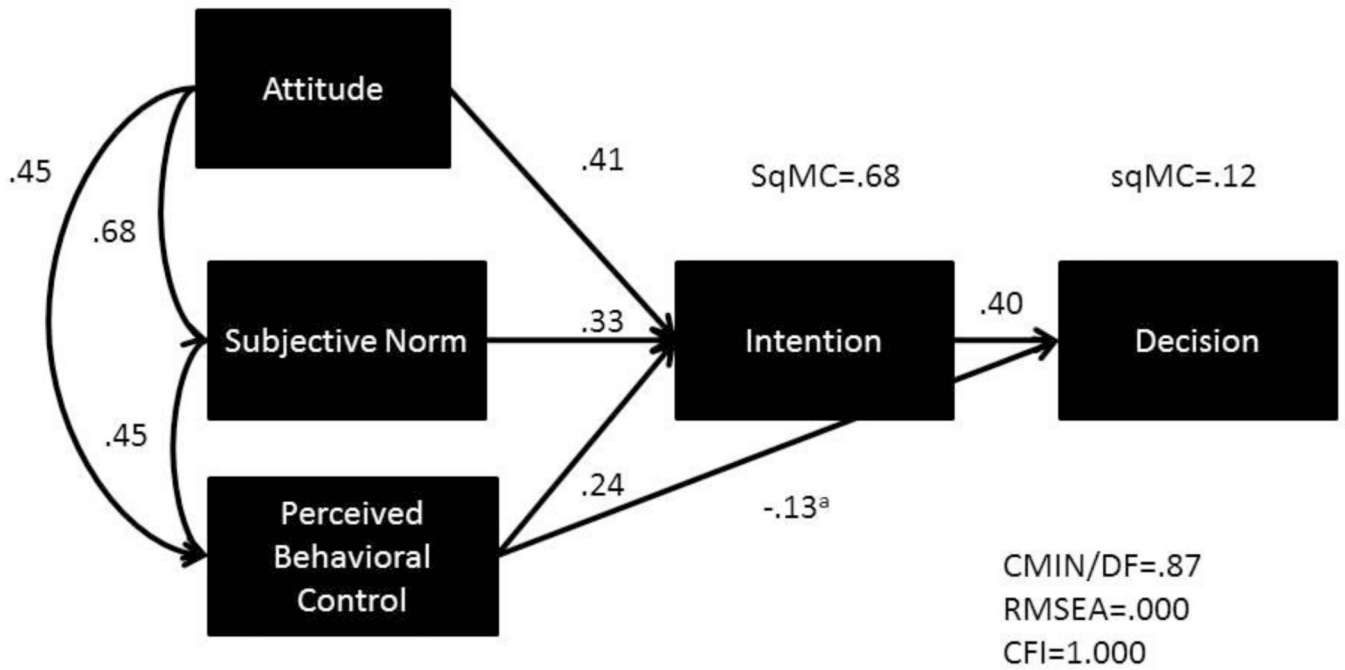


Figure 2.
 Predicting Mothers' Intention to Vaccinate Daughters
 All coefficients are significant at the $p < .001$ level except for (a) which is non-significant ($p = .25$)

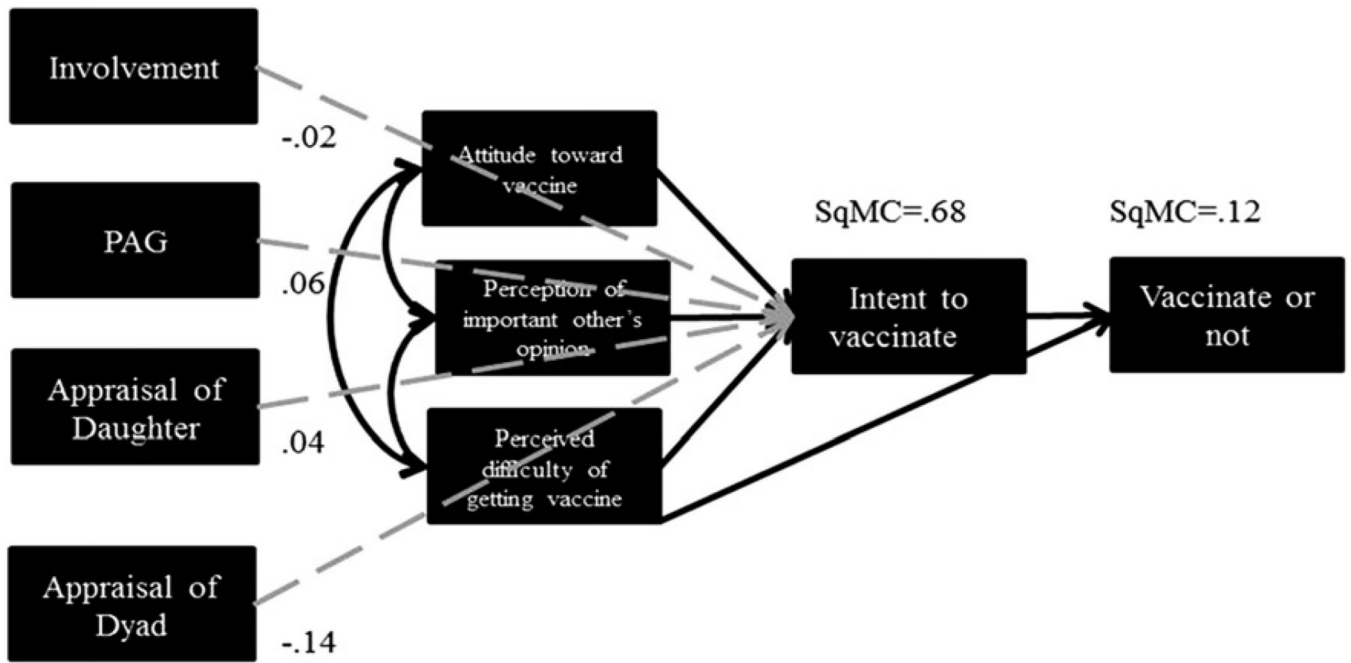


Fig. 3. Predicting mothers' intention to vaccinate daughters expanded model.

Table 1

Measures collected from mother-daughter dyads

Attitude	Perceived safety, effectiveness and benefits of vaccine.	Health Behavioral Belief Instrument ¹⁴
Subjective Norms		Health Behavioral Belief Instrument
Perceived Behavioral Control		Health Self Determination Index ^{15, 16} .
Intention to Vaccinate		Health Behavioral Belief Instrument ¹⁴
Parenting and Relationship	Conflict and negative communication between parents and adolescents are measured. Autonomy, involvement.	Conflict Behavior Questionnaire ¹⁷ ; 16 items. Parenting Style Index ¹⁸ ; 18 items.
Demographics		Age, race, education, employment, insurance, religion, birth order of daughter

Table 2

Sample items from Scales

Behavior attitude:

The HPV vaccine will be effective in preventing genital HPV.

Subjective Norm:

Many of my female friends will have their daughters vaccinated for genital HPV

Perceived Behavioral Control

I'll consider getting my daughter vaccinated for genital HPV if it doesn't cost too much.

Intention

How likely is it that you'll actually get the HPV vaccine for your daughter?

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Table 3

Questions and average responses that measure attitude, subjective norms, behavioral control and intention.

Intention Scale	<i>n</i>	Mean	SD
How likely is it that you'll try to get more information about the HPV vaccine?	68	5.10	2.13
How likely is it that you'll consider getting the HPV vaccine for your daughter?	68	4.53	2.29
How likely is it that you'll actually get the HPV vaccine for your daughter?	68	4.26	2.30
If a health care professional offered you the general HPV vaccine for your daughter three years from now, how likely is it that you'd get the vaccine?	68	4.57	2.20
Aggregate Intention Scale (range: 1 to 7)	68	4.62	2.13
Behavioral Attitude Scale	<i>N</i>	Mean	SD
The HPV vaccine will protect people from getting genital HPV.	67	5.00	1.39
The HPV vaccine will be effective in preventing genital HPV.	67	4.99	1.33
Getting the HPV vaccine could be risky.	67	3.33	1.49
Getting the HPV vaccine in the future may help my daughter stay healthier.	67	4.60	1.61
It usually doesn't bother me for my daughter to get a shot at the doctor's office.	67	5.51	2.06
If my daughter gets vaccinated for HPV, people may think that she sleeps around.	67	6.01	1.37
If my daughter gets vaccinated for HPV, I won't want anyone to know about it.	67	5.52	1.89
I won't need to get my daughter vaccinated for HPV, because she's not at risk for genital HPV.	67	5.37	1.86
I think that everyone should get vaccinated against genital HPV.	67	3.88	2.11
Aggregate Behavioral Attitude Scale (range: 2.56, 6.89)	67	4.91	0.99
Subjective Norms Scale	<i>N</i>	Mean	SD
Many of my female friends will have their daughters vaccinated for genital HPV.	66	4.65	1.69
My daughter's father will think it's a good idea for my daughter to get vaccinated against genital HPV.	66	4.06	1.88
Aggregate Subjective Norms Scale (range: 1 to 7)	65	4.34	1.55
Perceived Behavioral Control	<i>n</i>	Mean	SD
I'll consider getting my daughter vaccinated for genital HPV if it doesn't cost too much.	67	3.03	1.93
My daughter's doctor will think it's a good idea for my daughter to get vaccinated against genital HPV.	67	5.25	1.62
Intention Scale	<i>n</i>	Mean	SD
How likely is it that you'll try to get more information about the HPV vaccine?	68	5.10	2.13
How likely is it that you'll consider getting the HPV vaccine for your daughter?	68	4.53	2.29
How likely is it that you'll actually get the HPV vaccine for your daughter?	68	4.26	2.30
If a health care professional offered you the general HPV vaccine for your daughter three years from now, how likely is it that you'd get the vaccine?	68	4.57	2.20
Aggregate Intention Scale (range: 1 to 7)	68	4.62	2.13
Psychological Autonomy Granting	68	32.97	5.30

Table 4Comparing TPB variables by the decision to vaccinate [Mean (*SD*; *n*)]

	Behavioral Attitude	Subjective Norms	Perceived Behavioral Control	Intention
Yes	5.44(.86; 16)	5.12 (1.58; 16)	4.34 (1.40; 16)	5.83 (1.86; 16)
No	4.73(.97; 48)	4.08 (1.44; 46)	4.01 (1.42; 48)	4.31 (2.02; 49)
<i>F, p-value</i>	6.78, .012	6.02, .017	.67, .42	7.09, .01

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