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Using the Theory of Planned Behavior to Predict Mothers' Intentions to Vaccinate Their Daughters Against HPV

Natoshia M. Askelson, MPH, PhD, Shelly Campo, PhD, John B. Lowe, PhD, Sandi Smith, PhD, Leslie K. Dennis, PhD, and Julie Andsager, PhD

This study assessed mothers' intentions to vaccinate their daughters against human papillomavirus (HPV) using the theory of planned behavior (TPB). Experience with sexually transmitted infections (STIs), beliefs about the vaccine encouraging sexual activity, and perception of daughters' risk for HPV were also examined for a relationship with intention. A random sample of mothers in a rural, Midwestern state were mailed a survey with questions pertaining to the intention to vaccinate. Attitudes were the strongest predictor of mothers' intentions to vaccinate, but intentions were not high. Subjective norms also influence intention. Mothers' risk perceptions, experience with STIs, and beliefs about the vaccine encouraging sexual activity were not related to intention. Mothers' perceptions of the daughters' risks for HPV were surprisingly low. This research provides a foundation for designing interventions to increase HPV vaccination rates. Further research should explore ways to influence mothers' attitudes and to uncover the referent groups mothers refer to for vaccination behavior.

Keywords: communicable diseases; family life/sexuality; health education; immunizations; quantitative research

The Food and Drug Administration approved the first vaccine against human papillomavirus (HPV), Merck's Gardasil®, for preventing HPV infection types 6, 11, 16, and 18. The Advisory Committee on Immunization Practices (ACIP) recommended that this vaccine be given to females as early as 9–10 years of age, be routinely given to 11- to 12-year-olds, and females up to age 26 should be vaccinated if they had previously not been vaccinated (Advisory Committee on Immunization Practices, 2006). Although recommendations exist, a recommendation alone does not mean that girls and adolescents will be immunized, as seen in the case of the hepatitis B vaccine (Rosenthal, Kottenhahn, Biro, & Succup, 1995). It is important to assess influences of mothers' intentions to vaccinate, so that interventions and messages can

Natoshia M. Askelson, MPH, PhD, is an assistant research scientist at the Department of Community and Behavioral Health, University of Iowa.

Shelly Campo, PhD, is an associate professor at the Department of Community and Behavioral Health and Department of Communication Studies, University of Iowa.

John B. Lowe, PhD, is a head, School of Health and Sport Sciences at the University of the Sunshine Coast, Australia.

Sandi Smith, PhD, is a professor at the Department of Communication, Michigan State University.

Leslie K. Dennis, PhD, is a associate professor at the Department of Epidemiology, University of Iowa.

Julie Andsager, PhD, is a professor, Department of Journalism & Mass Communication, University of Iowa.

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be designed to encourage vaccination. Much of the previous research on vaccine acceptability was conducted before the vaccine was actually approved and available in health care settings. Factors influencing vaccination adoption beyond vaccine recommendations are reported below. Influencing factors can include risk perceptions, attitudes, subjective norms, perceived behavioral control, mothers' perceptions of the vaccine encouraging sexually activity, and experience with sexually transmitted infections (STIs).

The theory of planned behavior (TPB) posits that attitudes, subjective norms, and perceived behavioral control drive people's intention to perform a behavior, which in turn influences whether they engage in a behavior (Ajzen, 1984). Subjective norms are what important referent groups want an individual to do and an individual's willingness to comply with these groups. Perceived behavioral control is the amount of control a person believes to have over performing a behavior. Additionally, intentions are directly related to behavior. Specifically related to the HPV vaccine, there has been little preliminary research using the constructs of the TPB (Ogilvie et al., 2007). Research on decision making about other immunizations points to mothers' desires to want to do what their doctors want, to maintain the norm of vaccination, and to support the social contract implicit in the vaccination of children (Benin, Wisler-Scher, Colson, Shapiro, & Holmboe, 2006).

Risk perception is another possible influencer of the intent to vaccinate. Previous research indicates that parents who perceived their children at risk for HPV were more likely to be in favor of vaccination (Brabin, Roberts, Farzaneh, & Kitchener, 2006; Dempsey, Zimet, Davis, & Koutsky, 2006; Olshen, Woods, Austin, Luskin, Bauchner, 2005; Zimet et al., 2005). However, many parents do not think that their children are at risk for STIs including HPV (Olshen et al., 2005). Parents underestimate their children's risk behaviors, especially among younger adolescents and children (O'Donnell et al., 2008; Young & Zimmerman, 1998).

Mothers' experiences with STIs and the experiences of women they know have the potential to influence whether mothers would intend to vaccinate their daughters. A qualitative study conducted before the vaccine was released suggested that mother's experience with STIs positively influenced their support of a vaccine to protect their children against STIs (Mays, Sturm, & Zimet, 2004). Other research found that parents who had experience with STIs were more likely to accept the vaccine (Dempsey et al., 2006; Zimet et al., 2005). Knowing someone with an abnormal Papanicolaou test was also related to parents wanting a child to receive the HPV vaccine (Davis, Dickman, Ferris, & Dias, 2004). Women who had experience with HPV or abnormal Papanicolaou test were also more likely to know more about HPV (Tiro, Meissner, Kobrin, & Chollette, 2007).

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Early research on the acceptability of the HPV vaccine indicated that parents and others were concerned that the vaccine might encourage sexual activity among adolescents (Brabin et al., 2006; Dailard, 2006). People have argued that adolescents will decide to become sexually active or engage in risky sexual behavior (i.e., not using condoms) because they will believe that the vaccine decreases their risk for the negative consequences of sexual activity.

The purpose of this research was to investigate the influences of mothers' intentions to vaccinate their 9- to 15-year-old daughters against HPV. Specifically, this study examined how attitudes, subjective norms, and perceived behavioral control might influence intention to vaccinate against HPV. Additionally, the study was designed to investigate how mothers' personal experiences with STIs as well as the experiences of women they know might influence their intention to vaccinate their daughters with HPV. Finally, mothers' perceptions about their daughters' risk for HPV and their opinions about the vaccine encouraging sexual activity were explored. Mothers were the focus of this study because the vaccine manufacturer's media information campaign had targeted mothers (Merck, 2007).

METHOD

The survey was pretested with 10 mothers. Based on the pretest, the survey length was shortened and questions that were confusing were either changed with input from the mother or eliminated. The survey was given to a random sample of 1,207 mothers who had daughters aged 9–15 in a rural, Midwest state. A power analysis was done to determine the sample size. Sample size was based on the number of girls in this age group (144,260 girls) in this state according to the 2000 US Census (US Census Bureau, 2007). The sample was drawn from all women who were registered to vote in 2007 and who gave birth in the state to daughters born in 1993–1999, in an effort to obtain a true sample of mothers from this state. Voter registration rates in this state are high, with approximately 96% of adults registered to vote (Iowa State, Secretary of State, 2008). Birth certificate data from all female children born in the state, who were currently 9–15 years old, were matched with voter registration data to provide the most current addresses of mothers.

The survey was mailed to potential participants, followed by a reminder postcard 10 days later. Ten days after the postcard, a second copy of the survey was mailed. There were 306 completed or partially complete surveys returned. The response rate was 25.43% (American Association for Public Opinion Research, 2008). For this analysis, mothers who had reported already vaccinating their daughter, mothers whose daughters did not live with them at least half the time, and mothers who reported on daughters outside of the 9- to 15-year-old age were not included in the analysis. The remaining 217 were used for the analysis. The research project was reviewed and approved of by the institutional review board and the survey was accompanied with a letter that contained the elements of consent.

Theory of Planned Behavior

The questions measuring attitudes, subjective norms, and perceived behavioral control were based on the questions from the theory's creator (Ajzen, 2004). The mothers were asked to respond to statements using a Likert-type, 7-point scale with the higher score (7) representing a more favorable response. To assess mothers' intentions, they were asked about how likely they were to have their 9- to 15-year-old daughter vaccinated. They were also asked at what age they would vaccinate their daughter.

To measure subjective norms, mothers were asked to rate how much they agreed with each statement; "Most people who are important to me think that I should vaccinate my daughter," "It is expected of me that I will vaccinate my daughter against HPV," and "The people in my life whose opinions I value would want me to vaccinate my daughter." These measures were combined to form a total measure of subjective norms.

There were three measures of attitude toward vaccinating daughters who were 9–15 years old. Mothers were asked whether vaccinating "is necessary," "is a good idea," and "is beneficial." Again, the mean of the sum of these three responses provided the entire measure of attitude toward vaccinating daughters age 9–15.

Mothers were asked to respond to five different statements pertaining to perceived behavioral control; "For me, vaccinating my daughter against HPV is possible," "If I wanted to get my daughter vaccinated in the next 6 months it would be easy," "How much control do you have over your daughter getting vaccinated?" and "It is mostly up to me whether or not my daughter gets vaccinated against HPV." For the final perceived behavioral control measure, mothers were asked how much they disagreed with the statement; "The cost of the vaccine (about $360) is a barrier to my daughter getting vaccinated."

Other Measures

Other questions pertaining to mothers' perception of risk for their daughters, perception of the vaccine as promoting sexual activity, and STI experience were asked. The measure of STI experience for mothers and other women they know was based on a similar, previously published measure used to assess life experience with HPV (Dempsey et al., 2006). Mothers responded whether they had been told that they had an abnormal Papanicolaou test, HPV/genital warts, cervical cancer, or other STIs. The answers to each of these four questions were coded zero for no

TABLE 1. Variables for Mothers' Intention to Vaccinate 9- to 15-Year-Old Daughters Against HPV ($N = 217$)

Variables (all Variables on a Scale of 1–7)	*Mean (SD)*	*Factor Loading*	*Cronbach's α*
Intention to vaccinate	4.71 (2.21)		
How likely are you to vaccinate?			
Attitudes	5.21 (1.81)		.96
Vaccinating is necessary	4.81 (1.99)	0.94	
Vaccinating is a good idea	5.39 (1.86)	0.98	
Vaccinating is beneficial	5.39 (1.80)	0.97	
Perceived behavioral control (PBC)			
PBC vaccinating is possible	5.83 (1.56)		
PBC vaccinating is easy	5.85 (1.63)		
PBC vaccinating is in my control	6.68 (0.68)		
PBC vaccinating is up to me	6.42 (1.12)		
PBC cost is barrier	4.41 (2.29)		
Subjective norms	4.56 (1.63)		.88
Most people think I should vaccinate my daughter	4.69 (2.05)	0.94	
It is expected of me that I will vaccinate	4.01 (1.89)	0.83	
The people in my life would want me to vaccinate	4.89 (1.83)	0.92	
Mothers' STI experience[a]	0.55 (0.83)		
Others STI experience[a]	1.35 (1.37)		
Risk for HPV	3.43 (1.74)		
Vaccine encourage sexual activity	6.15 (1.35)		

NOTES: HPV = human papillomavirus; STI = sexually transmitted infection.
[a] Mean of total experiences.

experience and one for experience. The answers to the four questions were summed to provide a total experience score. They were also asked whether they knew of someone who had been told that they had an abnormal Papanicolaou test, HPV/genital warts, cervical cancer, or other STIs. These answers were also summed to provide a cumulative measure of experience for women the mothers knew. Mothers were also asked how much they agreed with the statement "My daughter is or will be at risk for HPV" on a 7-point Likert-type scale. Mothers responded to the statement, "Vaccinating my daughter against HPV will encourage her to be sexually active ... will have NO effect on her decision to be sexually active" with a 7-point scale (having no effect was 7). Mothers were also asked if they had discussed whether to vaccinate their daughter with the child's other parent. The age of the daughters, mothers' age, health insurance status of the daughters, household income, educational attainment of the mothers, and mothers' race and ethnicity were also obtained.

Analysis

The analysis was conducted using SPSS version 15.0. Descriptive statistics were calculated. Confirmatory factor analysis was used to establish the validity of the constructs of the TPB. Factor analysis was done using a varimax rotation. Linear regression was used to estimate the influence of the constructs of the TPB and the measures of risk perception, disinhibiting impact of the vaccine, and STI experience on mothers' intention to vaccinate.

RESULTS

There were 217 respondents who were used in the analyses in this research. The majority of the respondents had at least graduated from college (63.3%, $n = 134$) and household income levels for most were $50,000 or above. The sample was predominantly White and there was almost no racial or ethnic diversity among the mothers. The mean age of the mothers was 40.30 ($SD = 5.50$) with a range of 27 to 56 years old. Daughters were between 9 and 15 years old, with a mean age of 11.21 ($SD = 1.82$). All of the mothers reported that their daughters had health insurance. Ninety percent ($n = 190$) had private health insurance and just 10% (n = 21) had public health insurance.

Results for the survey questions are presented in Table 1. The table shows the means and standard deviations for all the variables. For the

TABLE 2. Linear Regression of Factors That Predict Mothers' Intentions to Vaccinate Daughters Against HPV ($N = 217$)

	B	*SE*	β
Attitude	0.74	0.11	.61**
Subjective norms	0.22	0.11	.16*
PBC vaccinating is possible	0.15	0.10	.12
PBC vaccinating is easy	−0.02	0.07	−.02
PBC vaccinating is in my control	−0.06	0.18	−.02
PBC vaccinating is up to me	0.07	0.10	.03
PBC cost is barrier	0.08	0.05	.08
Mothers' STI experience	−0.02	0.12	−.01
Others STI experience	0.09	0.08	.05
Risk for HPV	−0.08	0.06	−.06
Vaccine encourage sexual activity	−0.01	0.08	−0.01
Adjusted $R^2 = .66$			

*$p < .05$. **$p < .001$.
NOTES: HPV = human papillomavirus; PBC = perceived behavioral control; STI = sexually transmitted infection.

measures of attitudes and subjective norms, which had high Cronbach's αs, the factor loadings and the αs are presented. Because of poor internal consistency (Cronbach's α .38), the perceived behavioral control variables could not be simply summed. Other combinations of these measures did not prove to have acceptable reliability; therefore, the variables were used individually. The confirmatory factor analysis confirmed that these variables did not load together or in other combinations; thus, the constructs of the TPB (attitudes, subjective norms, and perceived behavioral control) were entered into a linear regression model.

Linear regression was used to estimate the influence of the constructs of the TPB on mothers' intentions to vaccinate their daughters and the influence of risk perceptions, experience, and mothers' assessment of the vaccine's impact on sexual activity; $F\ (11, 173) = 31.17$, $p < .001$. The regression analysis results are shown in Table 2. The adjusted R^2 for this model is .66, which indicates that the model accounts for 66% of the variance and is a good fit for the data.

Intent to vaccinate was influenced by mothers' positive attitudes about the vaccine in such a way that more positive attitudes increased the likelihood of vaccinating ($\beta = .61$, $p < .001$). The results of the linear regression also indicated that those with subjective norms that were in support of the vaccine were more likely to intend to vaccinate ($\beta = .16$, $p < .05$). Perceived behavioral control did not influence intentions. There was no evidence that mothers' perceptions of risk of HPV for their daughters influenced intention to vaccinate. Furthermore, there was no support for the influence of maternal STI experience and STI experience of women the mothers knew on the intention to vaccinate. Mothers' concerns about the vaccine encouraging sexual activity also did not predict mothers' intentions to vaccinate. Mothers believed that the vaccine would have little effect on their daughter's decision to be sexually active, contrary to what we hypothesized.

DISCUSSION

This study had several strengths. Very few previous studies on HPV vaccine acceptability have used any theory or theoretical construct (Zimet, Liddon, Rosenthal, Lazcano-Ponce, & Allen, 2006), as this study had. The value of a random sample from a rural state was another unique feature of this study. This research points to the importance of mothers' attitudes and subjective norms in predicting intention to vaccinate and indicates that mothers' intentions to vaccinate are not overwhelming. The model presented also had a high R^2 value, indicating that much of the variance in intention to vaccinate was explained by the constructs of the TPB. Because of the importance of mothers' attitudes and the influence of subjective norms, further research should explore ways to influence their attitudes, heighten the importance of subjective norms that support vaccination, and help mothers understand their daughters' risks.

Attitudes were the strongest predictor of mothers' intentions to vaccinate. The importance of attitudes has been cited in previous HPV vaccine acceptability research (Dempsey et al., 2006; Ogilvie et al., 2007). Mothers from this rural, Midwestern state had fairly positive attitudes toward the vaccine. They believed it was a good idea and beneficial, while they were slightly less in agreement about whether the vaccine was necessary. Their view that the vaccine was not necessary might be related to their assessment that their daughters were not at risk for HPV. Other studies have indicated that risk perception and acceptability are related (Brabin et al., 2006; Dempsey et al., 2006; Mays et al., 2004; Zimet et al., 2005).

Subjective norms were the only other predictor of intention in this model. Mothers' responses to the subjective norms questions were more neutral, leaning slightly positive. Subjective norms in the form of health care providers' opinions have been shown in previous research to be influential (Dempsey et al., 2006). The current study did not look at specific people or groups of people, so it is not clear who the important persons or referent group would be for these mothers. Future research should explore this issue.

Perceived behavioral control was a problematic construct, as the measures for this construct did not hold together in the factor analysis. Mothers in this study indicated that their perceived behavioral control was very high when it came to vaccinating their daughters. That is, it appears that vaccinating against HPV was a behavior that mothers perceive as in their control, indicating that vaccinating their daughters was "possible" and "easy." Cost was not perceived as a barrier, most likely because all of the daughters in this sample had health insurance and the vaccine is covered by health insurance in this state. Only 3% of the children in this state are without health insurance, so cost would have minimal impact (Damiano et al., 2007). The construct of perceived behavioral control requires further investigation across a diverse sample.

Only about 48% of mothers who responded indicated that they agreed or strongly agreed with the statement that they were intending to vaccinate their daughters. The average age mothers reported for intending to vaccinate their daughters (13.20 years) was higher than the recommendations of 11–12 years. Other research before the Food and Drug Administration approval of the vaccine has indicated more support from mothers for vaccination than this current research study (Brabin et al., 2006). Other past research has also shown that mothers are more willing to vaccinate at older ages (Dempsey et al., 2006).

Experience With STIs

Mothers' experience with STIs and the experience of women whom mothers know were not related to intention in this study, which is in contrast with past research conducted before the vaccine was available (Davis et al., 2004; Dempsey et al., 2006; Mays et al., 2004; Tiro et al., 2007; Zimet et al., 2005). Mothers' experience should be substantial, as yearly some 3.5 million women in the United States have an abnormal Papanicolaou test result (Dailard, 2006), but women might not be sharing this information with each other. For women in the age group of the mothers, national HPV prevalence ranges from 19.6% to 27.5% (Dunne et al., 2007), and about 11,070 women were diagnosed with cervical cancer in 2007 (Jemal et al., 2008).

Risk Perceptions

Despite almost one third of mothers reporting knowing someone with genital warts/HPV, most did not think it was likely that their daughters were at risk for acquiring these infections and this perception had no impact on their intentions to vaccinate. Previous research has suggested that there is a relationship between risk perception and acceptability of the vaccine (Brabin et al., 2006; Dempsey et al., 2006; Mays et al., 2004; Olshen et al., 2005; Zimet et al., 2005). Mothers in this study perceived very low risk for their daughters. In accordance with the previous literature on parents' inability to estimate risk behaviors in their children (Bylund, Imes, & Baxter, 2005; O'Donnell et al., 2008; Young & Zimmerman, 1998), these mothers are likely underestimating their daughters' risk. Prevalence of HPV is 24.5% in females 14–19 years old (Dunne et al., 2007). Daughters are also likely to become sexually active before the age of 18, with one study reporting 36% of high school females being

sexually active (Melhado, 2008). By the 12th grade, 61% of students report being sexually active (Brener, Kann, Lowry, Wechsler, & Romero, 2006). Even if they do not have sex as a teenager, the vaccine would protect them later in life. A woman's lifetime risk for HPV infection is 50% (Centers for Disease Control and Prevention, 2004).

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Furthermore, because risk is a concept poorly understood by the general public and influenced by culture and society (Wilkinson, 2001), it is possible that mothers were not able to estimate risk of a disease, even if they recognized the disease to be very prevalent. Mothers' risk perceptions, which were low, were also not associated with mothers' intentions to vaccinate; therefore, mothers were choosing to vaccinate based on their attitude toward the vaccine and subjective norms, not how much danger their daughters were in without the vaccine. This is an interesting paradox that needs to be further explored.

Interestingly, mothers from this study strongly agreed that the vaccine would have no effect on their daughters' decisions to be sexually active. Not only does this finding go against early arguments made that the vaccine would encourage sexual activity among adolescents (Brabin et al., 2006; Dailard, 2006), but this might also indicate that mothers see decisions to be sexually active as being complicated and not easily influenced by one thing, such as a vaccination. This finding has practical significance, as the popular press has highlighted this concern of encouraging sexual activity (Senator: HPV vaccine more deserved debate, 2007).

The low response rate might contribute to a response bias in this study. Although the response rate was low in this survey, additional items from the survey measured parenting style (Baumrind, 1991) and family communication patterns (Ritchie, 1991). The distribution of mothers for both of these scales mirrored those seen in other research with mothers and parents (Huebner & Howell, 2003; Ritchie & Fitzpatrick, 1990). This provides some evidence that the mothers who responded to the survey are not unlike other mothers in regard to important characteristics like parenting style and family communication patterns.

Implications for School Nurses

Because mothers in this study were not overwhelmingly indicating that they intended to vaccinate their daughters and were not intending to vaccine at the recommended ages, it will be up to health care providers and public health practitioners to encourage mothers to vaccinate their daughters. Efforts will need to be focused on strengthening mothers' positive attitudes about the vaccine as it pertains to their daughters to change mothers' intentions. It is possible to increase mothers' positive attitudes toward the vaccine. Mothers did not universally believe that the vaccine is necessary. More work needs to be done to show mothers that HPV is common and a threat to their daughters. These messages may also have to be coupled with messages about daughters being at risk, if not immediately, then later in life when they are sexually active and have partners who could expose them to the virus. More emphasis could also be placed on the concepts of the vaccine being "*a good idea*" and "*beneficial*." Furthermore, more information and messages directed at the effectiveness of this highly effective vaccine might move attitudes in a more positive direction. School nurses are in a pivotal position to coordinate efforts in the health care community to raise awareness of the need for HPV vaccine and the subsequent recommendations for administration.

Future research needs to establish how school nurses can most effectively communicate with parents about vaccinations. The research should focus on what messages need to be communicated and how they should be communicated to inform and motivate parents to vaccinate their children. Messages about how these groups of people support the vaccination of girls at the recommended ages could motivate mothers to have their daughters vaccinated.

Furthermore, interventions also need to give mothers an accurate perception of risk. Although perceptions of risk did not influence intentions, it is still important for mothers to understand the real risks their daughters face. Parents with inaccurate risk perceptions are less likely to parent in ways that protect their children, such as talking to them about the issue (Eisenberg, Sieving, Bearinger, Swain, & Resnick, 2006; Swain, Ackerman, & Ackerman, 2006). Information about an average adolescent's risk for sexual activity and HPV need to be addressed, not only to impress upon mothers the risks their daughters face but also to encourage mothers to address their daughters' sexual development.

"Information about an average adolescent's risk for sexual activity and HPV need to be addressed, not only to impress upon mothers the risks their daughters face but also to encourage mothers to address their daughters' sexual development."

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