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ORIGINAL PAPER

Predictors of Initial Uptake of Human Papillomavirus Vaccine Uptake Among Rural Appalachian Young Women

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Abstract Women in Appalachian Kentucky experience a high burden of cervical cancer and have low rates of human papillomavirus (HPV) vaccination. The purpose of this study was to identify normative influences predicting initial HPV vaccine uptake among a sample of young women in southeastern Kentucky. Women ($N = 495$), ages 18 through 26 years, were recruited from clinics and community colleges. After completing a questionnaire, women received a free voucher for HPV vaccination. Whether women redeemed the voucher for Dose 1 served as the primary outcome variable. Hierarchical logistic regression was used to estimate the influence of healthcare providers, friends, mothers, and fathers on vaccine uptake. One-quarter of the total sample (25.9 %) received Dose 1. Uptake was higher in the clinic sample (45.1 %) than in the college sample (6.9 %). On multivariate analysis, women indicating that their healthcare provider suggested the vaccine, that their friends would "definitely" want them to be vaccinated, and that their fathers would "definitely" want them to receive the vaccine all were 1.6 times more likely to receive Dose 1. Interaction effects occurred between recruitment site (clinic vs. community college) and all three of the normative influences retaining multivariate significance, indicating that the associations only applied to the clinic sample. HPV vaccine interventions may benefit from highlighting paternal endorsement, healthcare provider recommendation, and peer support.

Keywords Human papillomavirus vaccine · Appalachia · Cervical cancer · Normative influences

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Introduction

Human papillomavirus (HPV) vaccination is approved and recommended for use in females from 9 to 26 years of age for the primary prevention of cervical cancer (Centers for Disease Control and Prevention [CDC], 2007). The vaccine protects against HPV types 16 and 18, which are implicated in over two-thirds of invasive cervical cancers (CDC, 2012b). Because the vaccine is most effective when administered before infection with HPV (i.e., before a girl is sexually active), the current age recommendation for HPV vaccination is 11–12 years; however, "catch-up" vaccination is also recommended for females between the ages of 13 and 26 (CDC, 2007).

Notably, women aged 20–24 experience the highest prevalence of HPV infection among all age groups at 44.8 % (Dunne et al., 2007), yet HPV vaccination rates among these women are markedly lower than among their adolescent counterparts. National estimates suggest that only 21 % of women aged 19–26 years have initiated the HPV vaccine series compared with 48.7 % of girls aged 13–17 years (CDC, 2011, 2012a). There are also documented racial and socioeconomic disparities in HPV vaccine initiation, particularly among women who are African American, who reside in rural communities, who are covered by public insurance, and who live in poorer neighborhoods (Chao, Velicer, Slezak, & Jacobsen, 2010; Crosby, Casey, Vanderpool, Collins, & Moore, 2011; Dempsey, Cohn, Dalton, & Ruffin, 2011). Unfortunately, women in the 19–26 age group are no longer eligible for the federal Vaccines for Children program and are often under- or uninsured, leading to increased out-of-pocket healthcare expenses (Dempsey et al., 2011; Jain et al., 2009).

To date, much of the literature has focused on adolescent females, assessing intentions and vaccine acceptability among the girls themselves as well as among their parents (Allen et al., 2010; Brewer & Fazekas, 2007). The studies that have investigated young adult women's HPV vaccination perceptions, intentions, and behaviors have been primarily focused on university students in urban environments (Allen et al., 2009; Bennett, Buchanan, & Adams, 2012; Bynum, Brandt, Sharpe, Williams, & Kerr, 2011; Crosby, Schoenberg, Hopenhayn, Moore, & Melhan, 2007; Gerend & Shepherd, 2012; Hopfer & Clippard, 2011; Juraskova, O'Brien, Mullan, Bari, Laidsaar-Powell, & McCaffery, 2012; Krawczyk et al., 2012; Licht et al., 2010; Moore, Crosby, Young, & Charnigo, 2010; Roberts, Gerrard, Reimer, & Gibbons, 2010). Unfortunately, behavioral and psychosocial factors that influence uptake of the HPV vaccine have not been investigated among young adult women in low-income, medically underserved communities, such as those in rural Appalachia.

Women residing in rural, Appalachian Kentucky carry a high burden of cervical cancer incidence and mortality (CDC, 2002; Kentucky Cancer Registry, 2012; Wingo et al., 2008), while also facing poor socioeconomic conditions, lower Pap screening rates, more geographic barriers, and limited access to medical services (Appalachian Regional Commission (ARC), 2010; Behringer & Friedell, 2006; Couto, Simpson, & Harris, 1994; Kentucky Department for Public Health, 2008; Murray et al., 2006). Related to HPV vaccination, Crosby et al. (2011) have reported extremely low rates of vaccine initiation and completion among Appalachian women compared with those among their urban counterparts. Qualitative research conducted in both rural Appalachian Kentucky and Ohio communities suggests that young women may lack a complete understanding of the relationship between cervical cancer and HPV infection and thus may not fully grasp the importance of the HPV vaccine (Cohen & Head, 2013; Head & Cohen, 2012; Katz et al., 2009).

To inform future HPV vaccination promotional efforts in rural Appalachia, we must identify the predictors of HPV vaccine initiation. Although previous studies have identified peers, mothers, and healthcare providers as important influences on HPV vaccination intention and uptake, both collectively and independently (Allen et al., 2010; Brewer & Fazekas, 2007; Caskey, Lindau, & Alexander, 2009; Conroy et al., 2009; Hopfer & Clippard, 2011; Marchand, Glenn, & Bastani, 2012; Roberts et al., 2010; Rosenthal et al., 2011), these normative influences have not been empirically studied in a rural Appalachian population. Accordingly, the purpose of this study was to prospectively test four normative influences—mothers, fathers, friends, and clinicians—for their independent predictive value regarding HPV vaccine uptake among young Appalachian women 18–26 years of age.

Methods

Study Setting

The Appalachian Kentucky region chosen for this study is one of the few remaining areas in Appalachia containing a high concentration of "distressed counties" as classified by ARC based on federal employment, poverty, and income indicators (ARC, 2010). This geographic area has some of the poorest counties in the nation (U.S. Census Bureau, 2010), many of which are considered health professional shortage areas by the Health Resources and Services Administration (2012).

Study Procedures

From March 2008 to September 2009, a research assistant recruited female patients in five health clinics

providing primary care and women's health services located in five rural counties of southeastern Kentucky. Age-eligible women were approached by clinic staff to first determine their interest in participating in the study. If they were interested, the women were then directed to the research assistant, who spoke privately with each woman to explain the study, to answer any questions, and to obtain written informed consent. During that same time period, a second research assistant recruited women attending a local community college (with buildings located in four of the same five counties used for the clinic sample). Recruitment at the community college sites involved e-mails, flyers, classroom presentations, and booths at college health fairs. Community college women were recruited to offset what would have otherwise been a purely clinic sample of young women. Women were eligible to participate if they were not pregnant, were 18–26 years old, and had not been vaccinated with the quadrivalent HPV vaccine, Gardasil, the only HPV vaccine approved by the U.S. Food and Drug Administration at the time of the study.

To eliminate the confounding influence of insurance plans, Medicaid coverage, and out-of-pocket vaccine costs, we offered the vaccine free of charge to all study participants. However, the fact that the HPV vaccine would be provided at no cost was not advertised or disclosed until after the questionnaire was completed. To avoid self-selection bias, we called the project the Women's Health Study. Volunteers were told, "The purpose of this survey is to learn more about why women would or would not accept the HPV vaccine if it was made available to them." After providing informed consent, women recruited from the community colleges completed a self-administered questionnaire, and women recruited from the clinics completed the same questionnaire, but because of probable low health literacy among these women (as is quite common in these eastern Kentucky counties), an interview-assisted format was used.

After completing the questionnaire, women in both groups were compensated with a $25 gift card for their time, as well as a voucher to receive all three doses of the HPV vaccine series at either the clinic they were recruited from or, in the case of the community college women, the large regional health clinic in the five-county region. The voucher was dated and valid for 1 year after being issued. These coupons were coded with an ID number that matched the ID number recorded on women's questionnaires. Redeemed coupons were used to create a free-standing set of medical records indicating initial HPV vaccine uptake. The number of women who redeemed the voucher for the first dose of HPV vaccine series within 2 months of survey completion served as the study outcome variable. The institutional review board at the University of Kentucky approved the study protocol.

Measures

The questionnaire was refined based on our previous experience (Moore et al., 2010). The questionnaire began with a brief paragraph that explained HPV and its role in association with cervical cancer. This paragraph included two sentences informing women about the newly approved HPV vaccine. Four questionnaire items assessed women's perceptions regarding normative influences (mothers, fathers, friends, healthcare providers; Table 1). The concept of normative influences stems from the theory of reasoned action (Crosby, Salazar, & DiClemente, 2013) and has been previously identified in the HPV vaccination literature cited above. This concept essentially suggests that perceptions of what key people think someone should do may be predictive of behavioral intent and behavior. In addition, for the purposes of the controlled analysis, the questionnaire included measures assessing sexual behavior, HPV-related diagnostic history, and hormonal contraceptive use.

Data Analysis

Bivariate associations between the predictor variables and the primary outcome variable were assessed by prevalence ratios, their 95 % confidence intervals (95 % CIs), and respective p values. Due to marked skewness (defined as skewness ratios exceeding the absolute value of 2.0), each variable representing a normative influence was dichotomized to overcome issues with lack of normality. Dichotomization was performed to compare women responding "Yes, definitely" to those indicating a less favorable response (i.e., those not responding "Yes, definitely"). Predictors achieving a screening level of significance ($p < .10$) were entered into a two-block hierarchical logistic regression model, using forward Wald entry for each block. The first block contained likely covariates thereby relegating the four normative

Table 1 Normative influences-related survey questions

Question	Response options
Do you think your friends would want you to be vaccinated against HPV?	Yes, definitely; probably, but I'm not sure; no, they would not; what friends think doesn't matter
Do you think your mother would want you to be vaccinated against HPV?	Yes, definitely; probably, but I'm not sure; no, they would not; no mother/no relationship with mother
Do you think your father would want you to be vaccinated against HPV?	Yes, definitely; probably, but I'm not sure; no, they would not; no father/no relationship with father
A healthcare provider for me has suggested that I should be vaccinated against HPV.	Yes; no

influences to the second and final block. In this model, multivariate significance was defined by 95 % CIs and p values of <.05. Because we anticipated that recruitment site (clinic vs. community college) would be a natural predictor of vaccine uptake (given the ease for clinic-recruited women of being vaccinated immediately after receiving the voucher), this variable was not a planned part of the analysis. However, this variable was used to test for interaction effects.

Results

Descriptive Findings

Of 505 women who were eligible to participate in the study, 495 were enrolled, yielding a 98 % participation rate. The mean age of the total sample was 21.6 years (standard deviation = 2.5). The vast majority of study participants were white (98.0 %). The total sample was evenly divided between women recruited from clinics ($n = 247$) and those recruited from community colleges ($n = 248$). The mean age of college-recruited women was not significantly different than that of clinic-recruited women (21.7 vs. 21.4 years, $p = .17$). Similarly, other variables related to sexual behaviors, family or friends with cervical cancer, or clinical history were not significantly different between the two samples (Table 2). One-quarter of the total sample (25.9 %) initiated the HPV vaccine series within 2 months of completing the study questionnaire. Descriptive characteristics of the sample, stratified by receipt of Dose 1, are shown in Table 3.

Bivariate Associations

Age was not associated with uptake ($M_{\text{vaccinated}} = 22.07$ years, $SD = 2.62$, vs. $M_{\text{unvaccinated}} = 21.87$ years, $SD = 2.61$), $t(494) = .81$, $p = .42$. Table 3 displays the bivariate findings pertaining to the assessed covariates and the four normative influences. As expected, uptake was strongly associated with recruitment site, with clinic-recruited women (45.1 %) being more than six times likely than college-recruited women (6.9 %) to receive Dose 1. Also, as shown, four of the six assessed covariates achieved bivariate significance at the established screening level of .10. These covariates were (1) having sex with two or more partners in the past 12 months, (2) ever having a Pap test, (3) ever having an abnormal result on a Pap test, and (4) currently using hormonal contraceptives. More

Table 2 Uptake of Dose 1 among college-recruited and clinic-recruited women ($N = 495$)

Variable	College n (%)	Clinic n (%)	p*
Had sex at least once in the past 12 months	204 (82.2)	214 (86.7)	.17
Had sex with two or more partners in the past 12 months	40 (16.2)	29 (11.7)	.15
Friend or family member diagnosed with cervical cancer	92 (37.2)	96 (38.7)	.74
Ever had a Pap test	215 (86.6)	213 (86.3)	.92
Ever had an abnormal Pap test result	67 (27.1)	51 (20.6)	.09
Currently using hormonal contraceptives	125 (50.2)	118 (48.0)	.62

* p values are two-tailed

Table 3 Bivariate associations between predictor variables and uptake of Dose 1 ($N = 495$)

Predictor	% vaccinated	PR	95 % CI	p*
Recruitment site				
Clinic ($n = 247$)	45.1	6.58	[4.08, 10.63]	.0001
Community college ($n = 248$)	6.9			
Had sex at least once in the past 12 months				
No (77)	23.4	.89	[.57, 1.37]	.59
Yes (418)	26.3			
Had sex with two or more partners in the past 12 months				
No (426)	24.4	1.45	[.99, 2.05]	.07
Yes (69)	34.8			
Friend or family member diagnosed with cervical cancer				
No (307)	25.4	.95	[.70, 1.30]	.77
Yes (188)	26.6			
Ever had a Pap test				
No (67)	11.9	2.35	[1.21, 4.90]	.005
Yes (118)	28.1			
Ever had an abnormal Pap test result		1.67	[1.24, 2.25]	.001
No (376)	22.3			
Yes (118)	37.3			
Currently using hormonal contraceptives		1.47	[1.08, 1.99]	.012
No (242)	31.0			
Yes (251)	21.1			
Normative influences				
A healthcare provider has suggested that I be vaccinated				
Not indicated (297)	20.5	1.66	[1.23, 2.23]	.001
Yes (197)	34.0			
Friends would "definitely want me" to be vaccinated				
Not indicated (297)	19.2	1.88	[1.39, 2.53]	.0001
Yes (197)	36.0			
Mother would "definitely want me" to be vaccinated				
Not indicated (202)	17.3	1.83	[1.30, 2.59]	.0001
Yes (293)	31.7			
Father would "definitely want me" to be vaccinated				
Not indicated (255)	18.4	1.83	[1.34, 2.51]	.0001
Yes (240)	33.8			

CI confidence interval, *PR* prevalence ratio

* *p* values are two-tailed

importantly, all four of the assessed normative influences achieved bivariate significance.

Multivariate Associations

Table 4 displays the results of the logistic regression model. The model was significant, $\chi^2(5) = 39.14$, $p < .0001$, and achieved a satisfactory fit with the data goodness-of-fit $\chi^2(8) = 9.1$, $p = .34$. As shown, two of the four covariates with bivariate significance retained significance in the regression model (ever having an abnormal Pap test result and currently using hormonal contraceptives). Three of the four normative influences with bivariate significance retained

Table 4 Significant multivariate associations between assessed predictors and HPV vaccine uptake ($N = 495$)

Variable	AOR[a]	95 % CI	p*
Currently using hormonal contraceptives	1.56	[1.03, 2.39]	.038
Ever had an abnormal Pap test result	1.77	[1.12, 2.82]	.015
Healthcare provider suggested I be vaccinated	1.64	[1.07, 2.51]	.024
Friends would "definitely want me" to be vaccinated	1.64	[1.03, 2.63]	.036
Father would "definitely want me" to be vaccinated	1.61	[1.01, 2.57]	.046

AOR adjusted odds ratio, *CI* confidence interval

* p values are two-tailed

[a] Adjusted for the influence of all other variables in the model

significance in the presence of these two covariates. The influence of mothers as a normative influence did not retain significance ($p = .46$) in the regression model. The independent influence of fathers, friends, and healthcare providers were all remarkably of similar strength, with women indicating perceptions of endorsement for vaccination being about 1.6 times more likely to initiate the HPV vaccine series than women not indicating the same perceptions.

Interaction Effects

The large difference in uptake between clinic-recruited women (45.1 %) and college-recruited women (6.9 %) warranted further analysis. Interaction effects occurred between recruitment site (clinic vs. community college), with all three of the referent norms retaining multivariate significance with uptake. Each interaction effect indicated that the obtained association between the referent norm and uptake only applied to women recruited from clinics. A significant interaction was found pertaining to healthcare providers (adjusted odds ratio (AOR) = 3.65, 95 % CI [2.57, 5.17], $p < .0001$). A strong association between this normative influence and uptake among clinic-recruited women was observed, with uptake being higher in women who indicated that a provider suggested that they be vaccinated than in those who did not indicate provider suggestion (54.3 % vs. 36.9 %, $p < .0001$). This association was not significant among college-recruited women, with uptake being 7.8 and 5.0 %, respectively, for women indicating provider suggestion versus those not indicating provider suggestion ($p = .42$).

A significant interaction was found pertaining to the influence of friends (AOR = 6.89, 95 % CI [3.41, 13.91], $p < .0001$). Among clinic-recruited women, 56.9 % of those indicating "Yes, definitely" to this influence initiated the vaccine series compared with 34.6 % of those not indicating "Yes, definitely" ($p < .0001$). This association was not significant among college-recruited women, with uptake being 6.2 and 7.2 %, respectively, for women indicating "Yes, definitely" versus those not indicating "Yes, definitely" ($p = .76$).

Finally, a significant interaction was found pertaining to the influence of fathers (AOR = 8.02, 95 % CI [3.62, 17.75], $p < .0001$). Among clinic-recruited women, 53.3 % of those indicating "Yes, definitely" to this influence initiated the vaccine series compared with 34.9 % of those not indicating "Yes, definitely" ($p < .004$). This association was not significant among college-recruited women, with uptake being 7.8 % and 6.2 %, respectively, for women indicating "Yes, definitely" versus those not indicating "Yes, definitely" ($p = .61$).

Discussion

Given that the HPV vaccine is only vaccine available to prevent the development of cervical cancer, the extremely low rate of HPV vaccine uptake (26 %) among this sample of rural, Appalachian women is clearly problematic, particularly in light of the high cervical cancer burden in these communities. Our findings offer several insights worthy of consideration in future efforts to increase HPV vaccine uptake in these young women. First, it appears that offering the vaccine free of charge is not enough; it must also be convenient to obtain it. The extremely large discrepancy in vaccine uptake between women recruited from clinics and those recruited from community colleges demonstrates this point. The greater uptake observed

among clinic-recruited women is probably attributable to a convenience factor that did not apply to college-recruited women, who had to make arrangements to receive the HPV vaccine at a federally qualified health clinic, that for some of them, was in a different county than where they lived or attended school. Whether clinic-recruited women had a proclivity toward receiving healthcare that prompted their greater uptake of the vaccine is also a possible explanation of this finding, but this requires further study. Although other factors may explain the large difference in uptake between clinic-recruited and college-recruited women, it is important to note that these women did not significantly differ on any of the six variables (e.g., sex at least once in the past 12 months, ever having an abnormal Pap test result) shown in Table 2.

One interesting finding of this prospective analysis of HPV vaccine uptake is that the influence of fathers was clearly important. Indeed, young Appalachian women holding strong perceptions that their fathers want them to receive the vaccine were more likely than those not holding the same perceptions to initiate the vaccine series. To the best of our knowledge, this multivariate finding has not been previously reported in the peer-reviewed literature. This finding is intriguing, and it is consistent with those of other studies suggesting that parents play a pivotal role in the sex-related decision process of young women (Crosby & Miller, 2002; DiClemente et al., 2001). However, it is critical to note that this effect only applied to clinic-recruited women. It should also be noted that our findings do not suggest that mothers are not important in young women's health-related decisions. Several researchers have previously documented the important role that mothers play in HPV vaccination behaviors among college-age women (Head & Cohen, 2012; Hopfer & Clippard, 2011; Krieger, Katz, Kam, & Roberto, 2012; Moore et al., 2010; Roberts et al., 2010). Perhaps, when considering mother and father support independently, paternal endorsement (i.e., "Daddy's little girl") is more influential in vaccine uptake than maternal endorsement, at least among this sample of young women. Future studies that qualitatively investigate the influence that fathers have on their daughters regarding the vaccine may benefit HPV vaccine promotion efforts.

Our findings also support those of previous studies suggesting that healthcare providers are an important normative influence of HPV vaccine initiation among young women (Caskey et al., 2009; Chao et al., 2010; Conroy et al., 2009; Hopfer & Clippard, 2011; Moore et al., 2010; Rosenthal et al., 2011). Without question, enhanced uptake of HPV vaccines among rural adolescent and young women will be partly a function of provider willingness to counsel these female patients regarding the vaccine. However, to date, few studies have investigated rural, Appalachian clinicians' perceptions of and practices related to the HPV vaccine (Huey, Clark, Kluhsman, & Lengerich, 2009; Katz et al., 2009a, b; Keating et al., 2008). Importantly, Krieger et al. (2012) found that Appalachian pediatricians were less likely than their non-Appalachian counterparts to recommend the HPV vaccine to their eligible patients. More research to identify opportunities for young rural women to receive the HPV vaccine during various clinical interactions (e.g., routine primary care appointments, OB/GYN and family planning visits, college physicals, well-child visits) is warranted.

Furthermore, our findings suggest that friends of young rural women are an important normative influence regarding HPV vaccination. This finding is consistent with those of past studies indicating that peer norms are a powerful antecedent to sex-related decisions and behaviors among young women (Dishion & Dodge, 2005; Padilla-Walker & Bean, 2009; Rodgers, Rowe, & Buster, 1998), including HPV vaccination (Gerend & Shepherd, 2012; Head & Cohen, 2012; Teitelman et al., 2011).

The two covariates retained in the regression model also provide some intriguing findings. Regarding the first significant covariate (currently using hormonal contraceptives), it is quite possible that young women currently using hormonal contraceptives have benefited from the time and attention they received from healthcare providers during their pelvic exams associated with the dispensation of contraception. It is important to bear in mind that this effect is clearly independent from having a healthcare provider suggest HPV vaccination (given that this latter variable explained variance beyond that captured by the measure of current hormonal contraceptive use). It is also possible that young rural women who take the time and "trouble" to seek out services for hormonal contraception are also predisposed to seeking similar prevention services such as HPV vaccination. Indeed, healthcare providers prescribing hormonal

contraception may have a teachable moment to introduce the HPV vaccine to their age-eligible patients.

Regarding the second significant covariate (ever having an abnormal Pap test result), it is possible that an abnormal Pap test result may increase young women's perception of cervical cancer threat, which, in turn, may predispose them to initiate the HPV vaccine series. Again, however, the effect of this variable was independent from the effect of a healthcare provider suggesting HPV vaccination. According to current clinical guidelines, women with a history of abnormal Pap test results are still eligible for HPV vaccination (CDC, 2007), indicating another teachable moment for clinicians to educate young women about the benefits of the HPV vaccine (Kepka, Berkowitz, Yabroff, Roland, & Saraiya, 2012).

Whether women accepted or declined the free HPV vaccine was not significantly related, even in bivariate analyses, to being sexually active in the past 12 months or to having a friend or family member diagnosed with cervical cancer. Each of these null findings was counterintuitive.

Limitations

Our study is limited by the use of a convenience sample and the reliance on self-reported data. In particular, it is possible that social desirability bias may have been present among the clinic-recruited women given the face-to-face format of the assessment. It is also worth noting that our use of a self-administered questionnaire with the college-recruited women versus use of an interviewer-assisted questionnaire with the clinic-recruited women is a potential source of confounding. A further limitation involves the possibility of sample bias, given that women participating in the study may have spread the word regarding the opportunity to receive the HPV vaccine free of charge through our study, despite our measures to keep this information from women until after they completed the questionnaire. However, such a sample bias would actually translate into artificially elevated rates of vaccine uptake (i.e., if young women enrolled specifically to obtain the free vaccine, then the bias would favor a high acceptance rate). Lastly, our study was limited by our use of a single-item measure rather than a subscale to assess the four normative influences.

In line with previous studies, our study only focused on initial HPV vaccine uptake versus completion of the entire three-dose series. From a behavioral perspective, initiation of the vaccine series is the most important step because bringing young women into the "system" poses far more challenges than working with them once they have received the first dose. In fact, standard-of-care procedures (e.g., reminder phone calls, mailed letters) are usually applied to promote adherence to Doses 2 and 3. Unfortunately, maintaining fidelity to standard-of-care protocols is difficult, and protocols widely vary; thus, this form of behavioral intervention confounds study designs that seek to identify predictors of receipt of subsequent doses. Within these limitations, our findings suggest that even when the HPV vaccine is provided at absolutely no cost, the uptake of this vaccine among rural, medically underserved, Appalachian women is very low. Because the vaccine may have its most beneficial effect in populations where Pap testing is under-utilized, where cervical cancer rates are elevated, and where health services are scarce, this study is novel and an important contribution to the literature.

Conclusion

Our prospective findings suggest that at least three modifiable factors may increase HPV vaccine initiation among young adult women—paternal endorsement, healthcare provider recommendation, and peer support. One key recommendation is to feature father–daughter relationships in social marketing campaigns designed to promote HPV vaccine uptake. Another recommendation is to use health communication messages and interventions to favorably influence peer norms regarding the vaccine. Finally, the active endorsement of healthcare providers should be an important foundation of all HPV vaccine promotional strategies. Our findings also suggest that altering these three factors to improve vaccine uptake may need to occur in harmony with efforts to make the vaccine easy and convenient to obtain following other clinical outreach models, such as community-delivered influenza vaccinations and mobile mammography. Research illuminating the normative predictors of HPV vaccine uptake among medically underserved women is vital to informing future HPV vaccination interventions, which can have a substantial impact on

reducing cervical cancer incidence, morbidity, and mortality.

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