Published in final edited form as:
Womens Health Issues. 2009 ; 19(5): 344–351. doi:10.1016/j.whi.2009.06.001.

Exposure to high-risk genital human papillomavirus and its association with risky sexual practices and laboratory-confirmed Chlamydia among African-American women

Puja Seth, Ph.D.[1,2,3*], **Gina M. Wingood, Sc.D.**[1,2,4], **LaShun S. Robinson, Ph.D.**[1,5], and **Ralph J. DiClemente, Ph.D.**[1,2,6]

[1]Department of Behavioral Sciences and Health Education, Rollins School of Public Health, Emory University

[2]Emory Center for AIDS Research, Social and Behavioral Sciences Core

[4]1518 Clifton Road NE, Room 556, Atlanta, GA 30322; gwingoo@sph.emory.edu; Telephone: (404) 727-0241; Fax: (404) 727-1369

[5]1520 Clifton Road NE, Room 274, Atlanta, GA 30322; lsimps2@sph.emory.edu; Telephone: (404) 712-9189; Fax: (404) 712-9738

[6]1518 Clifton Road NE, Room 554, Atlanta, GA 30322; rdiclem@sph.emory.edu; Telephone: (404) 727-0237; Fax: (404) 727-1369

Abstract

Background—Genital human papillomavirus (HPV) is the most common sexually transmitted infection (STI) in the United States and African-American women have the highest prevalence of high-risk HPV. This study examined exposure to high-risk HPV in African-American women and its relation to risky sexual practices and laboratory-confirmed Chlamydia.

Methods—A sample of 665 African-American women between 18–29 years old, recruited from October 2002-March 2006 in Atlanta, Georgia, completed an Audio Computer Assisted Survey Interview assessing sociodemographics, health practices, and risky sexual practices. Participants also provided vaginal swab specimens assayed for STIs and high-risk HPV.

Results—The overall prevalence of high-risk HPV was 38.9%. Among women 18–24 years old, it was 42.4% and 31% among women 25–29 years old. Age-stratified logistic regression analyses indicated that women between the ages of 18–29 and 18–24 who had multiple male sexual partners, did not use a condom during last casual sexual encounter, and tested positive for Chlamydia were significantly more likely to test positive for high-risk HPV. Women 18–24 years old who reported having a casual or risky sexual partner were significantly more likely to test positive for high-risk HPV. No significant correlates were identified among women 25–29 years old.

3*Corresponding Author: 1520 Clifton Road NE, Room 218, Atlanta, GA 30322; pseth@emory.edu; Telephone: (404) 727-8673; Fax: (404) 712-4299.

Conclusions—Programs should aim to educate, decrease risky sexual practices, and increase screening and treatment for STIs among women with high-risk HPV infections. HPV vaccination recommendations for young adult African-American women warrant special consideration.

Introduction

Genital human papillomavirus (HPV) is the most common sexually transmitted infection (STI) in the United States. Approximately 6.2 million individuals 15–44 years old were infected with HPV in 2000, and 4.6 million (74%) occurred among individuals between the ages of 15–24 years old. Although only 25% of sexually active individuals are between 15–24 years of age, they account for 50% of sexually transmitted infections (Weinstock, Berman, & Cates, 2004). Previous research has suggested that 75% of sexually active individuals will become infected with HPV in their lifetimes (Koutsky, 1997). HPV types 16 and 18 are associated with approximately 70% of cervical cancer cases and the current HPV vaccine targets both types 16 and 18. The Centers for Disease Control and Prevention's (CDC) Advisory Committee on Immunization Practices recommend that girls 9–12 years of age be offered the HPV vaccine and women 13–26 years of age be offered a "catch-up" vaccine, preferably before they have been exposed to HPV (Markowitz et al., 2007; Paavonen & Lehtinen, 2008; Weinstock et al., 2004).

HPV prevalence rates have been reported to be highest among young women a few years after they become sexually active (Manhart et al., 2006; Revzina & DiClemente, 2005; Tarkowski et al., 2004; Winer et al., 2003). Adolescents and young adult women also are biologically more vulnerable to HPV infection (Moscicki, Burt, Kanowitz, Darragh, & Shiboski, 1999). One study reported that the rate of HPV prevalence increased each year for young women between the ages of 14–24 years (Dunne et al., 2007). Previous research has found HPV to be associated with young age (Burk et al., 1996; Ho, Bierman, Beardsley, Chang, & Burk, 1998; Kahn, Lan, & Kahn, 2007), specifically among women younger than 25 years old (Koutsky, 1997), low education level (Kahn et al., 2007), being single (Kahn et al., 2007; Manhart et al., 2006), having an African-American partner (Manhart et al., 2006), combining sex and alcohol, number of sexual partners (Burk et al., 1996; Ho et al., 1998; Manhart et al., 2006), illicit substance use (Manhart et al., 2006), smoking, oral contraceptives, and male partner's risky sexual behavior (Revzina & DiClemente, 2005; Winer et al., 2003). Also, Chlamydia infection has been associated with cervical cancer and may lead to the persistence of HPV infection (Shew et al., 2006; Smith et al., 2002). It has been suggested that the interaction between high-risk HPV and chronic Chlamydia infection increases the risk for cervical cancer (Smith et al., 2002).

For effective prevention, control, and clearance of high-risk HPV infections, it is pertinent to gain an understanding of risk factors associated with high-risk HPV. African-American women have been found to have the highest rate of high-risk HPV (Manhart et al., 2006). Previous research has reported a high-risk HPV prevalence rate ranging from 24% to 42.4% among samples of all or majority African-American women (Brown, Legge, & Qadadri, 2002; Burk et al., 1996; Datta et al., 2008; Revzina & DiClemente, 2005). The present study examined exposure to high-risk HPV infection and its relation to smoking, oral contraceptives, risky sexual practices, and laboratory-confirmed STIs. While many studies have examined risk factors associated with high-risk HPV among various populations, to our knowledge, this is one of a few studies to examine these factors solely among an urban sample of young adult African-American women.

Methods

Participants were part of a larger study evaluating an HIV/STI intervention tailored for African-American women. From October 2002 through March 2006, 9393 members from three Kaiser Permanente Centers having the greatest number of African-Americans in Atlanta, GA, were randomly selected using the Kaiser subscriber database. Of these members, 4905 (52.5%) did not meet the study inclusion criteria of being an African-American woman between the ages of 18–29 years. The recruitment team contacted, via telephone, and screened the remaining 4488 women meeting these inclusion criteria and sent letters inviting them to participate in the study. Among the 4488 women invited to participate in the study, 2510 (55.9%) did not meet additional eligibility criteria, 591 (13.2%) were not available to participate, and 408 (9.1%) were not interested in participating in the study. Thus, 979 (21.8%) met all eligibility criteria, including being a member of one of the three Kaiser Permanente Centers, unmarried, sexually active in the prior 6 months, and provided written and verbal informed consent. All 979 eligible women were invited to participate in the study and 848 (86.6%) completed baseline assessments. However, HPV specimen collection was initiated 5 months after the trial began. Thus, current analyses are from the 665 (78.4%) participants who provided HPV specimens and were conducted on baseline data. Participants were compensated $50 for travel and child care to attend each intervention session and to complete behavioral and biological assessments. The Emory University Institutional Review Board (IRB) approved the study protocol prior to implementation.

Data Collection

Data collection occurred at baseline and at 6- and 12-months follow-up. At each assessment, data were obtained from two sources. First, participants completed a 40-minute Audio Computer Assisted Survey Interview (ACASI) assessing sociodemographics, health practices, and risky sexual practices. Subsequently, participants were tested for HPV and provided two vaginal swab specimens that were tested for non-viral sexually transmitted infections.

Measures

Sociodemographics—Participants completed information regarding their age, education level, living situation, and income source.

Human papillomavirus—High-risk (cancer-associated) HPV infection was defined as a laboratory-confirmed test for a high-risk HPV type at the baseline assessment. Participants provided a vaginal swab specimen at baseline that was assayed for HPV. Swabs were tested by polymerase chain reaction (PCR)/reverse blot strip assay (Roche Diagnostics, Indianapolis, Ind). This assay uses nondegenerate primer pairs to amplify 19 oncogenic HPV types (types 16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 55, 56, 58, 59, 68, 73, 82, 83 and 84) (Gravitt, Peyton, Apple, & Wheeler, 1998; Gravitt et al., 2000). Vaginal swabs provide a more cost-effective way for obtaining specimens for HPV testing in comparison to cervical swabs, where a clinician is also needed. Previous research has indicated that vaginal swabs are reliable for detecting HPV. Additionally, the test agreement between vaginal swabs and cervical swabs has been found to be very good (Brown et al., 2005; Gravitt et al., 2001; Shah et al., 2001; Wright, Denny, Kruhn, Pollack, & Lorincz, 2000). All women who tested positive for high-risk HPV types were referred to their primary care provider at Kaiser Permanente for further counseling and follow-up.

Other sexually transmitted infections—For this study, having an STI was defined as a positive laboratory test result for Chlamydia, Gonorrhea, or Trichomonas infection at the baseline assessment. Specimens were collected after all other assessment procedures were completed. Participants provided 2 vaginal swabs. One swab was evaluated for *Neisseria*

gonorrhoeae (GC) and *Chlamydia trachomatis* (CT) using the Becton Dickinson ProbeTec ET *Chlamydia trachomatis* and *Neisseria gonorrhoeae* Amplified DNA Assay (Sparks, MD). A second vaginal swab was tested for *Trichomonas vaginalis* (TV) using Taq-Man PCR. The Caliendo Laboratory developed and validated this test which employs a homogenous kinetic polymerase chain reaction to amplify and detect a conserved part of a repeated DNA fragment of *T. vaginalis*. All assays were conducted at the Emory University, Department of Pathology, Caliendo Research Laboratory. Women testing positive for CT, GC or TV were provided directly observable single-dose treatment, received appropriate risk-reduction counseling per CDC recommendations, and were encouraged to refer sex partners for treatment. The county health department was notified of reportable STIs.

Health and risky sexual practices—Participants completed questions on current smoking, current oral contraceptive use, having a risky sexual partner (i.e., partner who was recently released from jail, had an STI, used injection drugs, and/or had a concurrent sexual partner) over the past 3 months, multiple sexual partners over the past 6 and 12 months, having a casual male sexual partner, condom use during last sexual encounter with a casual and a main partner, and consistent condom use. Consistent condom use over the past 30 days was defined as the use of a condom during every episode of vaginal intercourse (DiClemente & Wingood, 1995). In terms of the variables examined in this study, sexual encounter/relationship was defined as vaginal intercourse (i.e., when a guy puts his penis in your vagina). Main partner was defined as a current partner with whom you have a sexual relationship or someone with whom you have a special or committed relationship. Casual partner was defined as someone other than a current boyfriend, someone with whom you occasionally have sex and are NOT in a committed relationship.

Statistical Analyses—Descriptive statistics assessed the prevalence of high-risk HPV, risky sexual practices and biologically-confirmed Chlamydia. The data were analyzed in two sequential steps. First, bivariate analyses examined associations between high-risk HPV, HPV-associated sexual practices, and non-viral STIs. Second, all of the significant associations ($p \leq .10$) were then entered into age-stratified logistic regression analyses to examine the contribution of HPV for each outcome variable (Hosmer & Lemeshow, 1989; Hosmer, Taber, & Lemeshow, 1992). A more stringent alpha ($p \leq .05$) was used to retain significant factors associated with risky sexual practices and STI test results. Given that women between the ages of 18–24 years represent a subgroup of women with a higher prevalence of high-risk HPV (Kahn et al., 2007), separate logistic regression analyses were conducted for the overall sample and participants between 18–24 and 25–29 years old.

Results

Participant Characteristics

The analyses for this study were conducted on 665 women. There were 465 women in the 18–24 age group and 200 women in the 25–29 age group. Participants' average age was 22.04 (*SD*= 3.61). The majority of women reported completing 1–4 years of college (59.3%), with 25.6% graduating from high school, 11.2 % completing some high school (9^{th}–11^{th} grade), and 3.9% having graduate school training. In terms of their living situation (i.e., "Who do you live with?), the majority of participants reported living with parent(s) (53.5%), with 20.2% living alone, 12.4% living with a roommate, 5.2% living with their boyfriend, 5.4% living with another relative, and 3.3% living with their children. Finally, the majority of women obtained their spending money from their job (65.4%), with 28.5% not reporting their source of income and 6.1% receiving an allowance from parent(s) or boyfriend, public assistance, or school financial aid. The prevalence of high-risk HPV and significant correlates, by age group, are displayed in Table 1.

Bivariate and Age-stratified Logistic Regression Analyses

Bivariate analyses identified the aforementioned health and risky practices and STI variables that were significantly associated with high-risk HPV and these were entered into the age-stratified logistic regression analyses. Logistic regression analyses examined differences in high-risk HPV prevalence among the two age groups. The results indicated that women who were 18–24 years old were more likely to test positive for high-risk HPV infection than women who were 25–29 years old (*OR*= 1.64, *95% CI*= 1.15–2.33, *p*= .006). With regards to the other STIs, the overall prevalence was 10.4% for Chlamydia, 3.2% for Gonorrhea, and 6.5% for *Trichomonas vaginalis*.

Age-stratified logistic regression analyses indicated that women between the ages of 18–29 and 18–24 who had multiple male sexual partners over the past 12 months, multiple male sexual partners over the past 6 months, did not use a condom during last casual sexual encounter, and tested positive for Chlamydia were significantly more likely to test positive for high-risk HPV than women who did not engage in these risky behaviors or test positive for Chlamydia. Additionally, women between the ages of 18–24 who reported having a casual male sexual partner and a risky male sexual partner were significantly more likely to test positive for high-risk HPV than women who did not report having a casual or risky sexual partner. However, no significant correlates were identified among women 25–29 years old (see Table 2). Additionally, high-risk HPV was not associated with current smoking, oral contraceptive use, other condom use variables (e.g., condom use during last sexual encounter with a main partner, consistent condom use), Gonorrhea, and *Trichomonas vaginalis*.

Discussion

The prevalence of high-risk HPV infection in this study corroborates previous findings (Revzina & DiClemente, 2005). High-risk HPV was associated with multiple male sexual partners, no condom use during last casual sexual encounter, and biologically-confirmed Chlamydia among the overall sample and among women 18–24 years old. Additionally, it was associated with having a casual male sexual partner and a risky male sexual partner among women 18–24 years old. High-risk HPV was not associated with previously well-established correlates of current smoking and oral contraceptive use, other condom use variables, and testing positive for Gonorrhea and *Trichomonas vaginalis*.

The present study found that condom use with a casual sexual partner was the only condom use variable that was significantly associated with high-risk HPV infection. Previous studies have reported mixed results on the relationship between HPV infection and condom use (Manhart & Koutsky, 2002). Some studies reported no significant associations between HPV infection and condom use (Manhart et al., 2006), while others found that women who reported condom use were more likely to test positive for HPV (Kjaer et al., 2000; Young, McNicol, & Beauvais, 1997). However, previous research also found that condom use significantly reduced HPV incidence and also promoted HPV clearance (Hogewoning et al., 2003; Kjaer et al., 1997; Winer et al., 2006). One potential explanation for the mixed findings is that it is difficult to determine whether women began using condoms prior to or after HPV acquisition. Previous research has found that persistent high-risk HPV infection is a significant factor leading to cervical cancer (Koutsky, 1997; Moscicki, Ellenberg, Farhat, & Xu, 2004). Therefore, although condom use after HPV acquisition may help with HPV clearance, the role that condoms may play in preventing HPV infection is unclear (Manhart & Koutsky, 2002).

Additionally, no significant associations were found for women between 25–29 years old. It is possible that the lower prevalence of high-risk HPV infection found in this age group could indicate that a proportion of the infections have been naturally healed and/or many new infections may not occur in this age group. Overall, the results corroborate other research

demonstrating associations between high-risk HPV and young age (Kahn et al., 2007), specifically women younger than 25 years old (Koutsky, 1997), multiple sexual partners (Ho et al., 1998; Manhart et al., 2006) and having a casual sexual partner (Molano et al., 2002). Additionally, previous studies have mostly examined the association between Chlamydia and cervical cancer in detail (Shew et al., 2006; Smith et al., 2002) as opposed to the other STIs that were examined in this study.

Study Limitations

The present study examined cross-sectional analyses; therefore, the causal and temporal associations between high-risk HPV infection and the outcome variables cannot be assessed. Many of the factors examined in the study have been previously examined; therefore, the novelty of the present study is somewhat limited. However, this is one of a few studies to examine these factors among African-American women, a group to have the highest rate of high-risk HPV. The data on health and risky sexual practices rely on retrospective self-report data. It is possible that participants had difficulty recalling important information, and/or they provided socially desirable responses to sensitive questions. Therefore, participant's self-reported behaviors could be conservative estimates of their actual behavior. Also, while participants were encouraged to respond to every question and the ACASI aims to reduce social desirability bias, participants had the option of skipping certain questions, if they felt uncomfortable answering. Therefore, missing data and non-response to specific questions could lead to a potential bias in the data. There is also a potential selection bias, as we do not have data to compare women who agreed to participate in the study with those who did not agree. The sample also was limited to African-American women between 18–29 years old, from the southeastern part of the United States. Therefore, the results may have limited generalizability to other geographic regions of the United States, and replication with diverse ethnic and geographic populations would be needed. However, this study targeted a population at high-risk for acquiring HPV, and to our knowledge, this is one of a few studies to report these findings on an urban sample of all African-American young adult women. Additionally, although health and risky sexual practices were self-reported, all STIs were laboratory-confirmed.

Implications and Conclusions

Given that African-American women are more vulnerable to acquiring HPV (Manhart et al., 2006; Revzina & DiClemente, 2005), programs should aim to educate, decrease risky sexual practices and increase screening and treatment for STIs (Shew et al., 2006). The CDC has recommended that programs encourage delaying initiation of sexual activity, having fewer sexual partners, and choosing partners who do not engage in risky sexual practices (Division of STD Prevention, 1999). This is especially important for high-risk HPV clearance among HPV-infected women who engage in risky sexual practices (Shew et al., 2006).

Physicians are essential to the success of HPV vaccination programs, and physician referral is an important correlate of HPV vaccine acceptability. Practitioners should make collaborative decisions with women, implement various strategies to provide comprehensive information, and refer women to clinics providing the HPV vaccine (Zimet, 2005). However, health promotion education often does not occur in primary care settings (Stange, Flocke, Goodwin, Kelly, & Zyzanski, 2000; Stange, Goodwin, Zyzanski, & Dietrich, 2003). Often barriers, such as lack of time and lack of self-efficacy in health promotion education, make it difficult for clinicians to intervene (Cabana et al., 1999; Carpiano, Flocke, Frank, & Stange, 2003). Strategies to overcome barriers must be developed in order to provide effective health promotion programs in primary care settings. Given that our data indicated that risky sexual

practices were associated with HPV, it is also important that safe sex health behaviors and health promotion are also incorporated into programs.

The findings from this study indicated that high-risk HPV infection was associated with risky sexual practices and laboratory-confirmed Chlamydia among African-American women. HPV vaccination recommendations for African-American women, specifically 18–24 years old, warrant special consideration. Currently, Kaiser Permanente, from where the women in this study were recruited covers the HPV vaccine for girls ages 9–26 (Kaiser Permanente, 2008). The quadrivalent HPV vaccine is offered to eligible women without additional costs (Chao, Slezak, Coleman, & Jacobsen, 2009). African-American women have reported that education regarding the HPV vaccine, affordable costs, and having peers that have been vaccinated are important factors affecting whether they would receive the HPV vaccine (Scarinci, Garces-Palacio, & Partridge, 2007). However, if African-American women do not have health insurance or their insurance does not cover the vaccine, racial disparities could increase (Kahn et al., 2007).

Previous research has noted that lack of availability of the HPV vaccine due to cost-related concerns is also often a barrier to the receipt of HPV vaccination. Providers may have to pay up-front costs and do not receive adequate reimbursement due to low insurance coverage (Keating et al., 2008; Kempe et al., 2007; McInerny, Cull, & Yudkowsky, 2005; Middleman, 2007). Additionally, lack of insurance coverage often leaves patients to pay for the vaccine themselves or wait in hopes that the vaccine will be covered in the future. However, if insurance providers and managed care plans started providing coverage for the HPV vaccine, this could significantly reduce the cervical cancer burden and prove to be cost-effective in the long-term. Therefore, unrestricted and universal access to the HPV vaccine could help reduce the burden and racial disparities. A universal HPV vaccine could significantly reduce the cervical cancer burden and racial and socioeconomic disparities (Goldie et al., 2003; Harper et al., 2006; Kahn et al., 2007; Wise, 2003). Previous research has indicated excellent efficacy of the quadrivalent HPV vaccine in preventing infection, specific to HPV types 6, 11, 16, or 18 and cervical cancer (Ault, 2007; Hutchinson & Klein, 2008; Paavonen et al., 2007; Villa et al., 2006). Health policies should be reexamined to provide unrestricted access to the HPV vaccine and reduce racial disparities among women.

Acknowledgements

This study was supported by grant R01-MH62717, from the National Institute of Health, awarded to the second author.

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Table 1

Prevalence of high-risk HPV, risky sexual practices, and laboratory-confirmed Chlamydia, by age group and high-risk HPV, among African-American women.

	18–29 % (*n*)		18–24 % (*n*)	25–29 % (*n*)
Prevalence of high-risk HPV[a]	**38.9% (259)**		**42.4% (197)**	**31.0% (62)**
Variables	**18–29 % (*n*) N=665**		**18–24 % (*n*) N=465**	**25–29 % (*n*) N=200**
	HPV n=259	**No HPV n=406**		
Multiple partners over the past 12 months				
Yes	32% (83)	53.9% (219)	58.7% (273)	61.0% (122)
No	68% (176)	46.1% (187)	41.3% (192)	39.0% (78)
Multiple partners over the past 6 months				
Yes	46.3% (120)	30.8% (125)	38.7% (180)	32.5% (65)
No	53.7% (139)	69.2% (281)	61.3% (285)	67.5% (135)
Having a current casual sexual partner[b,c]				
Yes	49% (75)	40.6% (102)	40.3% (112)	51.3% (58)
No	51% (78)	59.4% (149)	59.7% (166)	48.7% (55)
Condom use during last casual sexual encounter[c]				
Yes	56.7% (122)	46% (145)	50.9% (192)	49.1% (75)
No	43.3% (93)	54% (170)	49.1% (185)	50.9% (78)
Having a risky sexual partner[d]				
Yes	38.2% (99)	34.2% (139)	35.8% (163)	36.8% (71)
No	61.8% (160)	65.8% (267)	64.2% (292)	63.2% (122)
Laboratory-confirmed Chlamydia				
Yes	13.5% (35)	7.6% (31)	11.8% (55)	5.5% (11)
No	86.5% (224)	92.4% (375)	61.7% (410)	94.5% (189)

[a] The assay identified 19 oncogenic HPV types (types 16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 55, 56, 58, 59, 68, 73, 82, 83 and 84)

[b] Variables contained missing data. Therefore, the n does not add up to the total Ns for each column.

[c] Casual partner was defined as someone other than a current boyfriend, someone with whom you occasionally have sex and are NOT in a committed relationship.

[d] Risky sexual partner was defined as a partner who was recently released from jail, had an STI, used injection drugs, and/or had a concurrent sexual partner over the past 3 months

Table 2

Age-stratified logistic regression analyses examining risky sexual practices and laboratory-confirmed Chlamydia as correlates of high-risk HPV among African-American women.

Age Group	**18–29**			**18–24**			**25–29**		
Correlates	**PR[a]**	**95% CI[b]**	**p**	**PR[a]**	**95% CI[b]**	**p**	**PR[a]**	**95% CI[b]**	**p**
Multiple partners over the past 12 months	1.81	1.30–2.51	.00	2.22	1.51–3.26	.00	1.12	.61–2.08	.71
Multiple partners over the past 6 months	1.94	1.41–2.68	.00	2.16	1.48–3.16	.00	1.35	.72–2.53	.35
Having a casual sexual partner over the past 6 months	1.41	.94–2.11	.10	1.80	1.11–2.92	.02	.91	.41–2.02	.82
No condom use during last casual sexual encounter	1.54	1.09–2.18	.02	1.60	1.06–2.41	.02	1.37	.68–2.76	.39
Having a risky sexual partner	1.19	.86–1.64	.30	1.45	.99–2.12	.05	.71	.37–1.34	.29
Laboratory-confirmed Chlamydia	1.89	1.13–3.15	.02	1.90	1.08–3.35	.03	1.29	.36–4.58	.69

[a] Prevalence Ratio

[b] Confidence Interval