HUMAN PAPILLOMAVIRUS (HPV) IN RURAL ADOLESCENT FEMALES: KNOWLEDGE, PROTECTED SEX, AND SEXUAL RISK BEHAVIORS

Janet F. Wang, PhD, RN, FAAN[1]
Patricia S. Simoni, EdD, RN[2]
Ying Wu, PhD[3]

[1] Professor, School of Nursing, West Virginia University, jwang@hsc.wvu.edu
[2] Associate Professor, School of Nursing, West Virginia University, psimoni@hsc.wvu.edu
[3] Assistant Professor, School of Nursing, West Virginia University, ywu@hsc.wvu.edu

Keywords: Female Adolescents' HPV Knowledge, Protected Sex, Sexual Risk Behaviors

ABSTRACT

Reduction of cervical cancer morbidity/mortality relies on prevention and early detection of human papillomavirus (HPV). This study examined HPV knowledge, attitudes toward protected sex, and sexual risk behaviors among rural female adolescents, through cross-sectional survey of a convenience sample (n = 159). Data analysis, via the Statistical Package for Social Studies (SPSS), identified a sexually active sample (64%) with limited knowledge regarding effective sexual protection or HPV. Subjects living with both parents were (a) less knowledgeable about HPV than those living with single parents (b = -2.05, p = 0.035), as well as (b) less likely to be sexually active than those in other living arrangements (55% vs 77%, p = .0082). These findings suggest that the adolescent-parent relationship warrants further exploration in increasing knowledge regarding risk and reducing exposure to HPV.

INTRODUCTION

Cervical cancer is a leading cause of morbidity and mortality worldwide and, in 99.7% of all cases, the etiological agent is human papillomavirus (Walboomers et al., 1999). Of the many types of HPV, over 30 are transmitted from one person to another through sexual contact and are carried by an estimated 80% of sexually active adults (National Cancer Institute, 2004; Rosenfeld, 2004). Despite the prevalence of relatively harmless HPVs that clear within two years, various epidemiological studies have established that at least half of the 30 types of sexually transmitted HPVs are high-risk viruses, constituting the major cause of invasive cervical cancer (Bosch & De Sanjose, 2003; Clifford, 2003; Einstein & Goldberg, 2002; Ho et al., 2004; National Cancer Institute, 2004; and Thompson, 2004).

Cervical cancer without HPV is exceedingly rare (Walboomers et al., 1999). Human papillomavirus (HPV) is the most prevalent sexually transmitted disease (STD) in the United States (US), and is significantly associated with morbidity and cost (Burk, 1999; Ho et al., 2004; Moscicki, 1999). The prevalence of HPV infection in young women has been estimated to range from 20% to 46%. Studies conducted in the US suggest that, at a given time, 60% of college-aged women are infec ted with HPV (Ho et al., 2004). An early study estimated that 38% of adolescent females in a population of predominantly inner-city females were HPV-positive (Rosenfeld et al., 1989).

"High-risk" HPV infection is asymptomatic, invisible, and may not be expressed in cervical tissue dysplasia for years (American Social Health Association, 2002). It will not be detected, except when cervical tissue is examined by microscope in routine pelvic examination,

employing Papanicolaou (Pap) testing; when viral DNA is identified in cervical cells (National Cancer Institute, 2004); or when invasive cancer produces symptoms.

Theoretical Framework

Fishbein's Theory of Reasoned Action (TRA), the theoretical framework for this study (Fishbein & Ajzen, 1975) defines a certain behavior as a function of intention to engage in that behavior. In this study, intention to engage in sexual behavior is a function of attitudes toward an individual's sexual behavior, as well as the subjective norms about sexual behavior held by reference groups; for adolescents, reference groups are primarily the family and peer group. Essential to research aimed at understanding adolescent exposure to HPV and other STD's is the need to explore knowledge, attitudes, and reported practices of sexual risk behaviors related to HPV and STDs.

HPV Knowledge

In the adult population, 70% of US women, aged 18 and older, have reportedly never heard of HPV, and 89% have never discussed HPV with health care providers (Kaiser Family Foundation, 2004). Significant knowledge deficits regarding HPV have been identified among college/university students, as well. Knowledge deficits, regarding the link between HPV and cervical cancer, are reported in studies by Vail-Smith et al. (1994) and Biro et al. (1991). Canadian researchers found that 87% of 523 inner-city high school students had not heard of HPV, and only 39% of sexually experienced female students knew they should receive Pap testing (Dell et al., 2000).

One study reported subjects were unaware that HPV was asymptomatic, also finding that subjects reporting high-risk behaviors were more knowledgeable about HPV (Anderson-Ellstorm, 1996). Thus, the authors concluded, educational HPV information was received by those who were currently involved in sexual behaviors. It becomes clear that even women who may adhere to a regular pattern of Pap testing are likely to be ignorant of the most basic rationale for the testing: to determine whether or not sexually transmitted HPV infection has caused cervical dysplasia or cancer. And the gravest truth is that, without this essential information, sexually active females of all ages lack, and have lacked, the foundational rationale for preventing or screening for HPV.

Risk-Taking Behavior and Related Factors

In Eco-Developmental Theory (Szapocznik & Coatsworth, 1999), risk-taking is characteristic of normal adolescence. This theory is supported by a literature review (Harvard Mental Health Letter, 2005), recognizing continued development of the brain during adolescence, a time when the desire for novel experiences is strong and results in high risk taking. Several studies have found a higher incidence of risk-taking behaviors among adolescents where there were low levels of parental monitoring (DiClement et al., 2001; Donenberg et al., 2002; Rai et al., 2003). In addition, more sexual activity is reported among adolescents whose parents have not completed high school than among those of college graduates (Santelli et al., 2000).

Family connectedness was found to be related to fewer sexual risk-taking behaviors, even when adolescents were otherwise identified as high-risk (Markham et al., 2003). A study

exploring living arrangements found fewer behavioral problems, in general, among children living with married, biological parents, than among those living with cohabiting or blended families (Nelson et al., 2004).

Purpose of Study

This study was designed to examine knowledge levels about HPV, other STDs, and protected sex; attitudes toward protected sex; use of protection and level of sexual risk behaviors among adolescent females in a rural Appalachian population.

Traditional knowledge, attitudes and behavior (KAB) studies, effective in identifying important relationships among key variables in social research, are not reported in current HPV literature. The purpose of this study was to identify relationships (a) among demographic variables, (b) knowledge about HPV, other STDs, and protected sex; and attitudes toward protected sex, (c) sexual risk behaviors, and (d) use of sexual protection in adolescent females living in two, rural, medically-underserved, Appalachian counties.

Method

The design of this study is non-probability survey. The study was conducted in 2002, focusing on students in three high schools in two counties in a rural, medically-underserved, Appalachian state. A total of 159 female adolescents, enrolled in high school academic programs, participated in the study. Institutional Review Board (IRB) for protection of human subjects approved the study, and required written subject and parental consenting was completed prior to the adolescents' participation in the study. The subjects completed a questionnaire addressing knowledge about HPV, other STDs, and protected sex; attitudes toward sexual protection; and sexual risk behaviors and use of sexual protection. The questionnaire included demographic items.

Measures

Instruments. A three-part instrument with subscales by Kirby (Kirby and Associates, 1998) was used in this study to measure knowledge, attitudes, and behaviors regarding sexual risk and sexual protection among adolescent females. The original Kirby questions were used in a questionnaire that, additionally, included items specific to HPV knowledge. Reliability for each of the Kirby subscales is identified in the following description of each subscale.

STDs/HPV Related Knowledge Scale. Subjects were asked to answer questions about STDs/ HPV; adolescent physical development, relationships, sexual activity, and pregnancy; and the use of sexual protection and probability of pregnancy and STDs. Correct answers for each question were coded as 1 (correct) and 0 (incorrect). A total score was obtained by summing the correct answers to all items (x = .77).

Protected Sex Attitude Scale. This Kirby subscale (alpha = .66) was included in the questionnaire to measure attitudes toward protected sex. The subscale contained five items asking responses to statements, such as, "More people should be aware of the importance of protected sex". Response options ranged from 1 (strongly disagree) to 5 (strongly agree). A summary score was used in the analysis, with the highest score indicting a highly positive attitude toward the importance of protected sex.

Sexual Risk Behaviors. Using Kirby's (1998) tool, respondents were asked whether (a) they had ever had sexual intercourse, (b) their age at first intercourse, and (c) whether they had sex during the past month, test-retest reliability coefficients for the behavior questions was .84.

Protected Sex. Respondents were asked whether or not they had used protection the first time they had sex. If they had engaged in protected sex, they were asked to identify the method used.

Demographic. Standard demographic variables constructed by the authors were included as control variables for data analysis: age, ethnic background, living arrangements, religion, parental educational level and occupation, and household income.

Survey Procedures

After obtaining permission from the high school principals, the investigators described the study's purpose and offered a $10 gift-certificate to each student who would participate in the study. The data were collected on a school day in a health class, in which STDs had been discussed earlier in the semester, as part of the prescribed curriculum. Students who agreed to participate in the study stayed in the classroom, and those who refused to participate in the study went to the library.

The investigators distributed a self-administered questionnaire to the participants, who were told the survey was anonymous and no identification should be written on the questionnaire. Except for 5% (n = 9), all eligible students in three high schools agreed to participate in the study, providing a subject sample of 159 students that represented freshman through senior classes. Students who did not participate in the study were not measured for differences from those who participated. Rational for non-participation was not gathered. Data were reviewed for missing and obviously inconsistent data by the researcher and, except for the question regarding family income, all items were used in analysis. The Statistical Analysis of Social Science (SPSS) was used for data analysis.

Analysis

The Level of HPV Knowledge. Frequencies of correct answers to each of the HPV knowledge questions were calculated and compared by sexual status (1 = ever had sexual experience, 0 = otherwise). Percent difference in correct answers for each item was examined by Chi-square test. Mean difference of the overall HPV knowledge scores between groups was examined by t-test.

Associations with HPV Knowledge. To identify significant demographic factors contributing to higher level of HPV knowledge among youths having sexual experience, a multiple regression analysis was conducted, using the overall HPV knowledge score as the dependent variable. The independent variables simultaneously entered into the model included age, living arrangement, father's occupation, mother's occupation, age onset of sexual intercourse, and frequently sexual activity (defined by having sex last month).

Associations with Protected Sex Attitude. Multiple regression analysis was conducted to identify knowledge deficits, significantly related to attitudes toward protected sex , that may have implications for the design of health promotion intervention strategies. Independent variables entered into the model were the items selected by stepwise regression among 30 HPV

Knowledge items and 34 Sexual Knowledge items. Age and sexual status were added into the multiple regression models as control variables.

RESULTS

This study identified deficits in knowledge related to HPV, as well as attitudes toward protected sex, that may contribute to behaviors placing adolescent females at risk for contracting HPV. Predictive variables were identified, as were statistically significant differences in knowledge between subjects with sexual experience and those without.

Characteristics of Subjects

Age and Race. A total of 159 female adolescents, ages 14 - 20, participated in the study (mean = 16.8 years). The subjects were almost racially homogeneous, with only 2% (n = 3) reporting that they were non-Caucasian. The majority of the subjects (82%, n = 130) were born in the rural state where the study was conducted.

Parents' Education, Occupation, and Income. Most participants reported higher maternal than paternal educational level. The mean years for paternal education was 11.3 years, and, maternal, 12.7 years, with mothers completing 1.4 more years of education than fathers. Seventy-one percent (71%) of fathers and 51% of mothers held jobs. Relatively few mothers or fathers held highly skilled professional positions. One father was a physician; a few parents worked as public school teachers, post-secondary educators, or managers; and many mothers were identified as homemakers.

Only 34% of the participants responded to the question asking the amount of family income, with others saying that they did not know their household incomes. Most employed mothers were non-professional, a fact related to lower reported household income. Twenty-eight percent of the families had combined incomes of more than $50,000; income tended to be higher for those participants living with both parents. Those reporting lower family incomes were from non-traditional family living arrangements, such as living with step-family, mother's fiancé, or other relatives (See Table 1).

Living Arrangements. Sixty-one (61%, n = 96) percent of participants were living with both biological parents, and 25% were living with their mothers (n = 40); about six (n = 10) percent were with their fathers; and 7.6% (n = 12) with other relatives. Adolescents living with biological parents reported less sexual activity than those not living with both parents (55% vs 77%, $p > .008$).

Sexual Experience and Protection. Sixty-four percent (n = 94) of subjects reported having had sexual intercourse, and of this group, 71% (n = 67) stated that they had sex during the past month. When asked their age at first intercourse, 80% (n = 87) said between age 10 and 15 years; 10% (n = 11) said between 16 and 17 years; and only two (n = 2) said that they did not have sex until they were 18 years of age. The mean age at first sexual intercourse in this group of rural adolescents was 15 years. When asked whether they had used protection the first and the last time they had sex, 80% (n = 85) indicated that they had used protection. The methods used were pills with condoms (36%); condoms, alone (30%), and pills, alone (24%) (See Table 1).

Table 1
Characteristics of 159 Women Participating in the Study.

Characteristic	N	%
Age		
14 - 15	54	34
16 - 17	45	28
18 - 20	60	38
Race		
White	153	98
Others	3	2
Did not answer	3	
Living with		
Both parents	96	61
Father	10	6
Mother	40	25
Other relatives	12	8
Did not answer	1	
Religion	122	84
Ever had sexual intercourse		
Yes	94	64
No	52	36
Did not answer	13	
Sexual Behaviors **(among n = 94)**		
Had sex during the past month	67	71
Age onset of sexual intercourse		
10 - 16	80	87
17	10	11
18	2	2
Did not answer	2	
Used contraceptive methods/the first time having sex		
Yes	80	85
No	14	15
Contraceptives methods/the last time having sex (among n = 80)		
Birth control pills with a condom	29	36
Birth control pills alone	19	24
Condom alone	24	30
Had sex during the safe time of the month	0	0
Withdrawal	7	9
Other	1	1

HPV Knowledge and Related Factors

Knowledge about HPV transmission and prevention was low in this sexually active sample of adolescent females. With or without sexual experience, there was limited knowledge about HPV or about behaviors that would afford protection from HPV, as indicated in Table 2 and Table 3. Items most accurately answered by the 159 subjects were three that dealt with symptoms of HPV, garnering 147 correct responses (92.5%), 139 correct responses (87.4%) and 138 correct responses (86.8%), respectively. The fourth item, "not having sex would prevent HPV," was answered correctly by 144 (90.6%). Few participants correctly answered questions regarding HPV transmission. At least 20% of respondents were not aware that withdrawal is the least effective protective method among the choices given.

Table 2
Numbers (%) of Correct Responses to the 34 Knowledge Questions among the 159 Women and Comparisons of those by Sexual Status.

Questions	**Overall** (n = 159)	**Sexual Status** **Had sex** (n = 94)	**No sex** (n = 54)	*pb*
Adolescent Physical Development				
The physical changes of puberty happen to different teenagers at different ages.	136 (86)	(88)	(83)	
Most teenagers feel awkward and jealous, develop “crushes”, and sometimes worry about their appearance.	145 (91)	(91)	(92)	
Girls have a monthly release of blood from the uterus during menstrual periods.	152 (96)	(95)	(98)	
Girls usually mature earlier than boys physically.	149 (94)	(95)	(92)	
Male testes produce millions of sperm for each ejaculation when they are physically mature.	91 (57)	(61)	(54)	
Nocturnal emissions are a normal part of growing up for a boy.	143 (90)	(93)	(85)	
In puberty, boys become slimmer, their penises grow larger, they produce sperm, and voices become lower.	143 (90)	(86)	(94)	
Adolescent Sexuality				
Half of teenagers graduate from high schools in US have had sex.	54 (34)	(28)	(44)	*
About one-third of American girls become pregnant before aged 20.	55 (35)	(41)	(25)	*
Potential consequences of adolescent sexual intercourse are pregnancy, guilty feelings, and becoming more or less close to their sexual partners.	118 (74)	(74)	(73)	
For most teenagers, emotions seem to change frequently.	150 (94)	(96)	(94)	
For a close relationship be important that sexual partners trust each other, date each other only, and think of the other person first.	150 (94)	(97)	(90)	
Teenagers become more interested in sex because of influences by hormones, media, and peer pressure.	123 (77)	(73)	(83)	

Adolescent Pregnancy					
Pregnancy is possible the first time she has sex, during the menstrual period, standing up or if there is ejaculation near the vagina, but no penetration.	129	(81)	(83)	(73)	
Most unmarried teenage girls would decide to have an abortion when they are pregnant.	61	(38)	(41)	(31)	
Girls might get pregnant when having sex without protection any time during the month.	113	(71)	(82)	(50)	****
Children born to teenage parents have a greater change of being abused by their parents.	43	(27)	(32)	(21)	
Most unmarried high school girls who have children depend upon their parents for support.	151	(95)	(97)	(92)	
Adolescent Marriage					
Identifies potential consequences of teenage marriage.	74	(47)	(48)	(50)	
Identifies problems of teenage marriage.	107	(67)	(71)	(65)	
Sexually Transmitted Disease					
HPV is a dangerous STD, can lead to cancer, and has no initial symptoms.	105	(66)	(64)	(73)	
HPV is impossible to cure.	53	(33)	(41)	(17)	***
It is harmful for a woman to have sex with partner having HPV.	138	(87)	(90)	(83)	
STD treatment is best if both partners are treated at the same time.	149	(94)	(94)	(92)	
Gonorrhea is 10 times more common than syphilis, a disease that can be transmitted from mothers to babies, difficult to detect in women, and make both men and women unable to have babies.	107	(67)	(69)	(63)	
Protected Sex					
Condoms can be the best prevention of getting STDs/HPV.	143	(90)	(95)	(81)	**
Withdrawal is a least effective method of protection.	127	(80)	(85)	(77)	
Knows correct way to use condom effectively.	134	(84)	(84)	(85)	
Knows the advantages of using a condom.	136	(86)	(88)	(81)	
Birth control pills must be taken for 21 or 28 days to be effective.	75	(47)	(53)	(44)	
One should learn about all protective methods before choosing.	151	(95)	(97)	(96)	
Some protective methods can be obtained by people under 18 without parents' permission.	49	(31)	(34)	(25)	
Knows the rhythm method ("natural" family planning).	70	(44)	(50)	(37)	
Believes that 90% will get pregnant if having sex regularly without any protection by the end of 1 year.	47	(30)	(34)	(25)	

a. 1=has ever had sexual experience, 0=no.
b.* $p < .05$, ** $p < .01$, *** $p < .001$, **** $p < .0001$ by Chi-square test.

There was 48.2% accuracy for all 159 students' answers to 30 questions addressing HPV. Chi square demonstrated statistically significant difference ($p < 0.05$) in knowledge between 94 students who indicated a history of sexual intercourse and 54 who did not, with those who had sexual experience providing more accurate answers, overall (see Table 2). A statistically significant knowledge difference ($p < 0.05$) between the groups was identified for two separate items: (a) length of HPV incubation period and (b) condoms as a protective measure against HPV. Students with a sexual intercourse history scored more accurately on both items than

Table 3
Numbers (%) of Correct Responses to the HPV Knowledge among the 159 Women and Comparisons of those by Sexual Status.

	Overall	Sexual Status 1	0	
	(n = 159)	(n = 94)	(n = 54)	*p*b
Concepts of HPV				
A test detecting HPV is now available	113 (71)	(76)	(62)	
There is no known cure for HPV	91 (57)	(62)	(50)	
Women with HPV are at higher risk for cancer	91 (57)	(61)	(54)	
HPV infection may not appear for years after exposure to the virus	84 (53)	(60)	(42)	*
A vaccine of HPV is now available	66 (42)	(45)	(31)	
Women with HPV are at higher risk for AIDS	32 (20)	(15)	(25)	
HPV can spread HPV even if the infection is not visible	6 (4)	(2)	(6)	
Symptoms of HPV				
A sore on the sex organs	147 (92)	(96)	(88)	
Pain while urinating	139 (87)	(87)	(87)	
Discharge of pus from the sex organs	138 (87)	(90)	(79)	
A bad cough	107 (68)	(73)	(63)	
Lower abdominal (below the stomach) pain in females	100 (63)	(66)	(56)	
A headache	82 (52)	(53)	(50)	
Transmissions				
Sharing drug needles	106 (67)	(69)	(65)	
A female having sex with another female	28 (18)	(22)	(12)	
Donating blood	27 (17)	(19)	(15)	
A male having sex with another male	23 (15)	(17)	(12)	
Hugging someone who has HPV	6 (4)	(4)	(2)	
Shaking hands with someone who has HPV	2 (1)	(2)	(0)	
Having more than one sex partner	2 (1)	(0)	(2)	
Having sex with someone who has had several sex partners	2 (1)	(1)	(2)	
Being in the same classroom with someone who has HPV	1 (1)	(0)	(2)	
Having intercourse (sex) with someone who has HPV	1 (1)	(0)	(2)	
Protective Behaviors from being infected with HPV				
Not having sex	144 (91)	(94)	(85)	
Using condoms (rubbers) during sex	134 (84)	(89)	(71)	*
Making sure that a partner looks healthy	116 (73)	(74)	(73)	
Not taking illegal drugs with a needle	106 (67)	(69)	(63)	
Urinating after having sex	102 (65)	(69	(54)	
Washing after having sex	96 (61)	(62)	(56)	
Eating a healthy diet and staying physically fit	95 (60)	(63)	(52)	
Over all score (mean)		24.5	22.7	*

1 = has ever had sexual experience, 0 = no.
*$p < .05$, Chi-square *p* value for testing proportion difference and T-test p value for testing mean difference.

students without a history. HPV knowledge significantly predicted endorsement of the importance of protected sex ($r = .34$, $p < .001$).

Multiple regression analysis indicated that there was a statistically significant relationship between HPV knowledge and subject's living arrangements. Those who lived with both parents tended to have lower HPV knowledge. Other variables, such as age, father's or mother's occupation, age at first sexual intercourse, or having had sex during the past month, were not related to HPV knowledge (see Table 4).

Table 4
Multiple Regression for HPV Knowledge Score (n = 78).

		T	*p*
Age	-0.427	-0.89	.38
Living with both parents	-2.048	-2.15	.035
Father's occupation (professional)	1.042	1.05	.3
Mother's occupation (professional)	-0.792	-0.83	.41
Age onset of sexual intercourse	-0.257	-0.61	.54
Had sex during the past month	-0.499	-1.52	.13

Attitudes toward Protected Sex and Related Factors

Preliminary analysis, using stepwise regression, identified seven (7) of the 65 knowledge questions that demonstrated a $p < .01$ correlation with the protected sex attitude score. These items were then entered as independent variables into the multiple regression model, controlling for the variance due to age and sexual status. Seven knowledge items remained in the final model, with R 2 = .28. Table 5 presents the results of the stepwise regression for attitude toward protective measures. Seven knowledge items remained in the final model, with R 2 = .28, controlling for age and sexual status. Data from 145 data observations were available for multivariate regression analysis.

The results indicate that adolescents who correctly answer the following questions are more likely to endorse the use of protected measures: "People who have HPV can spread HPV, even if the infection is not visible", ($b = 2.45$, $p < .007$); "STD treatment is best if both partners are treated at the same time", ($b = 2.5$, $p < .008$)"; "Condoms can best prevent getting STDs, ($b = 2.02$, $p < .01$)"; "Using condoms during sex reduces the chance of HPV infection", ($b = 1.58$, $p < .01$); "Having sex with someone who has multiple sex partners increases the chance of HPV infection", ($b = 4.66$, $p < .02$); "For most teenagers, emotions seem to change frequently", ($b = 2,17$, $p < .05$); "Women with HPV are at higher risk for cancer", ($b = .93$, $p < .05$) (see Table 5). High scores on these seven knowledge items are predictive of a positive attitude toward protected sex. Calculated by SAS, the power of the regression analysis was 71%.

Table 5
The Final Model of Stepwise Regression for Birth Control Attitude Score (n = 145).

		T	p
Age	0.02	0.13	.9
Had sexual experience	0.24	0.48	.63
People who have HPV can spread HPV even if the infection is not visible.	2.45	2.75	.007
STD treatment is best if both partners are treated at the same time.	2.50	2.69	.008
Condoms can best prevent getting a STD.	2.02	2.57	.01
Using condoms during sex reduces the change of HPV infection..	1.58	2.52	.01
Having sex with someone who has multiple sex partners increases the chance of HPV infection.	4.66	2.30	.02
For most teenagers, emotions seem to change frequently.	2.17	1.98	.05
Women with HPV are at higher risk for cancer.	0.93	1.98	.05

DISCUSSION

The expectation that it would be difficult to acquire parental consent for underage student was met, instead, with high participation. The investigators' speculations about the high level of participation in the study, overall, are that few opportunities are offered in rural settings to serve as research subjects; the subject of the study was interesting to adolescents, as may have been the $10 inducement; and families in these rural counties tend to be traditional and are, perhaps, concerned about prevalent expressions of adolescent sexuality.

This study is unique in its exploration of adolescent females' knowledge about HPV. Most studies on HPV have focused primarily on sexually experienced young women (Kaiser Family Foundation, 2004; Yocobi, 1999; Vail-Smith et al., 1994; Biro et al., 1991; Leonardo & Chrisler, 1992; Gerhardt et al., 2000) and few have been conducted in Appalachian rural areas among adolescents. The data from the present study show that those adolescents who know HPV may not show visible symptoms are more likely to favor protective measures. If they answered correctly about the HPV transmission, they were more likely to endorse protected sex.

Those adolescent females who believe STD treatment is important for both partners also favor sexual protection ($p < .008$). The data demonstrated high use of condoms among subjects who feared pregnancy or STDs, in general ($b = 2.02$, $p < .01$). Those who recognized the increased risk for HPV and other STDs in sex with multiple partners, or with a partner who has multiple partners ($b = 4.66$, $p < .02$), was also higher than for those who did not recognize the risk.

Subjects who had endorsed protected sex scored higher in awareness of the emotional changes during puberty ($b = 2.17$, $p < .05$); STD treatment knowledge ($b = 2.50$, $p < .008$) ; and knowledge of the link between HPV and cervical cancer ($b = .93$, $p < .05$) (see Table 5). These seven questions have potential for use in assessment, serving to identify those who have positive or negative attitudes toward protected sex.

Demographic findings descriptive of the rural Appalachian region in which this study was conducted were that (a) educational levels reported for many of the subjects' fathers were

lower than the levels reported for subjects' mothers, and (b) parents were typically employed in service or labor jobs, rather than in professions.

In this study, despite having been presented facts and figures in earlier scholastic curricula, the majority of subjects from this sexually active population are not knowledgeable about HPV transmission and prevention. Deficits in knowledge, beliefs, and high level risk behavior persist in a population vulnerable to HPV and cervical cancer.

Furthermore, knowledge represented by responses to items in this study, although related to accepting attitudes regarding protected sex, appeared not to have reduced sexual risk behaviors. HPV knowledge was identified as a predictive variable, with higher levels predicting endorsement of contraceptive methods. The study suggests, however, that information about HPV may not be reaching adolescent females. Although subjects responded to questions aimed at determining their knowledge about STDs/HPV, the level of their knowledge was low. For example, only 31% of the subjects did not know that they could obtain protective measures without parental consent.

A finding that invites further investigation is that girls who report living with both parents are more likely to know less about HPV than girls in other living arrangements. This study suggests that living with both biological parents appears to have a protective influence against early sexual activities. Adolescents living with biological parents reported less sexual activity than those not living with both parents (55% vs 77%, $p > .008$). These findings support Santelli's (2000) conclusion that family structure plays a role in adolescents' sexual behavior and provide evidence that changing adolescent attitudes and behaviors is more complex that simply educational design and implementation.

The data also supports Markham's (2003) findings that family connectedness may be a protective factor related to sexual risk-taking. It is likely that connectedness to family, as well as parental expectation of adolescent success in school and later in life, may be important factors in delaying the onset of sexual activity. It is also possible that when adolescents have high aspirations and life goals, they are more likely to delay sexual activity. Therefore, it can be concluded that efforts to reduce adolescent STDs/HPV infection should focus, not only on health professionals and school systems, but also on (a) increasing parental STDs/HPV knowledge; (b) enhancing parenting skills; and (c) offering community venues, for parents and adolescents, that foster emotional and physical health for this vulnerable age group.

This study supports the findings of Anderson-Ellstorm (1996) that educational HPV information was best received by those who were currently involved in sexual behaviors, with those who had sexual experience providing more accurate answers to the questionnaire, overall. Subjects living with both parents were less knowledgeable about HPV.

Results suggest that living with both biological parents can have a protective influence against early sexual activities. The data encountered in this study support Santelli's (2000) conclusion that family structures play a role in adolescents' sexual behavior, as well as findings in earlier studies of higher incidence of risk-taking behaviors among adolescents where there were low levels of parental monitoring (DiClement et al., 2001; Donenberg et al., 2002; Markham et al., 2003; Nelson et al., 2004; Rai et al., 2003). Parental educational preparation is not high, especially among fathers, in this subject sample of highly sexually active adolescents, supportive of Santelli et al's finding of higher sexual activity among adolescents whose parents have not completed high school.

Limitations

The homogeneity of the subjects is a limitation that precludes generalization of its findings to all populations. An additional preclusion to generalizing the results of this study to the larger population is the use of a convenience sample.

IMPLICATIONS FOR RURAL ADOLESCENT HEALTH

The findings of this study add emphasis to the complexity of understanding the variables that contribute to high incidence of HPV risk behaviors. Identification of low levels of knowledge, despite exposure to information, challenges researchers and school health educators to identify factors that would motivate subjects to learn and to apply learning to behaviors. The finding that living arrangements predict students' awareness of HPV should inspire examination of factors within the home environment that may influence primary prevention. Involvement of parents with adolescent females in school-based programs may lead to increased communication and effective education concerning sexual risk behaviors; **however, research related to the education of adolescents regarding sexuality, STDs, and HPV prevention must be continued**.

ACKNOWLEDGEMENT

This study was supported by a West Virginia University Senate Grant for Research.

REFERENCES

American Social Health Association. (2002). *HPV questions and answers.* Research Triangle Park, NC: ASHA Resource Center. Retrieved June 10, 2004, from http://www.ashastd.org/hpv/hpvref.html

Anderson-Ellstorm, A., Forssman, L., & Milson, I. (1996). The relationship between knowledge about sexually transmitted disease and actual sexual behaviors in a group of teenage girls. *Genitourinary Medicine, 72,* 32-36. [MEDLINE]

Biro, F., Rosenthal, S., Wildey, L., & Hillard, P. (1991). Self-reported health concerns and sexual behaviors in adolescents with cervical dysplasia: A pilot study. *Journal of Adolescent Health, 12,* 391-394. [MEDLINE]

Bosch, F., & de Sanjose, S. (2003). Human papillomavirus and cervical cancer burden and assessment of causalities. *Journal of National Cancer Institute. Monographs, 31,* 3-13. [MEDLINE]

Burk, R. (1999). Human papillomavirus and the risk of cervical cancer. *Hospital Practice, 34*(12):103-111. [MEDLINE]

Clifford, G.M. (2003). Human papillomavirus types in invasive cervical cancer worldwide: A meta-analysis. *British Journal of Cancer, 1,* 63-73. [MEDLINE]

Dell, D.L., Chen H., Ahmad, F., & Stewart, D.E., (2000). Knowledge about human papillomavirus among adolescents. *Obstetrics and Gynecology, 96,* 653-656. [MEDLINE]

DiClemente, R., Wingood, G., Crosby, R., Sionean, C., Cobb, B.K., Harrington K., et al. (2001). Parental monitoring: Association with adolescents risk behaviors. *Pediatrics, 107,* 1363-1368. [MEDLINE]

Donenberg, G., Wilson, H., Emerson, E., & Bryant, F.B. (2002). Holding the line with a watchful eye: The impact of perceived parental permissiveness and parental monitoring on risky sexual behavior among adolescents in psychiatric case. *AIDS Education and Prevention, 14*(2), 138-157. [MEDLINE]

Einstein, M.H., & Goldberg, G.I.(2002). Human papillomavirus and cervical neoplasia. *Cancer Institute, 20,* 1080-1085. [MEDLINE]

Fishbein, M., & Ajxen, I. (1975). *Belief, attitude, intention, and behavior: Introduction to theory and research.* Reading, MA: Edison-Wesley.

Gerhardt, C.A., Pong, K., Kollar, L.M., Hilliard, P.J., & Rosenthal, S.L. (2000). Adolescents' knowledge of human papillomavirus and cervical dysplasia. *Journal of Pediatric Adolescent and Gynecology 13,* 15-20. [MEDLINE]

Guo, J., Chung, I.J., Hill, K.G., Hawkings, D., Catalano, R.F., & Abbott, R.D. (2002). Developmental relationships between adolescent substance use and risky sexual behavior in young adulthood. *Journal of Adolescent Health, 31,* 354-362. [MEDLINE]

Harvard Mental Health Letter. (2005). The adolescent brain: Beyond raging hormones. *Harvard Mental Health Letter, 22,* 1-3. [MEDLINE]

Ho, G., Bierman, R., & Beardsley, L. (2004). Natural history of cervicovaginal papillomovirus infection in young women. *New England Journal of Medicine, 338,* 423-428. [MEDLINE]

Kaiser Family Foundation. (2004). *National Survey of public knowledge of HPV, the Human papillomavirus.* Retrieved October 20, 2004, from http://www.kff.org/womenshealth/apload/13385_1.pdf

Kirby, D. (1998). Math tech questionnaires: Sexuality questionnaires for adolescents. In C.D. Davis et al. (Eds.), Handbook of sexuality-related measures (pp. 35-47). Thousand Oaks, CA: Sage.

Leonardo C., & Chrisler, J. (1992). Women and sexually transmitted disease. *Women's Health, 18,* 1-15. [MEDLINE]

Markham, C., Tortolero, S., Escobar-Chaves, S.L., Parcel, G.S., Harrist, R., & Addy, R.C. (2003). Family connectedness and sexual risk-taking among urban youth attending alternative high schools. *Perspectives on Sexual and Reproductive Health, 35*(4), 174-179. [MEDLINE]

Moscicki, A.B. (1999). Human papillomavirus infection in adolescents. *Pediatric Clinics of North America, 46,* 783-807. [MEDLINE]

National Cancer Institute (2004). *Human papillomavirus and cancer: Questions and answers*. Retrieved March 3, 2004, from http://cis.nih.gov/fact/3_20.htm

Nelson, R., Clark, R., & Acs, G. (2004). *Beyond the two-parent family*. Retrieved September 8, 2004, from http://www.urban.org/ur/print.efm?ID=7422

Rai, A.A., Stanton, B., Wu, Y., Li, X., Galbraith, J., Cottrell, L., et al. (2003). Relative influence of perceived parental monitoring and perceived peer cross-sectional data sets. *Journal of Adolescent Health, 35*(2), 108-118. [MEDLINE]

Ramirez, J.E., Ramos, D.M., Clayton, L., Kanowitz, S., & Moscicki, A.B. (1997). Genital human papillomavirus infections: Knowledge, perception of risk, and actual risk in a non-clinic population of young women. *Journal of Women's Health, 6,* 113-121. [MEDLINE]

Rosenfeld, I. (2004, October 10). Do you know about HPV? *Parade Magazine.* Retrieved September 2, 2004, from http://archive.parade.com/2004/1010/1010_hpv.html

Rosenfeld, W., Vermund, S., Wentz, S.J., & Burk, R.D. (1989). High prevalence rate of human papillomavirus infection and association with abnormal Papanicolaou smears in sexually active adolescents. *American Journal of Diseases of Children, 143,* 1443-1447. [MEDLINE]

Santelli, J., Lowry, R., Brener, N., & Robin, L. (2000). The association of sexual behaviors with socioeconomic status, family structure, and rear/ethics among US adolescents. *American Journal of Public Health, 90,* 1582-1587. [MEDLINE]

Schiffman, M., Herrero, R., Desalle, R., Hildesheim, A., Wacholder, S., Rodriguez. A.C., et al. (2005). The carcinogenicity of human papillomavirus types reflects viral evolution. *Virology, 337,* 76 – 84. [MEDLINE]

Szapocznik, J., & Coatsworth, J.D. (1999). An ecodevelopmental framework for organizing risk and protection for drug abuse: A developmental model of risk and protection. In M. Glantz & C.R. Hartel (Eds.), *Drug Abuse: Origins and Interventions* (pp. 331-366). Washington, DC: American Psychological Association.

Thompson, E. (2004). *CDCs Human Papillomavirus (HPV) and cervical cancer prevention activities.* Testimony of Ed Thompson, MD, before the committee on Government Reform Subcommittee on Criminal Justice US House of Representatives 03/11/2004.

Vail-Smith, K., & White, D.M. (1994). Risk level, knowledge, and preventive behavior for humanpapillomavirus among sexually active college women. *Journal of College Health, 40,* 227-230. [MEDLINE]

Walboomers, J.M., Jacobs, M.V., Manos, M.M., Bosch, F.X., Kummer, J.A., Shah, K.V., et al. (1999). Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. *Journal of Pathology, 19,* 12-19. [MEDLINE]

Yocobi, E., Terrante C., Ferrante, J., Pal, N., & Roetzheim, R. (1999). University students' knowledge and awareness of HPV. *Preventive Medicine, 28,* 535-541. [MEDLINE]