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Human papillomavirus, cervical cancer and women's knowledge

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Abstract

Condensed abstract: In the wake of embarking an HPV vaccination program on the public, a significant proportion of women are not well informed about cervical cancer risk factors.

Background—Human papillomavirus (HPV) is the major risk factor for cervical cancer.

Methods—We implemented a retrospective case-series study to discern HPV knowledge accuracy among women diagnosed with and treated for cervical cancer. Cases (n= 1,174), identified from the Pathology database, were diagnosed and treated for cervical cancer at the same institution. Data were collected using self-administered questionnaires and by reviewing medical records.

Results—A total of 328 (27.9%) women returned the completed forms. Only 19% of the respondents had identified HPV as the primary risk factor for cervical cancer. Environmental pollutants, radiation exposure, poor dietary habits, excessive physical activity and family history of cervical cancer were listed as risk factors among many others. Multivariate analysis was performed to determine variables that were best associated with HPV knowledge accuracy. Age and education were the two variables that were statistically associated with the outcome. Younger and more educated women who participated in this study were more likely to know about the association between HPV infection and the risk of cervical cancer.

Conclusions—Cervical cancer risk factor knowledge, especially knowledge about HPV is low, even among women with the history of cervical cancer. Younger and more educated women are more likely to have HPV and cervical cancer knowledge accuracy. The importance of personal health practices and the focus on health education should be equally emphasized to achieve successful cancer prevention through vaccination.

Keywords

Cervical Intraepithelial Neoplasia Grade III; Cervical Cancer Risk Factors; Cervical Cancer; Human Papilloma Virus

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CONFLICT OF INTEREST – none declared

Introduction

Findings from clinical and epidemiologic research convincingly support that human papillomavirus (HPV) as the major risk factor for carcinoma of the cervix.^{1, 2} HPV infection, although highly correlated, outweighs other known risk factors for cervical cancer such as promiscuous sexual behavior, positive smoking history and low socioeconomic status.³

Results from several surveys suggest that among women with no prior history of cervical cancer, knowledge about cervical cancer risk factors, particularly about HPV infection and its association with cervical cancer is low.^{4–6} Also, it has been suggested that abnormal Pap smear and/or positive test for HPV are the only factors that are associated with HPV knowledge accuracy.⁴ Little is known about of HPV awareness and its association among U.S. women diagnosed with cervical cancer is not known. In view of this observation, we conducted a retrospective case-series study to discern the general knowledge about HPV and the other risk factors for cervical cancer in a group of women diagnosed with and treated for cervical cancer. We limited the study sample to women with pathologic confirmed diagnosis of carcinoma *in situ* because their course of diagnosis and treatment require more rigorous clinical interventions and interactions with the team of health care providers; therefore, more opportunities for educational intervention by the health care providers.

African-American women second to Hispanic-American women experience the highest incidence of cervical cancer in the US.⁷ Disparity in cancer incidence, treatment outcomes and survival across racial lines partially has been attributed to inequalities in accessing screening and other preventive health care services.^{8–10} However, cancer and many chronic health conditions are consequences of a complex of inter-related factors including life-style behavior, education, and socioeconomic status.¹¹ The second objective of the present study was to assess if the proportion of women with cervical cancer risk factor knowledge accuracy differed between African-American and White-American women in the study sample. Finally, various health behavior theories suggest that screening utilization and information seeking behavior are mediated by perception of risk, attitude and knowledge, social influence and self efficacy.¹² Our third objective was to assess the rate of Pap smear utilization in this group of women.

Materials and Methods

Setting

The Henry Ford Health System (HFHS) is a comprehensive, self-contained system, organized so that persons in the system receive every level of care from preventive and primary to subspecialty services. The majority of patients at HFHS are insured through a not-for-profit, mixed model HMO. When a patient is first seen at any of HFHS facilities for any reason, he/she is assigned a permanent and unique lifetime medical record number and is entered into the Master Patient Index database that resides within a larger relational database, the Corporate Data Store. This data store serves as the central repository for data on patient encounters. Annually, health care providers at the HFHS provide health services to over 560,000 individuals, of whom 35% have declared their racial heritages as African-American and 60% as White-American. The racial heritages of the remaining 5% include Native-American, Hispanic-American, Asian-American and individuals with bi-racial background.

Declaration of Ethics Board and Oversight Approval

In the application package to the Human Subject and Ethic Committee of the Institutional Review Board (IRB), we had included a copy of the questionnaire. Because of the personal and relatively sensitive information within the instrument, the committee granted us permission to contact patients only through the US postal services. However, we were permitted to list the

telephone numbers, e-mail addresses of the PI and project coordinators, if women needed further clarifications about the study. Randomly generated unique study numbers were used as study identifiers and were printed on questionnaires. Women who completed and returned the questionnaires were compensated minimally by providing them with gift cards from a major retail chain store. After study participants were reimbursed for their time, the link between any personal identifiers, i.e. names and medical record numbers, were deleted. Confidentiality of the women was maintained during the data collection period. This study was approved by the IRB at Henry Ford Health System (IRB#3538) and is in full compliance with the U.S. Congress Health Insurance Portability and Accountability Act (HIPAA) of 1996.

Study Sample Ascertainment, Recruitment and Sample Size

Case Ascertainment—The process of accruing the study sample began with identifying women diagnosed with gynecological cancers between January 1/1996 and December 31/2003, using the Pathology Information System databases. The Pathology Information System was upgraded in 1995 and then in 2004. To reduce the likelihood of loss of medical information due to incomplete migration of data from the old to then new system, we limited our search to the indicated time period. After identifying all cases of gynecological cancers, we conducted a second search using the key words, “cervical intraepithelial neoplasia grade III”, “CIN III” and “carcinoma *in situ* of the cervix”. Women with the diagnosis of CIN I or II and women with abnormal Pap smear were excluded from the study to reduce the likelihood of the potential confounding effect of treatment duration on the HPV knowledge accuracy. The result of our search yielded a sample size of 1,174 women with pathologic diagnosis of *in situ* cervical cancer between January 1/1996 and December 31, 2003

Consents to Participate in the Study—Due to the personal content of the questionnaire, we were permitted by the IRB to contact women only via the US postal services. Therefore, it became necessary to opt for the “consent by proxy” approach. The process required us first to obtain permissions from physicians to contact their patients. In doing so, we sent permission packages, containing letters explaining the purpose and the source of funding for the study and copies of the questionnaire, to physicians. After receiving their approvals, we mailed introductory letters to the potential study participants. Within the letter, we explained the purpose of the study and its source of funding. In addition, we explained that we were permitted by their physicians to contact them. About a week post mailing, the participants were mailed packets that contained the questionnaires, cover letters, a one-page instruction sheet about the questionnaire, self-addressed and stamped return envelopes and contact telephone numbers and e-mail addresses of the investigators. In the cover letter, we clearly and in bold letters emphasized the following two points. First, by completing and returning the questionnaires they were consenting to participate in the study. Second, names, addresses and any form of identifiers would be deleted after they were compensated for their participation in the study.

Data Collection

The underlying concept and format of the instrument was grounded on and closely modeled after several already developed and field tested questionnaires and the sections on sexually transmitted diseases and women’s health in the Centers for Disease Control Behavioral Risk Factor Surveillance System.¹³ The initial questionnaire was designed to collect data on: 1) demographic variables; 2) knowledge about cervical cancer risk factors, and 3) personal and life-style factors. The draft copy of the instrument was field tested. A total of 25 women, ages 25–55 years, who were patients at the HFHS participated in the evaluation of the instrument and provided us with feedback. The major concern was the length of the instrument and therefore, the required time to complete the instrument. We modified the instrument by omitting those questions, i.e. date of birth, date of diagnosis, number of live births, and number of spontaneous and induced curettage, for which data could be retrieved from the medical

records. The final questionnaire was limited to 5-pages to lower the probability of participation refusal, and recall bias due to cognitive boredom and fatigue.^{14, 15} The questionnaire was designed so that women could provide answers to the listed personal questions in private, without requiring assistance of an interviewer.

Demographic data, date of birth and self-described racial/ethnic heritage, were retrieved from the medical records. Also, dates for annual Pap smear utilization post diagnosis of cervical cancer, number of full-term pregnancies and spontaneous and/or induced curettage, age of menarche and menopause were collected from medical records. Information about personal life style and habits, risk factors, self-reported annual utilization of Pap smear, family history of cervical cancer and in utero exposure to DES were collected from the questionnaire. Returned questionnaires were reviewed for completeness of responses and evaluated for missing or questionable values. The direct telephone or in-person communication was not included in the study protocol, in compliance with the requirements of the IRB. However, responses for questions that could be validated against medical records, i.e. frequency of clinic visits for Pap smear were validated. This comparison identified women (n=5) with a high proportion of questionable answers and therefore, they were removed. The process of data quality control and editing was a continuous process that included range checks, inter-item checks. After completion of data retrieval and quality assurance step, all medical record numbers were deleted from the database, as it was required by the IRB, and each woman was identified by her assigned unique study identifier.

Statistical Analyses

We used descriptive statistics to summarize the characteristics of the study population. The variables “age at the time of diagnosis”, “age at menarche”, “age at the time of survey” and “age at first sexual intercourse” were used as continuous variables. Education level was categorized into 5 groups, less than high school, high-school/GED graduate, some college/associate degree, 4-year college graduate and post-graduate/professional training. For alcohol consumption, women were categorized as abstainer if they had reported no alcohol consumption. For those who had reported otherwise, we calculated their total alcohol consumption per month. We defined a “drink” of alcohol as either intake of liquor (30 mL), or one can of beer (360 mL), or one glass of wine (120 mL). Alcohol consumption per month was then quantified by multiplying the reported numbers of drinks of liquor, beer and/or wine by the indicated volume of alcohol for each category. For the variable “smoking history” women were classified as either “never smoker”, “ex-smoker” or “current smoker”. We then calculated pack-years of smoking history, i.e. packs of cigarettes per day multiplied by years smoked. We employed Census 2000 data at the block group level to estimate the annual household income. The use of census-block group assignment in the assessment of persons’ household income data has been shown to generate data that correlates with the reported income data.¹⁶ For each responder and non-responder we used her residential address to identify the census block group. Differences in the distributions the demographic, lifestyle and clinical variables between African-American and White-American women were assessed using two sample Student’s t-test, Chi-squared test of significance and Wilcoxon rank-sum test, as appropriate.

We calculated utilization continuity index to validate the self-reported Pap smear screening utilization against the medical records. In doing so, we collected data on the annual Pap smear utilizations by reviewing the medical records. In addition, we collected dates of the last contacts for any reason with the health care system. The ratio of clinically documented to the expected number of utilization, using the following formula, was then calculated.

$$CI = \frac{\text{No. of documented Pap smear screening post-treatment}}{\text{Age}_2 - \text{Age}_1}$$

Where, Age₂ was defined as a woman's age as of her last year of contact with the HFHS for any reason and Age₁ as the age at the time of her initial diagnosis. The theoretical value of CI is continuous, ranging from 0 to 1. Women with no documentation of Pap smear screening received a score of 0; while, women who had complied with the recommended annual Pap smear screening received a score of 1. Concordance between self-reported and clinically documented Pap screening utilization was tested using Kappa statistics.

We applied multivariate logistic regression to estimate the variables that were best associated with the risk factor knowledge inaccuracy. In doing so, we first dichotomized responses to the question "What is the primary risk factor for cervical cancer?" In the "correct" category we included responses that either had mentioned HPV or terms that were indicative of promiscuous sexual behavior. This classification was justified because of the high correlation between sexual promiscuity and HPV infection. Other responses, i.e. smoking, heredity, douching, cysts, hormonal therapy, urinary tract infection, swimming in infected pool of water, etc. were included in the "incorrect" category.

In developing the best-fitted model, we first estimated the individual effect of each variable and interaction by race on the outcome the "incorrect risk factor identification". Variables were evaluated because of their potential demographic or lifestyle influences. The variables of education, number of partners, pack-years, quantity of alcohol and age at the time of diagnosis were included in the model as continuous data. The remaining variables, such as menopausal status at the time diagnosis, use of contraceptives, and family history of cervical cancer were included in the model as categorical data. Correlations between different variables were estimated and multicollinearity was prevented by including in the model only variables with coefficient values of 0.7 or less.¹⁷ Variables with p-value <.10 from the univariate analysis were considered as the candidate variables. Interaction between variables also were tested at P<.10. The initial model was built using the forward stepwise selection approach. The final model contained only variables that were significant at P<.05. All statistical tests were two-sided and analyses were performed using the procedure statement "Proc Genmod" in SAS, v. 9.1 (SAS Institute, Cary, NC).

Results

A total of 1,174 questionnaires were mailed and 328 (27.9%) women returned the completed forms. Comparison of racial and age distribution between the responders and non-responders suggested that among non-responders the racial distribution was almost equal, with 52.5% (n=443) as White-American and 47.5% (n=401) as African-Americans. However, among responders 65.2% (n=215) were White-American and 34.9% (n=115) were African-American. The difference in the racial distribution between responders and non-responders was statistically significant (p<.001). The non-responders had the mean age of 32 ($\pm$ 13) years at the time of diagnosis, while, the mean age for responders was 35 ($\pm$ 13) years (p = 0.117). The responders had slightly higher estimated household income (\$ 54, 769.00) than the non-responders (\$38, 096.00) (p<.001).

Findings presented here forth represent women who completed and returned the questionnaires. African-American women with the mean age of 35 $\pm$ 13 years at the time of diagnosis were slightly older than White-American women (34 $\pm$ 12); however, this difference did not reach the level of statistical significance (p=.498). (Table 1) The average age for all women was 39 ($\pm$ 13) years at the time of survey with an average of 5.3 ($\pm$ 3.1) years post diagnosis.

For the variable "education" differences in the distribution of self-reported educational attainment between the two groups did not reach the level of statistical significance. (Table 1) Past or present smoking habits were more commonly reported by White-American women

($p=0.005$). About 30.8% ($n=59$) of White-Americans compared with 16% ($n=14$) of African-Americans had classified themselves as current smokers. The prevalence of past smoking habit was 20.3% ($n=43$) and 15.1% ($n=19$) among White-Americans and African-Americans, respectively. Similarly, consumption of alcoholic beverages was more commonly reported by White-Americans (72.7%, $n=152$) than African-Americans (55.5%, $n=65$) ($p=0.012$). The average age at first sexual intercourse was age 16 for African-American women compared with age of 17 for White-American women ($p=.043$); however, there was no statistically significant difference in the number of sexual partners between the two groups.

On the average African-American women (17.0 ± 7.0) had started their families about 2 years in advance of their White-American counterparts (19.0 ± 10.0) ($p=0.04$). In response to the question “have you ever experienced at least one full-term pregnancy?” about 89.1% ($n=103$) of African-American women compared with 83.4% ($n=177$) of White-American women had responded positively ($p=0.016$). Finally, in response to the question “how many sexual partners you have had throughout your life?” Three (0.9%) women had reported of no sexual partners, while, 53 (16.2%) women with more than 15 were at the other end of the spectrum. For the remaining 272 women, 77 (23.5%) had reported between 1–3 partners, 79 (24.1%) between 4–6 partners, 52 (15.9%) between 7–9 partners, 41 (12.5%) between 10–12 partners and 18 (5.5%) between 13–15 partners. There were no statistical differences in the proportions of African-American and White-American women in the reported number of sexual partners, or those who had reported ever using contraceptives, exposed to diethylstilbestrol *in utero*, or utilized annual Pap smear screening. Finally, the proportion of African-American women (29.4%, $n=34$) who had reported having a family history of cervical cancer was about 2-fold higher than White-American women (15.5%, $n=35$) ($p=0.009$).

All women underwent colposcopy that was followed by conization of the cervix. The procedure loop electrosurgical excision was the primary method of treatment ($n=211$, 58.4%) in this sample of women. The other surgical method included cold knife, also known as laser excision ($n=149$, 41.3%), and cryo therapy ($n=1$, 0.4%). Surgical management of 80 women (22.2%) included dilation and curettage in addition to conization. The distribution of treatment modality between African-American and White-American women did not reach the level of statistical significance.

In Table 2, we have presented responses to questions related to cervical cancer risk factors and early detection. About one-third of African-American (32.8%, $n=37$) and White-American (35.2%, $n=75$) women had reported that cervical cancer cannot be prevented ($p=0.219$). The majority had the knowledge about availability of a screening procedure for early detection of cervical cancer ($p=0.70$). The proportions of African-American (33.6%, $n=38$) and White-American (32.6%, $n=66$) women who had reported that promiscuous sexual behavior was a risk factor for cervical cancer were almost equal. However, only 10% ($n=12$) of African-American women compared with 22.5% ($n=49$) White-American women had correctly identified HPV infection as the primary risk factor for cervical cancer.

We then evaluated the variables that were best associated with the likelihood of risk factors knowledge inaccuracy. The two variables age and education remained statistically significant in the final logistic regression model. The odds ratio for incorrect risk factors identification increased by 3% for each year of age (OR=1.03, 95% CI 1.01–1.61, $p=0.003$), while this odds ratio decreased almost linearly with the level of education. For women with less than a high school education, the probability of providing a wrong answer was about 6 fold higher than the referent, women with post-graduate education (OR=6.27, 95% CI 1.98–19.71, $p=0.003$). This likelihood dropped to 2.12 (95% CI = 1.09–4.13, $p=0.006$) for women with a high school education and decreased to 1.91 and 1.10 for women with an associate and a 4-year college

education, respectively, although the latter two estimates of probability did not reach to the level of statistical significance.

Finally, we calculated concordance between the self-reported and clinically documented annual rate of Pap smear utilization ($\kappa = 0.0341$, $p = 0.151$). About 88% ($n=289$) of the study participants had reported annual utilization of Pap screening, 3.7% ($n=12$) biennial, and 8.2% every three or more years ($n=27$). Validation of self-reported data against medical records, however, indicated that 26.2% ($n=86$) had utilized Pap screening annually, 51.8% ($n=170$) biennially and 21.9% ($n=72$) every three years or more. When we stratified data by the racial heritage of women and evaluated concordance between the self-reported and medically reported Pap smear utilization, we did not detect a significant difference between the estimated kappa values for African-American women ($\kappa = 0.0360$, $p=0.316$) and White-American women. ($\kappa = 0.0336$, $p=0.284$).

Discussion

We conducted a retrospective case-series study to evaluate the general knowledge about cervical cancer risk factors and post-treatment Pap smear utilization in a group of women diagnosed and treated for cervical cancer. Women, who participated in this study had the knowledge that they had been diagnosed with cervical cancer, in addition, the majority of them had stated that cervical cancer could be prevented; however, only 19% of them had accurately identified HPV as the primary risk factor for cervical cancer. Although, our finding concurs with previous reports⁴⁻⁶ that only a small fraction of women have knowledge accuracy about HPV and its association with cervical cancer, this low level in our study sample is of a concern. The women who participated in this study were all diagnosed with carcinoma *in situ* of the cervix and had knowledge about their diagnosis. It has been suggested that an abnormal Pap smear and/or testing positive for HPV is the only factor associated with HPV knowledge accuracy.⁴ Women who participated in this study, because of their diagnoses and treatments, had multiple interactions with their health care providers and thereby, multiple opportunities for education about HPV infection and its association with cervical cancer. Various models of disease prevention are proponent of the influencing role of physicians in effectively educating women and motivating them to take more active roles in their primary and secondary health care interventions.¹⁸⁻²⁰ The observed low HPV knowledge accuracy in this group of women could be an indication that the influencing role of physician for education was not adequately exercised. Alternatively, it can be argued that this low proportion is a result of the recall bias. The average time span between the time of diagnosis and participation in the survey was about 5 years; it is likely that these women were educated during their course of treatments and yet the knowledge gradually had abated from their memories because of the repeated normal Pap smear screenings. Similar to previous findings we also found that younger and more educated women were more likely to know about the association between HPV infection and the risk of cervical cancer.⁴

The self-reported annual utilization of Pap smear was inflated in this study sample. This is most likely due to the fact that women were aware of their status as high risk for cervical cancer and therefore had opted to exaggerate in their responses. Research suggests that the validity of self-reported health behaviors are compromised if a certain health behavior is perceived as an expected behavior.^{21, 22}

We attribute the low rate of survey return in this study to the sensitive content of the questionnaire and to the method of contact, US postal services. Many women opted not to participate in this study because of the personal nature of the questionnaire, as it was indicated on their returned but un-answered surveys. However, several women chose to contact us by phone and after receiving the verbal assurance from the study manager and/or the PI of the

project about their confidentiality and anonymity, questionnaires were completed and returned. A second factor was the method of survey. The Human Subject and Ethic Committee at our institution had approved US postal services as the only means of communication with the women. This limitation was imposed to minimize the likelihood of distress for women who were receiving their health services at our institution at the time of the study. The low response rate when using postal surveys have been addressed previously.²³

To our knowledge this is the first report to assert that the knowledge of HPV and its association with cervical cancer in a group of women diagnosed with and treated for carcinoma *in situ* of the cervix. The main strength of our study was the source of patient population and clinical and pathologic data that were generated by practitioners, policies and procedures used in one single medical group. Our study also had two limitations. First, the low response rate in this sample of women most likely induced a bias in the direction of underestimating the true estimate of mis/uninformed women. Second, the retrospective design of the study did not permit us to adequately discern factors that were associated with low level of knowledge in this group of women. However, our finding further shed the light on the low awareness about the link between HPV and cervical cancer among US women. Findings from the present and several previously published studies are indicative for the pressing need to adequately educate public about HPV and its association with cervical cancer. The foundation of successful cancer prevention through vaccination requires a mutual focus on health education and the assertion of the importance of personal health practices. Worse would be to create an iatrogenic increase in the incidence of cervical cancer by creating a misconstrued notion about HPV vaccination as the panacea for cervical cancer.

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Table 1

Sociodemographic characteristics of study participants.¹

Variable	All women N=328	(%)	African-Americans N=116	(%)	White-Americans N=212	(%)	p-value	
Demographic								
Age at diagnosis	Yrs (mean ± SD) ²	34.0	(±12.7)	34.6	(±13.2)	33.6	(±12.5)	0.50
Age at the time of survey	Yrs (mean ± SD) ²	39.7	(±13.3)	40.5	(±13.5)	39.3	(±13.3)	0.43
Education ³	< High School	23	(6.7)	8	(6.8)	15	(6.7)	0.17
	High School/GED	112	(34.2)	38	(33.9)	74	(36.0)	
	2 yr College/Assoc. Degree	78	(23.8)	36	(30.5)	42	(20.0)	
	4-yr College	57	(17.4)	15	(12.7)	42	(20.4)	
	> 4 yr College	57	(17.4)	19	(16.1)	38	(16.9)	
Social & Life-style								
Smoking ⁴	Never Smoker	193	(55.8)	83	(68.9)	110	(48.9)	0.005
	Ex-Smoker	72	(18.7)	19	(15.1)	43	(20.3)	
	Current Smoker	62	(25.7)	14	(16.0)	59	(30.8)	
Alcohol ⁴	Abstainer	111	(33.8)	51	(44.5)	60	(27.3)	0.042
	Consumer	217	(66.2)	65	(55.5)	152	(72.7)	
Age at first sexual intercourse	Yrs (mean ± SD) ²	16.8	(±3.0)	16.0	(±3.0)	17.0	(±3.0)	0.043
Number of sexual partners ⁴	None	3	(0.9)	1	(0.8)	2	(0.9)	0.64
	1-3	77	(23.5)	20	(16.9)	57	(25.6)	
	4-6	79	(24.1)	31	(23.8)	53	(23.8)	
	7-9	52	(15.9)	19	(16.1)	35	(15.7)	
	10-12	41	(12.5)	20	(17.0)	27	(12.1)	
	13-15	18	(5.5)	6	(5.1)	13	(5.8)	
	More than 15	53	(16.2)	21	(17.8)	16	(16.1)	
Clinic								
Age at menarche	Yrs (mean ± SD) ²	12.6	(±1.6)	12.5	(±1.7)	12.6	(±1.6)	0.404
Age at first pregnancy	Yrs (mean ± SD) ²	18.5	(±9.0)	17.0	(±7.0)	19.0	(±10.0)	0.04
Ever experience induced or spontaneous miscarriage	No	181	(55.2)	48	(41.4)	133	(62.7)	0.06
	Yes	146	(44.5)	58	(58.6)	78	(36.8)	
Contraceptive	Never users	27	(8.1)	9	(8.4)	18	(8.0)	0.80
	Past/Present users	301	(91.9)	107	(91.6)	194	(92.0)	
In utero exposure to DES ⁵	No	286	(87.8)	97	(84.0)	189	(89.9)	0.30
	Yes	11	(3.6)	5	(4.2)	6	(2.6)	
	I do not know	31	(8.6)	14	(11.8)	17	(7.5)	
Pap-smear screening	Annually	289	(88.1)	103	(88.8)	186	(87.7)	0.66
	Biennial	12	(3.7)	2	(1.7)	10	(4.7)	
	Every 3 years or more	27	(8.2)	11	(9.6)	16	(7.6)	
Family history of cervical cancer	No	69	(21.0)	34	(29.3)	35	(16.5)	0.009
	Yes	253	(77.1)	82	(70.7)	171	(80.6)	
	I do not know	5	(1.5)	0		5	(2.3)	

¹ Number of women each category may not add-up to 328, due to the missing category.

² Student T-test

³ Wilcoxon Rank Sum test of significance

⁴ Mantel-Haenszel Chi-square test of significance

⁵ Diethylstilbestrol

Table 2

Distribution of responses to questions pertaining to cervical cancer prevention, screening and risk factor knowledge¹

Question	Response option	All women N=328	(%)	African-Americans N=116	(%)	White-Americans N=212	(%)	p-value
Is cervical cancer preventable?	No	212	(63.7)	76	(64.7)	136	(63.4)	0.22
	Yes	112	(34.6)	37	(32.8)	75	(35.2)	
	I do not Know	4	(1.7)	3	(2.5)	1	(1.3)	
Can women be screened for cervical cancer?	Yes, the screening procedure is called Pap smear	203	(61.9)	68	(58.6)	135	(63.7)	0.70
	Yes, but I do not know the name of the screening procedure	105	(32.0)	40	(34.4)	65	(30.7)	
	No, there is no screening for cervical cancer	20	(6.1)	8	(6.9)	12	(5.7)	
Risk factor Knowledge	Promiscuous sexual behavior	117	(32.4)	38	(33.6)	66	(32.6)	0.17
	HPV	69	(19.1)	12	(10.1)	49	(22.5)	
	Do no know	69	(19.1)	31	(26.9)	35	(15.4)	
	Hereditiy	37	(10.3)	9	(7.6)	25	(11.5)	
	Infection	30	(8.4)	11	(9.2)	18	(7.9)	
	Smoking	18	(5.0)	6	(5.0)	10	(4.9)	
	Others	21	(5.7)	10	(7.6)	12	(5.3)	

¹ Number of women in each category may not add-up to 328, due to the missing category

² Mantel-Haenszel Chi-square test of significance

³ Wilcoxon Rank Sum test of significance

⁴ The following responses were included in this category "Sex", "Sexual Partner", "Sex at Young Age", "Unsafe Sex", "Multiple Partners" and "Intercourse with Uncircumcised Men"

⁵ The following responses were included in this category: "STD", "Infection", "Hepatitis" and "Virus"

⁶ Cervical rupture during pregnancy, Chronic irritation, Douching, Exercise, Hair dyes, Hormonal therapy, Menopausal disorder, Obesity, Pelvic examination, Polluted swimming water, Poor dietary habits, Poor hygiene, Radiation, Trauma to vagina & cervix, Urinary tract infection

Table 3

Age and education were independently associated with the likelihood of providing incorrect information about cervical cancer risk factors: Results of multivariate logistic regression analysis.

	Incorrect Response (n=161, 49.1%) vs. Correct Response (n=167, 50.9%)		
Variable	Odds Ratio	95% Confidence Interval	p-value
Age at the time of diagnosis	1.03	1.01– 1.61	0.003
Education			
> 4 yr College	Reference	-	-
4-yr College	1.10	0.51– 2.40	0.934
2 yr College/ Assoc. Degree	1.91	0.94– 3.89	0.679
High School/GED	2.12	1.09– 4.13	0.006
< High School	6.25	1.98–19.71	0.003