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Psychosocial Predictors of Adherence to Risk-appropriate Cervical Cancer Screening Guidelines: a cross sectional study of women in Ohio Appalachia participating in the Community Awareness Resources and Education (CARE) project

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Abstract

Objective—We describe factors, in the context of the Social Determinants of Health model, associated with receiving Pap smears within risk-appropriate guidelines (i.e., guidelines that specify screening intervals based upon a woman's individual risk of developing cervical cancer).

Methods—Completed in June 2006, we conducted a cross-sectional survey of women from 14 health clinics in Ohio Appalachia pertaining to psychosocial, demographic, biological, and health-related factors. A logistic regression model was constructed to predict whether or not a woman was within risk-appropriate cervical cancer screening guidelines.

Results—Of 562 women with a date of last Pap smear, 380 (68%) were within risk-appropriate guidelines. Logistic regression showed that, compared to women with low-level SES, women with middle- and high-level SES had 3.39 [1.85, 6.21] and 3.86 [2.03, 7.34] times the odds, respectively, of being within risk-appropriate guidelines. Odds of being within guidelines increased 1.09 [1.04, 1.15] fold for each decrease of one major life event. Additionally, women that were financially better off or financially worse off than their parents at the same age had lower odds (0.41 [0.23, 0.73] and 0.49 [0.24, 0.98], respectively) of being within guidelines than women who reported their finances were the same as their parents. Results also showed an interaction between marital status and age at first intercourse (p=0.001).

Conclusion—The results suggest an impact of psychosocial factors on Pap smear testing behaviors, and illustrate the need to examine risk-appropriate interventions to improve screening.

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Conflicts of Interest: None

Keywords

cervical cancer; Pap smear; Pap test; risk-appropriate; screening; guidelines; women; barriers; underserved populations; health disparities

INTRODUCTION

Since its introduction in the 1950's, the Pap smear has been associated with sharp declines in cervical cancer incidence and mortality. While Pap smear testing has been recommended and well-established for many years, not all women report receiving screening at appropriate intervals. Data from the Ohio Behavioral Risk Factor Surveillance System (BRFSS) in 2006 show that 83.4% of women aged 18 and older reported having had a Pap smear within the past 3 years (Ohio Behavioral Risk Factor Surveillance System, 2006), yet this rate of Pap smear utilization is considerably lower than the Healthy People 2010 target of 90% (U.S. Department of Health and Human Services, November 2000). Moreover, this rate does not consider a woman's risk status for cervical cancer in determining if Pap smears were received at optimum intervals. For example, women with any risk factors for cervical cancer (i.e., smoking, early age at first intercourse, five or more sexual partners in a lifetime, or having a personal history or partner with a history of human papillomavirus (HPV) or a sexually transmitted infection (STI)) should have a Pap smears annually, while those women with no identified risk factors should have a Pap smears at least every 3 years (American College of Obstetricians and Gynecologists, 1995; Cyrus-David, Michielutte et al., 2002). Additionally, past studies have documented that certain groups of women (i.e., poorer income, lower educated, elderly, minority, geographically isolated) are less likely to report having had a Pap smear within recommended guidelines (Akers, Newmann et al., 2007).

The Community Awareness, Resources, and Education (CARE) project is a P50 Center grant funded through the National Institutes of Health Centers for Population Health and Health Disparities (CPHHD) initiative. This initiative has proposed a novel framework for addressing health disparities that integrates both upstream (i.e., individual-level demographics, behaviors, and biology) and downstream (i.e., community characteristics, policy and institutional contexts, and societal relationships and conditions) multilevel factors (Warnecke, Oh et al., 2008). Using this framework and consisting of both observational and intervention-based projects, CARE uses a transdisciplinary approach, focused on the Social Determinants of Health (SDH) model (Marmont, 1999), to address the problem of high cervical cancer incidence and mortality rates in Ohio Appalachia, a region, at the time the study was conducted, comprised of 29 counties in the state.

The first phase of CARE, completed in June 2006, involved collecting cross-sectional in-person survey data on women from participating clinics in order to characterize social, demographic, biological, and health-related factors associated with obtaining regular Pap smears. The focus of this paper is to describe factors that were associated with receiving Pap smears within risk-appropriate guidelines among women who completed the survey, using the CPHHD overall multilevel framework and the SDH model. To our knowledge, this is the first time that several of these factors have been examined in relation to risk-appropriate guidelines for Pap smear utilization.

METHODS

Study Design

The CARE project divided Ohio Appalachia into four regions (Hade, 2009 submitted to *Prev Med*). The northeast, central, southern, and southwest parts of Ohio Appalachia correspond to

Regions 1, 2, 3, and 4, respectively. Twenty-two health clinics in Ohio Appalachia were approached to participate in CARE, of which 14 (63.6%) agreed. Monthly random samples of women from these clinics were selected, and medical records were reviewed to determine eligibility. To be eligible, a woman had to be at least 18 years of age, a resident of an Ohio Appalachian county, not pregnant, seen in a participating clinic within the last two years, and have no history of hysterectomy or invasive cervical cancer. If a woman was eligible and agreed to participate, a baseline survey was conducted, usually at the participant's home. Of the 801 women who were contacted and determined to be eligible, 571 completed the interview yielding a cooperation rate of 71% (Hade, 2009 submitted to *Prev Med*). Women who refused to participate in the survey were demographically similar (age, race, and ethnicity) to those who did participate, except more women from Region 4 (21% vs. 13%, p=0.029), and more women who reported being current smokers (41% vs. 29%, p=0.004) refused to participate. The study was approved by the Institutional Review Boards at Ohio State University, the University of Michigan, and the Centers for Disease Control and Prevention (CDC).

Measures

Outcome Variable—The outcome of interest was whether or not a woman was within risk-appropriate cervical cancer screening guidelines, which was dependent on both screening history and cervical cancer risk level. A woman was classified as *high risk* for cervical cancer if she reported any of the following behaviors: 1) five or more sexual partners during lifetime; 2) sexual intercourse before age 18; 3) being a current smoker; 4) ever being diagnosed with an STI (HPV, genital warts, genital herpes, syphilis, gonorrhea, human immunodeficiency virus (HIV)); or 5) having a sexual partner with history of an STI (American College of Obstetricians and Gynecologists, 1995; Cyrus-David, Michielutte et al., 2002). Conversely, a woman was classified as *low risk* if she did not report any of the previous behaviors or conditions. High risk women were considered to be within guidelines if their most recent Pap smear was in the 13 months prior to their cross-sectional interview, while low risk women were classified as being within screening guidelines if their most recent Pap smear was in the 37 months prior to their interview. These definitions of compliance with risk-appropriate screening guidelines were drawn from the consensus recommendation of the National Institutes of Health with additional guidelines provided by the American College of Obstetricians and Gynecologists, and have been established for over a decade (American College of Obstetricians and Gynecologists, 1995; Cyrus-David, Michielutte et al., 2002). To determine the date of a woman's most recent Pap smear, information from medical records review was used, if available (N=428, 76.2%). Otherwise, self-reported dates were used (N=134, 23.8%). Of the 421 women who had both medical record information and self-reported information available, 340 (80.7%) had agreement between the two. Among women who self-reported being within guidelines (N=342), 19% (N=65) were not based on medical record review. In contrast, of those who self-reported not being within cervical cancer screening guidelines (N=79), 20% (N=16) actually did receive a Pap smear based on medical record review, thus discrepancies were evenly balanced.

Independent Variables—Independent variables were selected based on their relationships to Pap smear screening behaviors and were categorized using the SDH model. The categories included social and cultural factors, material factors, health and health behaviors, psychological factors, and environmental factors (Table 1).

Instruments used for the independent variables included social cohesion level (Sampson, Raudenbush et al., 1997), Detroit Area Study Discrimination Questionnaire (DAS-DQ) (Taylor, Kamarck et al., 2004), Trust in Physician Scale (TPS) (Anderson and Dedrick, 1990), Center for Epidemiologic Studies Depression (CES-D) scale (Radloff, 1977), Beck Anxiety Inventory (BAI) (Beck, 1990), Life Stressor Checklist-Revised (LSC-R) scale (Wolfe,

1997), Perceived Stress Scale (Cohen, Kamarck et al., 1983), and God Locus of Health Control (GLHC) measure (Wallston, 1999). Additionally, the collective efficacy scale utilized was based on a similar concept used by Sampson et al (Sampson, Raudenbush et al., 1997).

The measure of socioeconomic status (SES) used in this analysis was loosely based on the Hollingshead scale (Hollingshead, 1975), and was derived by combining information on occupation, education, and income. Scores ranged from 0 to 6, with a higher score suggesting better SES. All three variables were categorized into three groups and summed as follows: occupation (professional (+2), skilled laborer (+1), unskilled laborer (0)); income (over $50K (+2), $25K–$50K (+1), under $25K (0)); education (more than high school (+2), high school or GED (+1), less than high school (0)). For analysis purposes, SES was grouped into three levels: SES scores of 0–1, 2–3, and 4–6 represent low-, middle-, and high-level SES, respectively.

The barriers to cervical cancer screening score, the knowledge about cervical cancer and Pap smear testing scale, and the beliefs about Pap smear testing scale were all based on previously used measures (Paskett, Rushing et al., 1997; Paskett, Tatum et al., 2006). For the barriers score, each item was worth one point with possible scores ranging from 0 to 10. Higher scores reflected more barriers to getting a Pap smear. Scoring methods for the knowledge and beliefs scales were similar (Paskett, Rushing et al., 1997). Environmental factors were based on Census 2000 data at either the census tract or county level.

Statistical Analysis

Descriptive statistics were used to provide overall sample characteristics. Univariate logistic regression models incorporating clinic as a random effect were utilized to assess the association of each independent variable with whether a woman was within or outside risk-appropriate cervical cancer screening guidelines. Available case analysis was used for instances of item non-response at the univariate level.

Next, a multivariable random effects model was built using a forward stepwise selection procedure. After the initial main effects were determined, the presence of significant two-way interactions was assessed. Odds ratios and 95% confidence intervals were calculated from the final multivariable model. Complete case analysis was used for logistic regression modeling. All analyses were performed using SAS v9.1.3 (SAS Institute, Inc., Cary, NC) and Stata SE 9.2 (StataCorp, College Station, Texas).

RESULTS

A total of 571 women in the CARE study completed the cross sectional baseline survey. Of those, 562 (98%) had either a self-reported last Pap date or last Pap date confirmed by medical record review that was used to determine their screening status. The nine (2%) women who did not have either were excluded from all subsequent analysis.

Of the 562 participants with a date of last Pap smear, 380 (68%) were within risk-appropriate screening guidelines and 182 (32%) were not. Summary statistics for participant characteristics by cervical cancer screening status are listed in Table 1. At the univariate level, women who were outside guidelines tended to be less well-educated, had lower measures of SES, and were more likely to be divorced, widowed, or separated. Additionally, women who reported having had a greater number of major life events on the LSC-R, who had a higher score on the life stressor sum section of the LSC-R, and who reported greater feelings of discrimination on the DAS-DQ had higher odds of being outside of guidelines.

Table 2 displays summary statistics for variables related to cervical cancer risk status, as well as other variables involving Pap smear testing. Cervical cancer risk status, number of lifetime sexual partners, sexual intercourse before the age of 18, and smoking status were all highly associated with whether a woman was within risk-appropriate cervical cancer screening guidelines. Because cervical cancer risk status is a combination of components, including the number of lifetime sexual partners, age at first intercourse, history of STI, and smoking status, the overall risk covariate was not included in the selection procedure. Instead, the separate components of risk status were modeled as individual covariates in the forward selection process.

Odds ratios and 95% confidence intervals from the final multivariable model (n=479, after exclusion of incomplete cases) are shown in Table 3. Socioeconomic status, number of major life events, and perceived financial status compared to the participant's parents were all significantly associated with risk-appropriate screening status. In addition, there was a significant interaction between marital status and whether the participant first had sexual intercourse before age 18 ($p = 0.009$).

The final model showed good fit (Hosmer-Lemeshow goodness-of-fit test $p=0.795$) (Hosmer and Lemeshow, 2000) and acceptable discrimination (area under the ROC curve = 0.767). Fractional polynomials suggested appropriate modeling of continuous variables.

DISCUSSION

Recent cervical cancer incidence rates among counties in Ohio Appalachia ranged from 11.4 to 20.3 per 100,000 women, which was noticeably higher than the national rate of 9.6 per 100,000 women (Ohio Cancer Incidence Surveillance System, 2003). One of the possible reasons for the elevated cervical cancer rates observed in this region is the underutilization of the Pap smear. The main focus of this research was to identify factors associated with being within risk appropriate cervical cancer screening guidelines among women in Ohio Appalachia.

Results indicate that multiple factors were significantly associated with Pap smear screening status. Socioeconomic status and the number of major life events experienced had the strongest associations with whether or not a woman was within risk-appropriate screening guidelines. A woman's financial status compared to her parents at the same age was also found to be associated with the outcome. Lastly, there was an interesting interaction between marital status and if a woman had sexual intercourse before the age of 18. Among women who reported never being married, those who did not have sexual intercourse before age 18 had significantly lower odds of being within screening guidelines compared to those that did have sex before age 18. Additionally, among women who reported having had sex before age 18, those who were married and those who had been divorced, widowed, or separated had lower odds of being within risk appropriate guidelines than women who were never married.

Previous studies have examined predictors of Pap smear testing using a variety of data sources and a wide range of individual- and community-level variables. These earlier studies found that a woman's marital status, socioeconomic status, education, insurance status, smoking status, physical and mental heath, and family income were all significantly related to being within recommended cervical cancer screening guidelines (Snider, Beauvais et al., 1996; Lee, Parsons et al., 1998; Snider and Beauvais, 1998; Simoes, Newschaffer et al., 1999; Fontaine, Heo et al., 2001; Maxwell, Bancej et al., 2001; Cyrus-David, Michielutte et al., 2002; Ostbye, Greenberg et al., 2003; Sambamoorthi and McAlpine, 2003; Carrasquillo and Pati, 2004; Coughlin, Uhler et al., 2004; Diab and Johnston, 2004; Lockwood-Rayermann, 2004; Pirraglia, Sanyal et al., 2004; Ferrante, Chen et al., 2006; Akers, Newmann et al., 2007; Blackwell,

Martinez et al., 2008). This study highlights some of these same findings in a unique population of Appalachian women (i.e., that poorer, less educated, and non-married women were generally more likely to be outside of cervical cancer screening guidelines). In addition, this is the first study to our knowledge to highlight the potential association between major life events and adherence to cervical cancer screening guidelines. Furthermore, this study highlights a potential modifying effect involving age at first intercourse and marital status regarding risk-appropriate screening guidelines that has not been otherwise reported. While previous research has found age to be a significant predictor of cervical cancer screening compliance (Lockwood-Rayermann, 2004), after controlling for other multilevel factors, this study did not.

The finding that generational variation in financial status was associated with being within risk-appropriate cervical cancer screening guidelines is also unique to this study. Thus, not only is a woman's own SES an important correlate of Pap smear compliance, but a woman's financial status relative to her parents was also associated with risk-appropriate screening compliance, perhaps suggesting that early life influences exert an effect on cancer screening behavior. Lower odds of being within risk appropriate screening guidelines for women who reported their finances were worse off than their parents at the same age (compared to approximately the same) may be the result of having financial barriers to access, lack of knowledge about the need for regular screening, or facing added access barriers related to low SES. Contrastingly, lower odds of being within guidelines for women who reported being financially better off than their parents (versus approximately the same) may be due to financial disqualification from government sponsored screening programs like the Breast and Cervical Cancer Early Detection Program (BCCEDP) or ineligibility for Medicaid. These differences in screening adherence based on intergenerational financial differences should be examined in future studies.

Lastly, this study contributes to existing literature because variables considered in this analysis were selected from a multilevel framework (Warnecke, Oh et al., 2008) encompassing a robust range of social and cultural factors, material factors, health and health behaviors, psychological factors, and environmental factors. In determining compliance with cervical cancer screening guidelines, it is imperative to evaluate compliance in accordance with a woman's risk for developing cervical cancer. Notably, this study evaluated risk status simultaneously in investigating correlates of compliance with Pap smear testing guidelines. Aside from Cyrus-David et al. (Cyrus-David, Michielutte et al., 2002), this is the only study to evaluate a woman's Pap smear compliance in a risk-appropriate fashion. Our results are similar to those of Cyrus-David et al. in terms of the proportion of women determined to be at high risk for cervical cancer, but this study had higher risk-appropriate screening rates. This may be attributable to the multiracial composition of the Cyrus-David et al. study, and their use of only low-income clinic populations. Additionally, this study refrained from modeling risk status as a predictor variable to prevent high correlation with other independent variables from which a woman's risk status was determined.

Strengths and Limitations

This study has several strengths. Women were randomly selected from clinics to participate, and eligibility was confirmed using medical record review. Additionally, this study identified whether women were within screening guidelines based on their cervical cancer risk status. Furthermore, we captured information that has not been traditionally measured in previous studies focusing on the receipt of Pap smears. These factors, like major life events, extend our current knowledge about women who comply or do not comply with cervical cancer screening guidelines.

Limitations of this report include that it is cross-sectional, and was limited to women who had a medical visit in the past two years at one of the study clinics. In addition, the participation

rate was 71.3%. Thus, the women in this study may not represent all women living in the Appalachia Ohio region. Another limitation stems from the reliance on self-reported date of Pap smear for 23.8% of the women, which may vary when compared to medical record. The validation rate of 80% for self-reports, however, is encouraging.

CONCLUSIONS

Among a population of women who reside in a region with high cervical cancer rates, an observational study found a relationship between social and psychological factors and being within risk-appropriate guidelines for Pap smear utilization. Risk-appropriate screening intervals could actually better reflect clinical practice recommendations (American College of Obstetricians and Gynecologists, January 2008) and may offer a way to reduce cervical cancer incidence and mortality in high risk populations, like women in Appalachia. While it is certainly important to promote cervical cancer screening adherence among all women, it is equally important that providers have heightened vigilance among women identified to be at high risk of this disease. This information can be used to develop and test risk-appropriate interventions to improve cervical cancer screening with the overall goal of lowering cervical cancer incidence and mortality rates in Appalachian Ohio.

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Table 1

Descriptive statistics and univariate model results by risk-appropriate cervical cancer screening status among participating women in Ohio Appalachia, 2006 (n=562)

	Within Risk-Appropriate Cervical Cancer Screening Guidelines, n (%)				
Predictor Variable	**No**	**Yes**	**Total[a]**	**OR_{crude}**	**95% CI**
Demographics					
Age (in years)					
Older than 50	49 (27%)	71 (19%)	120 (21%)	1.00	
31–50	82 (45%)	177 (47%)	259 (46%)	1.38	[0.87, 2.20]
18–30	51 (28%)	132 (35%)	183 (33%)	1.61	[0.95, 2.73]
Race					
White	173 (95%)	359 (94%)	532 (95%)	1.00	
Other	9 (5%)	21 (6%)	30 (5%)	1.31	[0.57, 3.02]
Socioeconomic Status					
Education					
Less than high school	25 (14%)	20 (5%)	45 (8%)	1.00	
High school graduate/GED	72 (40%)	130 (34%)	202 (36%)	2.07	[1.05, 4.06]
Some college/college graduate	85 (47%)	230 (61%)	315 (56%)	2.80	[1.44, 5.45]
Employment Status					
Other	48 (26%)	75 (20%)	123 (22%)	1.00	
Unemployed/Disabled	27 (15%)	50 (13%)	78 (14%)	1.17	[0.64, 2.16]
Full-time/Part-time	107 (59%)	254 (67%)	360 (64%)	1.41	[0.91, 2.18]
Income					
Less than $20,000	74 (43%)	109 (30%)	183 (34%)	1.00	
$20,000–$50,000	64 (37%)	143 (40%)	207 (39%)	1.48	[0.96, 2.30]
More than $50,000	36 (21%)	109 (30%)	145 (27%)	1.97	[1.18, 3.28]
Poverty Income Ratio (PIR, by score)[b]					
Less than 1.0	54 (31%)	83 (23%)	137 (26%)	1.00	
1.0–1.9	61 (35%)	102 (28%)	163 (30%)	1.13	[0.70, 1.83]
2.0–2.9	19 (11%)	65 (18%)	84 (16%)	2.40	[1.26, 4.57]
3.0 or above	40 (23%)	111 (31%)	151 (28%)	1.84	[1.08, 3.13]
Socioeconomic Status (SES, by category)					

	Within Risk-Appropriate Cervical Cancer Screening Guidelines, n (%)				
Predictor Variable	**No**	**Yes**	**Total[a]**	**OR_{crude}**	**95% CI**
0–1	53 (29%)	48 (13%)	101 (19%)	1.00	
2–3	63 (35%)	151 (40%)	214 (40%)	2.43	[1.43, 4.03]
4–6	58 (32%)	162 (43%)	220 (41%)	2.76	[1.63, 4.66]
Housing & Household Characteristics					
Marital Status					
Divorced/widowed/separated	58 (32%)	60 (16%)	118 (21%)	1.00	
Married/member of a couple	102 (56%)	243 (64%)	345 (62%)	2.00	[1.28, 3.12]
Never married	21 (12%)	77 (20%)	98 (17%)	3.58	[1.89, 6.81]
Number in Household[c]	3.1 (1–9)	3.3 (1–17)	560 (100%)	1.04[d]	[0.92, 1.18]
Number of years lived in county[c]	28.9 (0–82)	26.0 (0–73)	562 (100%)	1.05[e]	[0.99, 1.11]
Health Care Access					
Health Insurance					
No	45 (25%)	88 (23%)	133 (24%)	1.00	
Yes	137 (75%)	290 (77%)	427 (76%)	0.93	[0.60, 1.45]
Type of Insurance					
Private	108 (60%)	235 (62%)	343 (61%)	1.00	
Other	73 (40%)	142 (38%)	215 (39%)	1.01	[0.68, 1.51]
Diagnosed with Non-STD Comorbidity[f]					
No	141 (77%)	322 (85%)	463 (82%)	1.00	
Yes	41 (23%)	58 (15%)	99 (18%)	0.65	[0.41, 1.03]
Psychological Factors					
Center for Epidemiological Studies Depression Scale (CES-D)					
16 or above	62 (34%)	113 (30%)	175 (31%)	1.00	
Less than 16	120 (66%)	266 (70%)	386 (69%)	1.12	[0.75, 1.65]
Perceived Stress Scale (PSS)[c]	18.3 (3–40)	17.3 (0–39)	561 (100%)	1.06[g]	[0.94, 1.20]
Life Stressor Checklist—Revised (LSC-R)[c]	36.4 (0–102)	27.1 (0–99)	512 (100%)	1.15[g]	[1.09, 1.21]
Number of Major Life Events (from LSC-R)[c]	8.4 (0–22)	6.3 (0–21)	512 (100%)	1.85[g]	[1.45, 2.36]
Beck Anxiety Inventory (BAI)[c]	12.6 (0–45)	10.9 (0–53)	474 (100%)	1.05[g]	[0.96, 1.16]
Trust in Physician Scale (TPS)[c]	40.5 (20–55)	41.0 (13–55)	437 (100%)	0.95[g]	[0.82, 1.09]

	Within Risk-Appropriate Cervical Cancer Screening Guidelines, n (%)				
Predictor Variable	**No**	**Yes**	**Total[a]**	**OR_{crude}**	**95% CI**
Spirituality (God Locus of Health Control, GLHC)[c]	19.0 (6–36)	19.4 (6–36)	435 (100%)	1.03[h]	[0.90, 1.18]
Discrimination					
Discrimination feelings scale (from DAS-DQ)[c]	10.3 (0–40)	8.5 (0–35)	561 (100%)	1.17[g]	[1.03, 1.33]
Lifetime discrimination (from DAS-DQ)					
3 or above	14 (8%)	23 (6%)	37 (7%)	1.00	
2	31 (17%)	38 (10%)	69 (12%)	0.74	[0.32, 1.72]
1	46 (25%)	116 (31%)	162 (29%)	1.49	[0.69, 3.23]
0	90 (50%)	197 (53%)	287 (52%)	1.38	[0.66, 2.91]
Culture					
Self-identification as Appalachian					
No/Don’t know	117 (64%)	248 (65%)	365 (65%)	1.00	
Yes	65 (36%)	132 (35%)	197 (35%)	0.92	[0.62, 1.36]
Neighborhood has a name					
Yes	84 (46%)	140 (37%)	224 (40%)	1.00	
No	97 (54%)	235 (63%)	332 (60%)	1.36	[0.93, 1.97]
Social Factors					
Neighborhood (social cohesion level)[c]	12.4 (5–25)	12.2 (5–25)	561 (100%)	1.06[g]	[0.83, 1.35]
Collective efficacy[c]	12.6 (0–20)	13.0 (0–20)	460 (100%)	1.05[h]	[0.83, 1.33]
Number of close contacts					
0–5	24 (13%)	52 (14%)	76 (13%)	1.00	
6–10	26 (14%)	52 (14%)	78 (14%)	0.83	[0.41, 1.67]
11–20	34 (19%)	70 (19%)	104 (19%)	0.79	[0.41, 1.53]
20 or more	98 (54%)	204 (54%)	302 (54%)	0.81	[0.45, 1.44]
Perceived relative disadvantage					
Satisfaction with current financial situation					
Not at all satisfied	63 (35%)	123 (32%)	186 (33%)	1.00	
More or less satisfied	63 (35%)	135 (36%)	198 (35%)	1.14	[0.73, 1.78]
Pretty well satisfied	56 (31%)	121 (32%)	177 (32%)	1.11	[0.70, 1.77]
Financial situation during past few years					
Getting worse	50 (27%)	98 (26%)	148 (26%)	1.00	

	Within Risk-Appropriate Cervical Cancer Screening Guidelines, n (%)				
Predictor Variable	**No**	**Yes**	**Total[a]**	**OR_{crude}**	**95% CI**
Stayed the same	61 (34%)	128 (34%)	189 (34%)	1.23	[0.76, 1.97]
Getting better	71 (39%)	152 (40%)	223 (40%)	1.12	[0.71, 1.76]
Finances compared to parents at same age					
Worse off	37 (21%)	64 (17%)	101 (19%)	1.00	
About the same	35 (19%)	92 (25%)	127 (23%)	1.45	[0.81, 2.59]
Better off	108 (60%)	210 (57%)	318 (58%)	1.06	[0.66, 1.72]
Family income compared to other families					
Far below average or below average	86 (48%)	135 (36%)	221 (40%)	1.00	
Average	71 (39%)	183 (48%)	254 (45%)	1.57	[1.05, 2.35]
Above average or far above average	24 (13%)	60 (16%)	84 (15%)	1.54	[0.87, 2.74]
Environmental Factors[i]					
Region					
4: Northeast	46 (25%)	62 (16%)	108 (19%)	1.00	
3: Central	48 (26%)	113 (30%)	161 (29%)	1.68	[0.63, 4.50]
2: Southern	31 (17%)	114 (30%)	145 (26%)	2.67	[0.97, 7.34]
1: Southwest	57 (31%)	91 (24%)	148 (26%)	1.05	[0.39, 2.81]
County of Residence Type					
Urban	64 (35%)	155 (41%)	270 (48%)	1.00	
Rural	118 (65%)	225 (59%)	292 (52%)	0.88	[0.48, 1.60]
Per capita income[c]	$20,337	$20,144	552 (100%)	0.98[j]	[0.92, 1.04]
median 1999 earnings for adults 16 years and older	($13,217–$27,529)	($3,778–$30,859)			
Poverty Income Ratio (census-tract level)[b,c]	14.0% (1.5%–33.0%)	14.3% (1.5%–84.3%)	552 (100%)	1.08[k]	[0.81, 1.45]
High school graduation percentage[c]	77.5% (66.7%–89.7%)	78.6% (57.3%–100.0%)	552 (100%)	1.16[l]	[0.99, 1.37]
Percentage of households with female as head[c,m]	6.7% (2.8%–13.2%)	6.5% (1.0%–20.8%)	552 (100%)	0.97[n]	[0.89, 1.05]

OR_{crude} is the crude (unadjusted) odds ratio of being within risk-appropriate cervical cancer screening guidelines versus not, including clinic location as a random effect.

95% CI is the corresponding 95% confidence interval for the crude odds ratio.

GED is General Equivalency Degree.

DAS-DQ is the Detroit Area Study Discrimination Questionnaire.

[a] May not sum to 562 due to missing data

[b] Annual household income divided by the federal poverty level for the relevant household size

[c] Continuous variables show mean value with range in parentheses. *Per capita income* shows median value with range in parenthesis.

[d] Odds ratio for a 1-member increase in the household

[e] Odds ratio for a 5-year decrease

[f] Includes lupus, colitis, Crohn's disease, chronic hepatitis, thyroiditis, HIV, rheumatoid arthritis, tuberculosis, or diabetes

[g] Odds ratio for a 5-unit decrease

[h] Odds ratio for a 5-unit increase

[i] Geocoded to census tract or county-level

[j] Odds ratio for a $1,000 increase in median tract income

[k] Odds ratio for a 10% increase in poverty ratio

[l] Odds ratio for a 5% increase in high school graduation rate

[m] With own children less than 18 years of age

[n] Odds ratio for a 1% increase in female head of household rate

Table 2

Relationship between variables pertaining to cervical cancer risk and risk-appropriate cervical cancer screening status in Ohio Appalachia, 2006 (n=562)

	Within Risk-Appropriate Cervical Cancer Screening Guidelines, n (%)				
Predictor Variable	**No**	**Yes**	**Total[a]**	**OR_{crude}**	**95% CI**
Cervical Cancer Risk Status					
Low	12 (7%)	105 (28%)	117 (21%)	1.00	
High	170 (93%)	268 (72%)	438 (79%)	0.16	[0.08, 0.30]
Individual Risk Status Components					
5 or more lifetime sexual partners					
No	87 (48%)	230 (61%)	317 (56%)	1.00	
Yes	95 (52%)	150 (39%)	245 (44%)	0.59	[0.41, 0.85]
Had sex before age 18					
No	48 (27%)	161 (44%)	209 (38%)	1.00	
Yes	133 (73%)	209 (56%)	342 (62%)	0.43	[0.29, 0.65]
Current smoker					
No	119 (65%)	288 (76%)	407 (72%)	1.00	
Yes	63 (35%)	92 (24%)	155 (28%)	0.62	[0.42, 0.93]
Previous sexual partners with sexually transmitted infection					
No	148 (88%)	300 (88%)	448 (88%)	1.00	
Yes	21 (12%)	41 (12%)	62 (12%)	0.98	[0.55, 1.77]
Ever diagnosed with venereal warts, condylomas, or HPV					
No	165 (91%)	346 (91%)	511 (91%)	1.00	
Yes	16 (9%)	33 (9%)	49 (9%)	0.90	[0.47, 1.72]
Ever diagnosed with genital herpes, syphilis, or gonorrhea					
No	165 (91%)	361 (95%)	526 (94%)	1.00	
Yes	16 (9%)	18 (5%)	34 (6%)	0.52	[0.25, 1.07]
Belief Scale Score					
Negative (−5 to 1)	71 (39%)	149 (39%)	220 (39%)	1.00	
Positive (2 to 5)	111 (61%)	230 (61%)	341 (61%)	0.95	[0.65, 1.38]
Knowledge Scale Score					
Poor to Fair (−14 to 4)	51 (28%)	87 (23%)	138 (25%)	1.00	
Good (5 to 6)	31 (17%)	95 (25%)	126 (22%)	1.62	[0.94, 2.82]

	Within Risk-Appropriate Cervical Cancer Screening Guidelines, n (%)				
Predictor Variable	**No**	**Yes**	**Total[a]**	**OR_{crude}**	**95% CI**
Very Good (7 to 8)	40 (22%)	95 (25%)	135 (24%)	1.25	[0.74, 2.10]
Excellent (9 to 14)	60 (33%)	102 (27%)	162 (29%)	0.88	[0.53, 1.46]
Barriers Scale Score (0 to 10)					
Mean (Range)	1.93 (0–7)	1.67 (0–6)	438 (100%)	0.90[b]	[0.77, 1.05]
Previous Abnormal Pap Smear					
No	125 (70%)	239 (63%)	364 (65%)	1.00	
Yes	54 (30%)	140 (37%)	194 (35%)	1.25	[0.84, 1.86]

OR_{crude} is the crude (unadjusted) odds ratio of being within risk-appropriate cervical cancer screening guidelines versus not, including clinic location as a random effect.

95% CI is the corresponding 95% confidence interval for the crude odds ratio.

HPV is human papillomavirus

[a] May not sum to 562 due to missing data

[b] Odds ratio for a 1-point increase in the barriers scale score

Table 3

Final model for variables associated with being within risk-appropriate cervical cancer screening guidelines in Ohio Appalachia, 2006 (n=479)

Predictor Variable	OR_{adj}	95% CI	p-value
Socioeconomic Status (SES, by category)			
0–1	1.00		
2–3	3.39	[1.85, 6.21]	<0.001
4–6	3.86	[2.03, 7.34]	<0.001
Decrease of one major life event on Life Stressor Checklist—Revised (LSC-R)	1.09	[1.04, 1.15]	0.001
Finances compared to parents at the same age			
About the same	1.00		
Better off	0.41	[0.23, 0.73]	0.002
Worse off	0.49	[0.24, 0.98]	0.042
Interaction: Marital Status × Sexual Intercourse Before Age 18			0.009[a]
Among women who reported having had sex before age 18			
Never married	1.00		
Divorced/widowed/separated	0.19	[0.08, 0.46]	<0.001
Married/couple	0.24	[0.11, 0.53]	<0.001
Among women who reported not having had sex before age 18			
Never married	1.00		
Divorced/widowed/separated	1.12	[0.33, 3.87]	0.852
Married/couple	1.97	[0.64, 6.06]	0.235
Among women who have never been married			
Reported having had sex before age 18	1.00		
Reported not having had sex before age 18	0.32	[0.09, 1.08]	0.067
Among women who have been divorced/widowed/separated			
Reported having had sex before age 18	1.00		
Reported not having had sex before age 18	1.92	[0.76, 4.82]	0.165
Among women who are married/couple			
Reported having had sex before age 18	1.00		
Reported not having had sex before age 18	2.63	[1.47, 4.71]	0.001

OR_{adj} is the adjusted odds ratio (for all variables presented in the final model) of being within risk-appropriate cervical cancer screening guidelines versus not including clinic location as a random effect. All other variables were considered in the modeling process but did not exert independent, confounding, or modifying effects.

95% CI is the corresponding 95% confidence interval for the adjusted odds ratio.

[a] p-value is from a likelihood ratio Chi-square test for the interaction effect