

Original Research Report

Knowledge of cervical dysplasia and human papillomavirus among women seen in a colposcopy clinic

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Available online 8 September

Abstract

Objective. This study was undertaken to evaluate knowledge of cervical dysplasia and human papillomavirus (HPV) among women seen in a colposcopy clinic.

Study design. Demographics, knowledge, and psychological distress were assessed in structured interviews with 175 women before, during, and after colposcopy.

Results. Respondents had low knowledge scores before and after colposcopy; however, their overall knowledge improved slightly ($P = 0.013$) following the exam. When responses were examined by question, respondents demonstrated a significant increase of correct answers to only one question: *Does dysplasia, or precancerous cells on the cervix, always go away without treatment?* Pre-exam knowledge was positively associated with educational level and was lower among Hispanics and patients recruited at the clinic. Post-exam knowledge was positively associated with pre-exam knowledge and educational level.

Conclusion. Routine clinical education during colposcopy can improve patients' understanding of cervical cancer; however, the low level of knowledge that persisted after colposcopy is a cause for concern.

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Keywords: Knowledge; Cervix dysplasia; Papillomavirus, human; Colposcopy

Introduction

Cervical cancer

Although use of the Papanicolaou (Pap) smear has dramatically reduced the incidence of cervical cancer in this country, 10,520 new cases of invasive cervical cancer and 3900 deaths in the US were estimated to occur in 2004 [1]. Patients' nonadherence to follow-up and treatment after

an abnormal Pap smear is associated with increased incidence of and mortality from cervical cancer [2].

Although not all cervical changes detected by Pap smear require treatment, women with abnormal Pap results are often referred for colposcopy and biopsy. Rates of nonadherence to colposcopy and follow-up treatment range from 10% to 40% [3]. Two factors that have been found to affect adherence are knowledge and psychological distress. Women with lower levels of knowledge about their results, cancer screening, and cervical cancer are less likely to keep follow-up appointments for colposcopy and treatment [3–9]. Psychological responses to screening such as distress and fear have also been reported to adversely affect treatment adherence and follow-up screening [3,5].

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Knowledge

Human papillomavirus (HPV), a sexually transmitted infection (STI), is detected in 99.7% of cervical cancers worldwide [10] and is recognized as being causally related to cervical cancer [11]. HPV is one of the most common STIs in the United States [12].

Despite its prevalence, knowledge and awareness of HPV are reported to be low among clients at STI and primary care clinics [13–15], university students [16–19], adolescents [20], the general population [21], and the work force [22].

In general, individuals also lack information about the larger scope of issues concerning cervical cancer. Few people understand the relationship between dysplasia and cancer or the risk factors of cervical cancer [15,22–26]. Knowledge about the utility and purpose of screening and diagnostic methods such as the Pap smear and colposcopy is typically low, even among women undergoing these procedures [23,27–30]. Knowledge about these screening technologies is typically lowest among lower-sociodemographic populations [27].

Women report that general practitioners and nurses are a frequently used source of information about cervical screening and HPV [22]. During a colposcopy exam, the health care provider may present information regarding cervical dysplasia or the colposcopy procedure, may discuss future screening and treatment plans, and may take the opportunity to solicit and answer the woman's questions. In one study, women who had previously received abnormal Pap results or experienced a colposcopy exam scored higher on knowledge tests regarding cervical screening and diagnostic methods and the meaning of abnormal results [22].

Psychological effects of colposcopic exam

Women have consistently reported increased distress and anxiety after receiving an abnormal Pap smear result and being referred for a colposcopic exam [4,31–35]. Higher than average levels of anxiety and distress have been attributed to a fear of cancer [7,36–38], fear or lack of awareness about the colposcopic procedure [7,29,32,36,37,39], and concerns about future infertility and sexuality [7,37,38].

Relationships between knowledge, emotional outcomes, and adherence

Pre-colposcopy education sessions have been recommended to increase patients' knowledge, decrease their distress, and improve adherence [32,36]. However, a variety of educational strategies such as pamphlets, audiovisual programs, and individual and group education sessions have produced mixed results [3]. Among interventions in which both knowledge and anxiety were targeted, most programs resulted in increased knowledge but had little or no

significant effect on the participants' levels of anxiety [30,40–43]. The results of one intervention, a nurse-administered educational session [44], indicated reduced post-Pap smear anxiety but no change in knowledge. An exception was an intervention [45] that provided pre-colposcopy education and reported concurrently increased knowledge and decreased anxiety.

In one of the studies [40] in which increased knowledge did not correlate with reduced levels of anxiety, the women nevertheless expressed a desire to know more and appreciation of the offered information.

Two studies in which information was presented in video or pamphlet form resulted in decreased anxiety regarding colposcopy [46] and abnormal Pap smear [47]. However, knowledge level was not measured in either study.

Interestingly, one recent study of women attending a colposcopy clinic [7] found that higher pre-exam knowledge was significantly associated with *higher* levels of pre-visit fear, anxiety, and adherence to follow-up, whereas post-exam knowledge was associated with neither these emotions nor adherence. Unfortunately, the authors' use of two different knowledge questionnaires at pre- and post-visit makes their results difficult to interpret.

Knowledge, psychological distress, and adherence to follow-up screening and treatment are related in complex ways, and a better understanding of the relationships between these variables may improve efforts to increase adherence. The goal of this study was to investigate the relationship between knowledge and psychosocial variables such as depression, intrusive and avoidant thoughts, pain, anxiety, and cervical cancer distress among women attending initial colposcopy appointments. We tested three hypotheses: (1) women undergoing colposcopy would initially have low knowledge regarding HPV, dysplasia, Pap tests, colposcopy, cervical cancer, and cervical cancer risk factors and their knowledge would improve after colposcopy; (2) women with higher pre-existing distress—as determined by higher depression, trait anxiety, and more intrusive and avoidant thoughts about the abnormal Pap smear—would have lower levels of baseline knowledge; and (3) women experiencing more distress during the exam—measured by pain, anxiety, and distress during the exam and post-exam state anxiety—would gain less knowledge during colposcopy.

Material and methods

Participants

Study participants were patients attending initial colposcopy appointments for follow-up of an abnormal Pap smear. The study was part of a larger National Cancer Institute-funded trial to evaluate the use of optical spectroscopy in the diagnosis of cervical dysplasia. Participants had a history of an abnormal Pap smear and included women

recruited at the colposcopy clinic and community volunteers who came to the clinic after seeing an advertisement or news story about the trial.

Women were eligible if they were 18 years or older, not pregnant, and referred to the clinic for colposcopy on the basis of an abnormal Pap smear or community volunteers who had an abnormal Pap smear in the last 12 months.

Women were recruited from four clinic sites in Houston, Texas: the Gynecologic Oncology Clinic at The University of Texas M. D. Anderson Cancer Center, the Cancer Prevention Clinic at M. D. Anderson, the Harris County Hospital District (HCHD) Lyndon B. Johnson Clinic, and The University of Texas Houston Health Science Center (UT-HHSC) Obstetrics and Gynecology Clinic. The research protocol was approved by the institutional review boards of M. D. Anderson Cancer Center, HCHD, and (UT-HHSC).

After obtaining informed consent, female interviewers administered the study questionnaire to women before the colposcopy exam. The questionnaire assessed demographics, knowledge, state and trait anxiety, intrusive and avoidant thoughts regarding the abnormal Pap smear, and depression prior to the colposcopy exam. During the colposcopy exam, the women were asked to verbally rate their pain and anxiety using numeric scales. Immediately after the exam, the women completed measures of knowledge, state anxiety, and distress they felt during the exam. The same interviewer administered questionnaires at each of the three time periods.

Measures

Knowledge of HPV, dysplasia, Pap tests, colposcopy, cervical cancer, and cervical cancer risk factors was assessed using a 17-item questionnaire. The questionnaire included 13 true/false/don't know questions and 4 multiple-choice questions such as (1) *Does dysplasia (precancerous cells) sometimes change into cancer?* and (2) *Does syphilis cause cervical cancer?* The questionnaire items were developed based on the literature regarding knowledge of cervical cancer and on discussions with experts in public health, psychology, and gynecologic oncology. Overall knowledge scores were computed as the sum of the correct responses resulting in knowledge scores ranging from 0 to 17. The knowledge scale had good internal consistency reliability at each administration (Cronbach's coefficient $\alpha = 0.78, 0.79$).

Anxiety was assessed using the State Trait Anxiety Inventory for Adults (STAI) [48], a 40-item self-report scale measuring both underlying (trait) and situational (state) anxiety. Subscale scores range from 20 to 80, with higher scores indicating higher levels of anxiety. The scale has been widely used in research with colposcopy clinic patients [30,32,35,41,42,46] and demonstrated good internal consistency reliability in this sample (state subscale: Cronbach's coefficient $\alpha = 0.94$ at pre-exam and 0.95 at post-exam; trait subscale: $\alpha = 0.92$).

Depression was assessed using the Center of Epidemiologic Studies Depression (CESD) scale [49], a 20-item scale designed to measure symptoms of depression in a general population. Scores range from 0 to 60, higher scores indicating more depressive symptoms. The CESD scale is well validated and it demonstrated high internal consistency in this sample ($\alpha = 0.90$).

The Impact of Events scale [50] was used to assess the participants' subjective distress related to their experience of an abnormal Pap smear result. Two subscales measured the occurrence of intrusive (range 0–35) and avoidant (range 0–40) thoughts regarding the abnormal Pap smear. Both subscales demonstrated good internal consistency reliability (avoidance scale $\alpha = 0.84$; intrusion scale $\alpha = 0.90$).

Both pain and anxiety during colposcopy were assessed using a single verbal numeric (0–10) rating. Single-item ratings to assess pain and anxiety have been found to differentiate between experimental conditions and are sensitive to changes over the course of colposcopic examinations [51,52].

After the examination, women completed the 23-item Cervical Dysplasia Distress Questionnaire (CDDQ) [53], a measure designed to assess the psychosocial concerns of women whose Pap smears were abnormal. The two subscales that are part of this analysis measure distress experienced during the colposcopy exam, including (1) embarrassment regarding the procedures and (2) discomfort/tension during the procedures. Subscale scores range from 1 to 4 and they demonstrated good internal consistency reliability in this sample ($\alpha = 0.79$ and 0.85).

Statistical analyses

Data were analyzed using SPSS version 12.0 (SPSS, Chicago, IL). Standard descriptive statistics (e.g., frequencies, means, and standard deviations) were calculated for the demographic variables.

To test the first hypothesis, that women would gain knowledge during the study, a paired *t* test was used to compare pre-exam and post-exam knowledge scores. Proportions of correct responses to pre- and post-exam knowledge questions were compared using McNemar's tests for paired dichotomous data.

Pearson's correlation coefficients were used to assess the correlation between pre- and post-exam knowledge scores and the demographic and distress variables hypothesized to affect knowledge. We tested the second hypothesis about the relationship between distress and pre-exam knowledge using a forward sequential regression model in which we predicted pre-exam knowledge, controlling for the factors of age, race, education level, and recruitment method in the first block; this was followed by a second block composed of retrospective distress measures, including intrusive and avoidant thoughts, depression, and trait anxiety.

We tested the third hypothesis regarding the relationship of distress and post-exam knowledge by performing a

forward sequential regression in which we controlled for the factors of age, race, education level, recruitment method, and pre-exam knowledge in the first block. In the second block we included exam-related distress measures of embarrassment, discomfort, pain, and anxiety experienced during the exam and post-exam state anxiety.

Both regression models used pairwise deletion for missing data. Statistical significance was set at $P = 0.05$. The McNemar's test followed the omnibus t test and can be considered a post hoc test; therefore, adjustment for multiple testing was not necessary.

Results

Participant characteristics

Our final sample included 175 women who completed the baseline knowledge questionnaire and 171 who completed post-exam questionnaires. All of the women had a prior abnormal Pap smear result; half ($n = 87$) were recruited at the colposcopy clinic and the other half ($n = 88$) were community volunteers who, after seeing an advertisement or news story, came to the clinic to participate in the trial. Table 1 contains the participants' demographic characteristics. The mean age of the women was 36.4 years and half (54.9%) were married or living with a partner. The sample was racially diverse, with more than half of the women from minority groups: 33.7% of the sample self-identified as Hispanic and 16.6% as Black. The sample was also diverse in level of education, an indicator of socio-

Table 1
Demographic profile of sample

Characteristic	Frequency	%
Age (years)		
18–29	61	34.9
30–39	47	26.9
40–49	40	22.9
50–59	18	10.3
60–69	7	4.0
70–79	2	1.1
Race		
White, non-Hispanic	80	45.7
Black, non-Hispanic	29	16.6
Asian/Pacific Islander	3	1.7
White Hispanic	59	33.7
Other	4	2.3
Education		
Elementary school (grades 1–8)	13	7.4
Some high school (grades 9–11)	19	10.9
Grade 12 or GED	37	21.1
Some college (1–3 years)	50	28.6
College and above (4 years or more)	56	32.0
Marital status		
Never married	36	20.6
Married or living with partner	96	54.9
Divorced or separated	36	20.6
Widowed	7	4.0

economic status: 32.0% had a college education or beyond, whereas 18.3% had less than a high school education.

Baseline knowledge and knowledge gains

The first hypothesis was supported. Participants' baseline pre-exam knowledge about HPV, dysplasia, Pap tests, colposcopy, cervical cancer, and cervical cancer risk factors was relatively low: the mean number correct was 10.19 of 17 (SD = 3.6). A paired t test demonstrated that during the colposcopy exam overall knowledge increased significantly to a post-exam mean of 10.53 (SD = 3.6) ($t = 2.5$, $df = 170$, $P = 0.013$). However, post hoc McNemar's tests demonstrated that participants experienced significant improvement in knowledge ($P = 0.02$) on only one question: *Does dysplasia, or precancerous cells on the cervix, always go away without treatment?* (Table 2).

As shown in Table 2, the average percentage of correct responses at both pre- and post-exam indicated that participants were most likely to know the answers to these questions: (1) *What is a colposcopy?* (2) *If a woman has an abnormal Pap smear, does it mean she probably has cancer?* (3) *Does dysplasia (precancerous cells) sometimes change into cancer?* Participants were least likely to know the answers to these questions: (1) *Does syphilis cause cervical cancer?* (2) *Does smoking cause cervical cancer?* (3) *Does HPV (human papillomavirus) cause genital warts?*

Distress

The mean scores on the psychological distress measures are presented in Table 3. Only the state anxiety subscale was administered at both pre- and post-exam time points, and following the colposcopy exam, mean scores significantly decreased from a pre-exam mean of 38.7 to a post-exam mean of 34.9 ($t = 4.0$, $df = 171$, $P < 0.001$).

Relationship between knowledge and distress

Our second hypothesis posited that women with greater pre-exam distress would have lower levels of knowledge at baseline. Pearson's correlation coefficients demonstrated that both trait anxiety and depression were negatively associated with baseline knowledge ($P < 0.01$). The Pearson's correlations between knowledge and demographic and psychosocial variables are summarized in Table 4. The multiple regression model presented in Table 5 indicated that pre-exam knowledge was positively associated with educational level ($\beta = 0.317$, $P = 0.002$) and was lower among Hispanics ($\beta = -0.265$, $P = 0.003$) and participants recruited from the colposcopy clinic ($\beta = -0.192$, $P = 0.040$). In contrast to our hypothesis, adding the psychosocial variables to the model did not increase the proportion of variance explained.

Our third hypothesis, that women experiencing greater distress related to the colposcopy exam would demonstrate lower gains in knowledge, was not supported. Pearson's

Table 2
Comparison of pre- and post-colposcopy knowledge by question

		Pre-exam	Post-exam	Overall	McNemar (<i>p</i>) ^a
What is colposcopy? (multiple choice)	% Correct	90.9	92.0	91.5	0.21
	% DK ^b	8.0	4.0	7.0	
If a woman has an abnormal Pap smear, does it mean she probably has cancer?	% Correct	86.3	81.7	84.0	0.10
	% DK	6.3	8.0	8.1	
Does dysplasia (precancerous cells) sometimes change into cancer?	% Correct	84.0	82.9	83.5	0.10
	% DK	13.1	12.6	14.8	
When a woman has an abnormal Pap smear, does it mean... (multiple choice)	% Correct	77.7	80.6	79.15	0.14
	% DK	18.3	14.3	17.5	
What is a Pap test? (multiple choice)	% Correct	71.4	71.4	71.4	0.82
	% DK	1.7	1.1	1.9	
Does dysplasia, or precancerous cells on the cervix, always go away without treatment?	% Correct	64.6	72.0	68.3	0.02 ^c
	% DK	26.9	17.7	24.7	
Can HPV (human papillomavirus) be spread by sex?	% Correct	69.7	65.7	67.7	0.33
	% DK	26.9	28.0	30.0	
If a woman has HPV (human papillomavirus) does she always have symptoms?	% Correct	65.7	66.3	66.0	0.66
	% DK	29.1	26.9	30.4	
If a woman is infected with HPV (human papillomavirus), she must have caught it... (multiple choice)	% Correct	63.4	66.9	65.2	0.10
	% DK	32.6	28.6	31.9	
Can men be infected with HPV (human papillomavirus)?	% Correct	56.6	60.6	58.6	0.08
	% DK	38.3	30.9	37.0	
Will cervical dysplasia (precancerous cells) grow into cancer even if it is found and treated early?	% Correct	45.1	51.4	48.3	0.13 ^c
	% DK	32.0	24.0	29.2	
Is dysplasia (precancerous cells) on the cervix caused by a virus?	% Correct	46.3	49.1	47.7	0.42
	% DK	37.1	34.3	37.5	
Does HPV (human papillomavirus) cause cervical cancer?	% Correct	46.9	46.3	46.6	1.00
	% DK	45.1	43.4	46.7	
Is HPV (human papillomavirus) related to the AIDS virus?	% Correct	46.9	44.0	45.5	0.56 ^c
	% DK	42.9	42.9	46.2	
Does HPV (human papillomavirus) cause genital warts?	% Correct	42.3	46.3	44.3	0.12
	% DK	50.3	41.7	48.3	
Does smoking cause cervical cancer?	% Correct	41.1	36.6	38.9	0.19 ^c
	% DK	36.0	32.6	35.8	
Does syphilis cause cervical dysplasia?	% Correct	10.9	14.9	12.9	0.17
	% DK	76.0	69.1	73.1	

^a Binomial distribution used unless noted.

^b DK = don't know.

^c Chi-square test used.

correlation coefficients indicated that none of the during- or post-exam psychological variables were significantly correlated with post-exam knowledge or knowledge change. The multiple regression model indicated that baseline knowledge ($\beta = 0.842$, $P < 0.001$) and educational level ($\beta = 0.121$, $P = 0.045$) positively predicted post-exam knowledge (Table 6). Adding the psychosocial variables to this model did not increase the proportion of variance explained, but the

inclusion of these variables did cause the education covariate to reach statistical significance. When analyzed by educational level after adjustment for pre-exam knowledge, post-exam knowledge scores showed a gradual, if somewhat inconsistent, increase across educational level (Fig. 1).

Comment

Our findings indicated that while women had little knowledge about the range of issues concerning cervical cancer before their colposcopy exams, they had significantly more overall information afterward. In regard to the individual items, there was a significant increase in knowledge on one specific question: *Does dysplasia, or precancerous cells on the cervix, always go away without treatment?* The percentage of participants answering this question correctly increased from 64.6% to 72.0%. Although this represents an important gain in knowledge, it also indicates that at the conclusion of this study nearly a third (28.0%) of the participants still did not

Table 3
Mean distress scores (SD) before and after colposcopy exam

	Pre-exam mean (SD)	Post-exam mean (SD)
Depression	19.9 (10.7)	–
Avoidant thoughts	13.4 (10.4)	–
Intrusive thoughts	9.6 (9.6)	–
State anxiety	38.7 (13.6)	34.9 (12.8)
Trait anxiety	37.5 (11.1)	–
Discomfort	–	2.2 (0.73)
Embarrassment	–	1.6 (0.79)

Table 4
Pearson correlation coefficients of knowledge with demographics and distress

	Pre-exam knowledge	Post-exam knowledge	Knowledge change ^a
<i>Sample characteristics</i>			
Education	+0.511**	+0.498**	NS ^b
Hispanic	−0.344**	−0.279**	NS
Black	NS	−0.151*	NS
Age	NS	NS	NS
Colposcopy clinic patient ^c	−0.375**	−0.329**	NS
<i>Pre-exam</i>			
Trait anxiety	−0.223*	N/A ^d	NS
Depression	−0.202**	N/A	+0.190*
Intrusive thoughts	NS	N/A	NS
Avoidant thoughts	NS	N/A	+0.224*
<i>During-exam</i>			
Pain ^e	N/A	NS	NS
Anxiety ^e	N/A	NS	NS
<i>Post-exam</i>			
Discomfort	N/A	NS	NS
Embarrassment	N/A	NS	NS
State anxiety	N/A	NS	NS

^a Knowledge change score = post-exam knowledge − pre-exam knowledge.

^b NS = not significant.

^c Referent = community volunteer.

^d N/A = not applicable.

^e Single item numeric rating.

* $P < 0.05$ (two-tailed).

** $P < 0.01$ (two-tailed).

understand the necessity of treatment for precancerous conditions. All participants in this study required follow-up screening, and many needed immediate and potentially ongoing treatment. The treatment of precancerous conditions is vital to the prevention of cervical cancer; that a substantial proportion of this population of women remained relatively unaware of its necessity is a cause for concern.

Educational level, Hispanic ethnicity, and recruitment method predicted pre-exam knowledge. These findings

differ from those of Massad et al. [27], who demonstrated that, of various sociodemographic variables, educational level was the only significant predictor of knowledge concerning cervical cancer screening. Educational level and pre-exam knowledge predicted post-exam knowledge. It is possible that women with a higher educational level may have been better equipped to understand and benefit from the information presented during the exam.

The relationships between distress and knowledge were primarily accounted for by education. In the bivariate analysis, two measures of distress correlated with knowledge, but neither were significant in the regression models after sociodemographic factors were controlled.

While slightly elevated, the state and trait anxiety levels of women in this study were somewhat lower than those found in comparable studies in which generalized anxiety was measured [32,35,41,42,47,54,55]. The less pronounced anxiety of these women may account for the absence of the hypothesized association between anxiety and knowledge when demographic variables were controlled.

The women's mean score on the CESD was relatively high at 19.9. Validation studies of the CESD typically use 16 as the cut-off point, with scores at or above this level indicating that evaluation for clinically significant depression is warranted [49,56]. More than half (55.4%) of these women had scores at or above this level. In future research, the effects of depression on receptivity to educational interventions should be explored.

The bivariate analysis in our study demonstrated a significant *negative* correlation between pre-exam trait anxiety and pre-exam knowledge. In contrast, some earlier studies documented significant *positive* associations between (1) pre-exam anxiety and pre-exam knowledge among women undergoing colposcopy [7] and (2) anxiety and knowledge regarding cancer screening among Latina community members [57]. The difference may be due partly to different measures of generalized anxiety and knowledge used in these studies, or it may be related to the unique characteristics of the women in our sample. The absence or presence of perceived threat resulting from abnormal results

Table 5
Multiple linear regression model predicting pre-exam knowledge ($n = 175$)

Block 1	$R^2 = 0.345, R^2_{adj} = 0.316$				Block 2	$R^2 = 0.364, R^2_{adj} = 0.313, R^2_{change} = 0.019, P = 0.502$			
	<i>B</i>	SE	β	<i>P</i>		<i>B</i>	SE	β	<i>P</i>
Age	−0.038	0.022	−0.132	0.096	Age	−0.042	0.023	−0.146	0.074
Race					Race				
Hispanic	−2.014	0.670	−0.264	0.003	Hispanic	−2.027	0.674	−0.265	0.003
Black	−1.248	0.817	−0.128	0.129	Black	−1.175	0.824	−0.121	0.157
Education	0.951	0.269	0.325	0.001	Education	0.926	0.288	0.317	0.002
Colposcopy clinic patient ^a	−1.393	0.660	−0.193	0.037	Colposcopy clinic patient ^a	−1.386	0.668	−0.192	0.040
					Trait anxiety	−0.062	0.042	−0.190	0.147
					Depression	0.032	0.053	0.095	0.545
					Avoidant thoughts	−0.027	0.035	−0.078	0.436
					Intrusive thoughts	0.025	0.045	0.066	0.583

^a Referent is community volunteer.

Table 6
Multiple linear regression model predicting post-exam knowledge ($n = 171$)

Block 1	$R^2 = 0.787, R^2_{adj} = 0.775$				Block 2	$R^2 = 0.798, R^2_{adj} = 0.777, R^2_{change} = 0.012, P = 0.305$			
	B	SE	β	P		B	SE	β	P
Age	-0.013	0.013	-0.045	0.332	Age	-0.017	0.015	-0.060	0.260
Race					Race				
Hispanic	0.105	0.408	0.014	0.797	Hispanic	0.021	0.427	0.003	0.962
Black	-0.574	0.484	-0.059	0.238	Black	-0.705	0.492	-0.072	0.155
Education	0.241	0.166	0.082	0.150	Education	0.355	0.175	0.121	0.045
Colposcopy clinic patient ^a	0.213	0.394	0.029	0.590	Colposcopy clinic patient ^a	0.374	0.409	0.051	0.362
Pre-exam knowledge	0.853	0.054	0.849	<0.001	Pre-exam knowledge	0.847	0.056	0.842	<0.001
					Pain ^b	0.036	0.067	0.028	0.596
					Anxiety ^b	-0.076	0.068	-0.071	0.267
					State anxiety post-exam	-0.010	0.018	-0.034	0.588
					Discomfort	0.287	0.305	0.057	0.348
					Embarrassment	0.459	0.239	0.100	0.058

^a Referent is community volunteer.

^b Single item numeric rating administered during colposcopy exam.

can influence psychosocial distress [58]. Our sample of women had experienced an abnormal Pap result, similar to the colposcopy clinic patients in the preceding study [7] but unlike the community members in the latter [57]. The educational level of our sample was higher than the level in these studies, which also may account for this difference.

Previous research on the relationship between knowledge and anxiety typically focused on standardized educational interventions provided in pre-colposcopy sessions. Our study differs from previous work in that we analyzed routine education as provided during a colposcopy exam to individual women in a clinical trial. The person-to-person information presented to women in this sample is roughly comparable to information typically given during colposcopy exams in doctors' offices and clinics. However, because we tested volunteers in a clinical trial, the women in our sample may have differed systematically from women undergoing colposcopy exams in a typical clinic setting.

A limitation of our study is that we did not account for participants' desire for information. Assessment of information receptivity and processing style using the cognitive-social health information processing model (C-SHIP) has been shown to predict responses to cervical cancer-related information [58,59]. Monitoring the information processing style of our sample may have helped to explain our unique finding of a negative correlation between trait anxiety and pre-exam knowledge.

Our results indicated that women's understanding of HPV and cervical dysplasia was significantly improved by their attendance at a colposcopy exam. Nevertheless, substantial knowledge deficits persisted. Targeted education during the colposcopic exam may be warranted to further increase a woman's knowledge acquisition at that time. Programs designed to increase understanding of cervical cancer screening should target women with lower levels of educational attainment and those of Hispanic ethnicity. The clinical and communication practices that contribute to

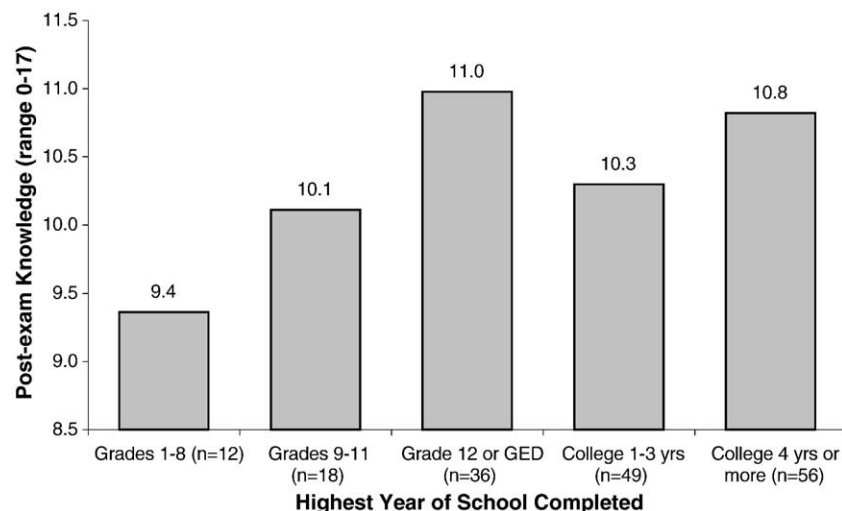


Fig. 1. Post-exam knowledge by educational level adjusted for pre-exam knowledge.

knowledge acquisition during the colposcopy exam should be a focus of future research.

Acknowledgments

This work was supported by National Cancer Institute grant P01-CA-82710, Michele Follen, M.D., Ph.D., principal investigator, and National Cancer Institute grant R25-CA-57730, Robert Chamberlain, Ph.D., principal investigator.

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