Adherence to Cervical Cancer Screening Guidelines for U.S. Women Aged 25–64: Data from the 2005 Health Information National Trends Survey (HINTS)

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Abstract

Background: Although it is widely accepted that Papanicolaou (Pap) screening can reduce cervical cancer mortality, many women still do not maintain regular cervical cancer screenings.

Objective: To describe the prevalence of cervical cancer screening and the demographic, behavioral, psychological, and cancer-related knowledge factors associated with adherence to U.S. Preventive Services Task Force (USPSTF) cervical cancer screening guidelines among women in the United States.

Methods: Data for women aged 25–64 were obtained from the National Cancer Institute's (NCI) 2005 Health Information National Trends Survey (HINTS). Women were considered adherent to screening guidelines if they had two consecutive, on-schedule screenings and planned to have another within the next 3 years. The sample comprised 2070 women.

Results: Ninety-eight percent of women reported ever having a Pap smear, 90% reported having had a recent Pap smear (within 3 years), and 84% were adherent to USPSTF screening guidelines. Maintaining regular cervical cancer screening was significantly associated with having health insurance, normal body mass index (BMI), smoking status (nonsmoker), mood (absence of a mood disturbance), and being knowledgeable about cervical cancer screening and human papillomavirus (HPV) infection.

Conclusions: Based on the observation that women who were current smokers, obese, or experiencing a substantial degree of psychological distress were significantly less likely to adhere to recommended screening guidelines, we suggest that healthcare providers pay particular attention to the screening needs of these more vulnerable women.

Introduction

UNDERSTANDING THE FACTORS associated with maintaining regular cervical cancer screening is critical, given that cervical cancer is one of the most preventable and treatable cancers, particularly when detected at an early stage. Early detection coupled with appropriate treatment is associated with excellent survival: the 5-year relative survival rate for women with localized disease exceeds 90%.[1] In fact, it is believed that nearly all cervical cancer deaths could be prevented if women and their healthcare providers adhered to screening recommendations and follow-up treatment.[2]

Since the introduction of the Papanicolaou (Pap) test in the 1940s, the incidence of and mortality from cervical cancer have decreased dramatically in countries with organized screening programs. Although cervical cancer screening has never been subject to randomized clinical trials, epidemiological data from countries that have instituted systematic screening programs strongly support the role of screening in reducing cervical cancer incidence and mortality. Data from case-control studies and large-scale screening programs conducted in the United States, Europe, and Australia suggest that Pap smear screening can reduce the incidence of invasive cancer by 60%–90%.[3–8]

Data from the 2000 National Health Interview Survey (NHIS) and 2004 Behavioral Risk Factor Surveillance System (BRFSS) indicate that 83%–86% of U.S. women aged ≥18 have had a Pap smear within the past 3 years, which is the guideline

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proposed by the U.S. Preventive Services Task Force (USPSTF).[9,10] Although this appears to be a relatively high screening rate, there are certain groups of women in the United States who are less likely than others to be screened. A number of factors have been associated with lower rates of cervical cancer screening, including lack of a usual source of healthcare,[10–13] lack of health insurance,[10,12,14] low income,[10,12] low educational attainment,[10–12,14] obesity,[15] smoking,[12,13] immigrant status,[16] foreign birth,[10] and not being married or living with a partner.[10,11,14] Recent data from the American Cancer Society (ACS) indicate that Asian and Hispanic women are less likely to be screened than non-Hispanic white and black women.[17] Lower rates of cervical cancer screening have also been reported for Mexican American women,[18] Vietnamese American women,[19] and women living in Appalachia.[20] Although one might expect that women with a personal or family history of cancer might be more likely to undergo regular screening, data from the Women's Health Initiative (WHI) Observational Cohort Study suggest otherwise.[12]

Given the undisputed value of cervical cancer screening in reducing morbidity and mortality, this study sought to understand the factors associated with maintaining regular screening in a nationally representative sample of 25–64-year-old women. Our data source was the National Cancer Institute's (NCI) 2005 Health Information National Trends Survey (HINTS), a cross-sectional health communication survey that captures not only sociodemographic and general health information but also cancer-specific items not included in other national health surveys, notably NHIS, BRFSS, and the National Health and Nutrition Examination Survey (NHANES). Specifically, HINTS 2005 allowed us to examine whether knowledge of the role of human papillomavirus (HPV) in disease and awareness of cervical cancer screening guidelines predicted screening adherence. Also unique to HINTS 2005 was an item that allowed us to query cancer information-seeking behavior.

Our study was designed as an exploratory study to describe the prevalence of Pap test screening (ever screening, recent screening, and consecutive, on-schedule screenings) and the demographic, behavioral, psychological, and cervical cancer knowledge factors that are associated with maintaining regular screening. Based on the observation that unhealthy lifestyle behaviors often cluster together,[21–25] we hypothesized that women engaged in unhealthy lifestyle behaviors (specifically, smoking and obesity) would be less likely to maintain regular Pap smear screening than women who did not endorse such behaviors. Further, we hypothesized that women who were knowledgeable about HPV infection and current screening recommendations would be more likely to adhere to regular screenings than women who were not so well informed.

Materials and Methods

Data source

Data were obtained from HINTS 2005, which is a nationally representative telephone survey designed to monitor trends in use of health information and communication technologies, as well as to examine cancer-relevant behaviors (e.g., cancer screening behaviors). The survey is available in English and Spanish. Details of survey development, design, and

methodology have been published elsewhere and are available online.[26,27] HINTS 2005 is available at hints.cancer.gov/hints/docs/HINTS_2005_Instrument-English.pdf. Survey items used in this analysis are identified by survey number (e.g., CV-01).

Data collection, response rates, and sample

Data were collected from February 2005 through August 2005. A list-assisted random-digit-dial method was used to obtain a representative sample of the U.S. civilian, noninstitutionalized adult (≥18 years) population. Trained interviewers used a computer-assisted telephone interviewing system to identify eligible households and conduct an extended interview with one adult per household. Response rates for the initial household screener and extended interview were 34% and 61%, respectively.

The study sample included women aged 25–64 without a history of cervical cancer. These age limits were selected based on current USPSTF guidelines,[9] which recommend starting regular cervical cancer screening within 3 years of onset of sexual activity or age 21, whichever comes first, and screening at least every 3 years until age 65. Screening is not recommended for women beyond age 65 if they are not otherwise at high risk for cervical cancer. Age 25 was selected as the lower age limit in order to allow for two screenings after age 21.

HINTS 2005 surveyed 2407 women between the ages of 25 and 64. Of this sample, three groups of women were excluded from the analysis: (1) women who had a history of cervical cancer ($n = 51$), (2) women who did not provide enough information to determine screening status ($n = 66$), and (3) women who provided enough information to determine screening status but provided incomplete information in response to the covariate questions ($n = 220$). The final sample comprised 2070 women.

Survey items

Dependent variable: Cervical cancer screening status (maintainer vs. nonmaintainer). A woman was considered adherent to cervical cancer screening guidelines (i.e., a maintainer) if she had two consecutive screenings within the recommended 3-year screening interval and expected to have a third screening within the next 3 years. A woman was not considered adherent (i.e., a nonmaintainer) if she did not meet these criteria. Screening status was determined based on self-reported answers to four questions. The first question asked if a woman had ever been screened for cervical cancer (CV-01). If she had, she was asked about the timing of her two most recent screenings (CV-02, CV-04). Response options were: A year ago or less, More than 1 but not more than 3 years ago, More than 3 but not more than 5 years ago, and Over 5 years ago. If a woman had been screened only once, she could indicate that her most recent Pap test was her first ever. The final question (CV-06) asked when a woman expected to have her next screening. Response options were: A year or less from now, More than 1 but not more than 3 years from now, More than 3 but not more than 5 years from now, Over 5 years from now, Am not planning to have another, If I have symptoms, and When doctor/health provider recommends. If a woman's two prior Pap tests were within the recommended 3-year interval and she indicated that her next Pap test would be When

doctor/health provider recommends or within the next 3 years, she was considered a maintainer. Women who had two previous on-time screenings and reported having a hysterectomy were also considered maintainers.

Potential correlates of screening: Sociodemographic variables. Respondents were asked to provide information on age (GA-0A), race/ethnicity (DM-04, DM-05), marital status (DM-02), education (DM-03), household income (DM-14), access to health insurance (HS-04), country of origin (DM-06), occupational status (DM-01), and comfort speaking English (DM-08). Because there were so few Asian Americans, Native Americans, Native Hawaiian, and Pacific Islanders, four mutually exclusive race/ethnicity groups were created: white, non-Hispanic; black, non-Hispanic; Hispanic; and other, non-Hispanic. Respondents who indicated more than one race were classified as other, non-Hispanic. To assess marital status, respondents were asked to indicate if they were married, divorced, widowed, separated, never married, or living with a partner. Women who were married or living with a partner were categorized as married/living with a partner, and all other women were categorized as not married because of small cell sizes that would have created unstable estimates. Access to healthcare coverage was assessed by the following question: Do you have any kind of healthcare coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare? Occupational status was assessed by asking if the respondent was employed for wages, self-employed, out of work for more than 1 year, out of work for less than 1 year, a homemaker, a student, retired, or unable to work. In order to avoid small cell sizes, employed for wages and self-employed were combined into a single employed category, and out of work for more than 1 year and out of work for less than 1 year were collapsed into an unemployed category.

Potential correlates of screening: Behavioral and psychological variables. Respondents were asked to describe their general health status (excellent, very good, good, fair, or poor) (HS-01) and to report the number of times they sought care from a healthcare provider in the past year (HS-05). They were also asked if they or a member of their family had ever been diagnosed with cancer (CA-01, CA-06).

Smoking status was a three-level variable based on responses to two questions (TU-01, TU-02): Have you smoked at least 100 cigarettes in your entire life? and Do you now smoke cigarettes? A current smoker was defined as a woman who had smoked at least 100 cigarettes and currently smoked every day or some days. A woman was considered a former smoker if she had smoked at least 100 cigarettes in her life but was not smoking at present. Never smokers comprised women who had never smoked and women who had smoked fewer than 100 cigarettes in their lifetime.

Body mass index (BMI) was calculated based on self-reported height and weight (EB-22, EB-23). Respondents were classified as underweight ($<18.5 \text{kg/m}^2$), normal weight ($18.5–24.9 \text{kg/m}^2$), overweight ($25.0–29.9 \text{kg/m}^2$), obese I/II ($30.0–39.9 \text{kg/m}^2$), or obese III ($\geq40 \text{kg/m}^2$).

To assess whether a woman experienced mood interference, that is, symptoms of psychological distress severe enough to interfere with daily life, a dichotomous mood status variable was created from two questions (HS-02, HS-03). The first question inquired how frequently a woman experienced psychological distress during the previous month, and the second question asked about the degree to which those feelings interfered with activities of daily life. If a woman indicated that she experienced psychological distress (e.g., hopelessness, nervousness, or extreme sadness) all of the time, most of the time, or some of the time during the past month, she was then asked how much those symptoms interfered with her life (a lot, some, a little, or not at all). Women who did not experience psychological distress or experienced feelings of distress only a little of the time were not considered to have mood interference. Women who reported that their symptoms interfered with their life a lot or some, were considered to have mood interference; women who acknowledged experiencing psychological distress but reported that their symptoms did not interfere with activities of daily living were considered not to have mood interference.

Cancer information seeking was assessed with a single question (CA-08): Have you ever looked for information about cancer from any source? Women were prompted to consider all sources of information, including the Internet, the library, friends, and healthcare professionals. To examine exposure to health information, a scale variable was created from three items (HC-04, HC-08, HC-10) that inquired whether respondents had read about health issues in a newspaper or magazine, watched a television program on health, or read about health on the Internet in the past year. Responses were coded on a 0–3 scale, with 0 indicating no sources of health information were used and 3 indicating that all three sources were used. Trust in health information sources was assessed by a question that asked how much respondents trusted health information from seven potential sources: a healthcare professional, family or friends, newspapers, magazines, radio, television, and the Internet (HC-13). Respondents were rated on a scale of 0–7, with 0 indicating that no sources of health information were trusted and 7 indicating that all the sources were trusted.

Potential correlates of screening: General cervical cancer screening knowledge. Cervical cancer screening knowledge was assessed with three items pertaining to awareness of cervical cancer screening guidelines and HPV infection. Women were asked how often they should have a Pap test (CV-07). Response options were more than once a year, once every 1–3 years, every 3+ years, or never. The last two responses were considered incorrect.

Knowledge of HPV was based on responses to two questions (CV-11, CV-13). Respondents were first asked if they had ever heard of HPV. Women who had never heard of HPV were not considered to be knowledgeable and were, therefore, not asked any further questions regarding HPV. Women who said that they had heard about HPV were asked six brief, relatively simple follow-up questions (e.g., Do you think that HPV causes cervical cancer? Do you think that HPV infection is rare?). If a woman answered any of the six HPV knowledge questions correctly, she was considered to have at least minimal knowledge about HPV; however, if she failed to answer any of the six questions correctly, she was not considered knowledgeable. Additionally, if a woman indicated that she had heard of HPV but replied don't know or refused to answer the six HPV questions, she was not considered knowledgeable.

Analysis plan

Data were analyzed with SAS-callable SUDAAN, version 9.0 (Research Triangle Institute, Research Triangle Park, NC), to account for the complex sampling design used in HINTS and to incorporate the jackknife replicate weights needed to compute accurate standard errors. All analyses were weighted to provide nationally representative estimates. HINTS 2005 data were poststratified—using information from the March 2005 Current Population Survey—to match U.S. population demographics, including sex, race/ethnicity, age, and educational level. Thus, weighted analyses of these variables accurately reflect the 2005 U.S. population. Respondents who had missing values for relevant variables used in any statistical models were excluded from the analysis.

Before conducting logistic regressions, bivariate associations between the potential correlates and screening maintenance were examined. For each potential correlate, the percentage of maintainers was computed along with 95% confidence intervals (CI). Based on the results of the bivariate analysis, a logistic regression model using a forward-stepwise variable selection method was developed. Model selection began with variables that were significant at the $\alpha = 0.05$ level. Additional variables were added or removed from the model based on the criterion that the p value remain at the $\alpha = 0.05$ level. Important demographic variables were also forced into the final model despite not meeting the $\alpha = 0.05$ threshold. Once the final model was established, odds ratios (ORs) with 95% CIs were computed.

Results

Demographics/prevalence estimates of cervical cancer screening

Table 1 shows the weighted distribution of demographic variables for the women in the sample. The majority of women were white, non-Hispanic, well educated, and gainfully employed. Most had some form of healthcare coverage. Ninety-eight percent of women reported having a Pap test at some time in their lives, and 90% reported having a Pap test within the past 3 years. Eighty-four percent of women met our definition of a screening maintainer.

Bivariate analyses

Initial bivariate analyses (Table 2) found the following variables associated with maintaining regular Pap screenings at the $p < 0.05$ level: education, marital status, general health status, number of healthcare provider visits in the past year, health insurance status, smoking status, BMI, mood interference, Pap test screening knowledge, knowledge of HPV, and ever searching for information about cancer.

Logistic regression models

Table 3 summarizes the ORs and 95% CIs for the final logistic model in which Pap screening maintenance was regressed on the set of predictors that were significant at the bivariate level. The initial multivariate model included all the variables that were significant at the bivariate level. Variables that did not achieve significance in the multivariate model were eliminated. Although age, race/ethnicity, and education

TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF STUDY SAMPLE: UNWEIGHTED SAMPLE SIZE (*N*), WEIGHTED PERCENTAGES, AND 95% CONFIDENCE INTERVALS (CI)

Characteristic	n	%	95% CI
Age group	2070		
25–34	370	23.98	(21.88, 26.21)
35–45	610	31.98	(29.98, 34.04)
46–64	1090	44.04	(41.72, 46.40)
Race/ethnicity	2070		
White, non-Hispanic	1572	69.44	(67.52, 71.30)
Black, non-Hispanic	195	12.55	(11.06, 14.21)
Hispanic	196	11.47	(10.21, 12.86)
Other, non-Hispanic	107	6.54	(5.05, 8.43)
Marital status	2067		
Married/living with partner	1349	71.58	(68.96, 74.06)
Not married	718	28.42	(25.94, 31.04)
Education	2070		
Less than high school	177	9.90	(8.91, 10.99)
High school graduate	481	27.30	(25.53, 29.15)
Some college	647	33.83	(31.78, 35.94)
College graduate	765	28.96	(27.61, 30.35)
Household income	1837		
<$20K	379	20.75	(18.43, 23.29)
$20K–<$35K	185	9.39	(7.75, 11.34)
$35K–<$50K	282	15.04	(12.73, 17.69)
$50K–<$75K	425	24.13	(21.80, 26.62)
>$75K	566	30.68	(28.46, 33.00)
Healthcare coverage	2070		
Insured	1816	86.21	(84.38, 87.85)
No insurance	254	13.79	(12.15, 15.62)
Born in the United States	2070		
Yes	1850	86.14	(83.99, 88.04)
No	220	13.86	(11.96, 16.01)
Occupational status	2066		
Employed	1326	63.21	(60.31, 66.03)
Unemployed	110	6.07	(4.82, 7.63)
Homemaker	305	16.66	(15.20, 18.23)
Student	33	1.99	(1.28, 3.08)
Retired	146	5.25	(4.21, 6.52)
Unable to work	146	6.82	(5.39, 8.58)

did not achieve significance in the final model, these variables were kept in the model because they are theoretically important demographic covariates.

Sociodemographic variables

The only sociodemographic variable that was significantly associated with maintaining regular Pap smear screening in the final model was access to healthcare coverage. Women who had some form of health insurance were significantly more likely to adhere to recommended screening guidelines than were women lacking health insurance.

Behavioral/psychological variables

All of the behavioral and psychological variables were significantly associated with screening maintenance. Compared to obese women, women with normal BMI were significantly more likely to maintain regular Pap screening.

TABLE 2. BIVARIATE ANALYSIS

	n	Weighted %[a]	p value[b]		n	Weighted %[a]	p value[b]
Age group	2070		0.0636	General health	2070		0.0001
25–34	370	88.25		Excellent/very good	949	88.88	
35–45	610	84.21		Good	666	84.60	
46–64	1090	81.95		Fair/poor	455	74.99	
Race/ethnicity	2070		0.2366	Provider visits in past year	2067		0.0001
White, non-Hispanic	1572	84.30		None	180	66.25	
Black, non-Hispanic	195	88.78		1 or 2	686	86.31	
Hispanic	196	83.33		3 or more	1201	86.08	
Other, non-Hispanic	107	75.66		Cancer diagnosis	2070		0.1298
Education	2070		0.0008	Personal and/or family	1633	85.05	
Less than high school	177	75.95		None	437	81.17	
High school graduate	481	79.08		Smoking status	2070		0.0008
Some college	647	87.72		Current smoker	398	74.01	
College graduate	765	87.67		Former smoker	487	88.07	
Marital status	2067		0.0003	Never smoker	1185	86.38	
Married or living with partner	1349	86.46		Body mass index	2070		0.0159
Not married	718	78.37		Underweight	35	80.00	
Level of comfort with English	2070		0.4908	Normal weight	857	87.64	
Comfortable	1953	84.61		Overweight	621	83.90	
Moderately comfortable	72	78.43		Obese I, II	467	81.18	
Not comfortable	45	80.22		Obese III	90	70.78	
Healthcare coverage	2070		0.0013	Mood interference	2070		0.0038
Insured	1816	85.99		Sometimes	803	80.40	
No insurance	254	72.88		Not at all	1267	86.92	
Pap test interval	2070		0.0007	Searched cancer information	2070		0.0067
At least once every 3 years	2039	84.82		Yes	1347	86.44	
Less often than every 3 years	31	29.39		No	723	80.38	
Heard of HPV	2070		0.0001	Exposure to health information	2070		0.1891
Yes	934	89.45		None	128	80.07	
No	1136	80.04		1 source	399	79.69	
Knowledge of HPV	2070		0.0001	2 sources	874	85.05	
Yes	847	89.62		All sources	669	86.92	
No	1223	80.54		Trusted sources of information	2070		0.1072
				0–2 sources trusted	36	64.40	
				3–7 sources trusted	2034	84.57	

[a]Percentage of respondents who are cervical cancer screening maintainers.
[b]Chi-square p value.

Women who had never smoked cigarettes were more likely to be maintainers than current smokers, women who were not experiencing psychological distress were more likely than distressed women to maintain regular screening, and women who had searched for cancer information were more likely to be maintainers than women who had never searched for cancer information.

Cervical cancer screening knowledge

Both knowledge variables were significantly associated with maintaining regular screening. Women who were informed about current cervical cancer screening guidelines and informed about HPV infection were more likely to be maintainers than were women who were not so informed.

Discussion

This study sought to understand the factors associated with maintaining regular Pap tests in a nationally representative sample of women. To the best of our knowledge, this is the first study to examine correlates of three successive, on-schedule Pap tests. Others have looked at correlates of ever having a Pap test or having a recent Pap test[10,11,28] or correlates of having two consecutive, on-schedule Pap tests.[14] Our study expanded the definition of regular Pap smear screening to include two recent consecutive, on-schedule Pap tests and the intention to have another Pap test within the recommended screening interval.

The prevalence estimate of recent cervical cancer screening (i.e., Pap test within the past 3 years) from HINTS 2005 was somewhat higher than the 2005 estimate from the Centers for Disease Control (CDC) and National Center for Health Statistics (NCHS).[29] Whereas 90% of HINTS respondents reported having a recent Pap test, 87% of 25–44-year-old women and 81% of 45–64-year-old women surveyed by the NCHS reported having a Pap test within 3 years. The only sociodemographic variable that was strongly associated with screening maintenance was access to healthcare coverage. This is consistent with 2005 NCHS data, which found that

TABLE 3. MULTIVARIATE LOGISTIC REGRESSION MODEL
PREDICTORS OF CERVICAL CANCER SCREENING
MAINTENANCE: SAMPLE SIZE (*n*), ODDS RATIOS (OR),
AND 95% CONFIDENCE INTERVALS (CI)

	n	OR	95% OR
Age group	2070		
25–34	370	1.52	(0.89, 2.58)
35–45	610	1.14	(0.78, 1.67)
46–64	1090	1.00	(1.00, 1.00)
Health care coverage	2070		
Insured	1816	2.21	(1.48, 3.28)
No insurance	254	1.00	(1.00, 1.00)
Smoking status	2070		
Current smoker	398	0.44	(0.29, 0.68)
Former smoker	487	1.30	(0.82, 2.05)
Never smoker	1185	1.00	(1.00, 1.00)
Body mass index	2070		
Underweight	35	0.77	(0.22, 2.72)
Normal weight	857	1.00	(1.00, 1.00)
Overweight	621	0.75	(0.48, 1.15)
Obese I, II	467	0.57	(0.37, 0.89)
Obese III	90	0.30	(0.15, 0.59)
Pap test interval	2070		
At least once every 3 years	2039	21.09	(6.79, 65.55)
Less freqently than every 3 years	31	1.00	(1.00, 1.00)
Knowledge of HPV	2070		
Yes	847	1.77	(1.17, 2.68)
No	1223	1.00	(1.00, 1.00)
Mood interference	2070		
Sometimes	803	0.65	(0.44, 0.96)
Not at All	1267	1.00	(1.00, 1.00)
Searched cancer information	2070		
Yes	1347	1.51	(1.10, 2.08)
No	723	1.00	(1.00, 1.00)
Education	2070		
Less than high school	177	1.18	(0.59, 2.39)
High school graduate	481	0.95	(0.62, 1.45)
Some college	647	1.61	(1.08, 2.40)
College graduate	765	1.00	(1.00, 1.00)
Race/ethnicity	2070		
White, non-Hispanic	1572	1.00	(1.00, 1.00)
Black, non-Hispanic	195	1.93	(0.90, 4.14)
Hispanic	196	1.24	(0.71, 2.17)
Other, non-Hispanic	107	0.50	(0.23, 1.09)

insured women were more likely than uninsured women to have had a Pap test within the past 3 years.[29] Others have found that compared with uninsured women, women who have health insurance are more likely to have not only timely Pap tests[12,30–34] but other cancer screening tests as well.[32,35–37] This is not surprising, as health insurance plans usually cover or defray the cost of cancer screening. Unfortunately, HINTS 2005 did not query usual source of healthcare, a variable that has been found to be a critical predictor of cervical cancer screening.[13,28,37] The combined effect of insurance and a usual source of care as a marker of access to care has been strongly associated with receipt of cancer screening.[12,30,38] In one national study, 35% of women who lacked health insurance and a usual source of care received a Pap test in the previous year compared with 67% of women who had both health insurance and a usual source of care.[39]

All the behavioral and psychosocial variables were strongly associated with screening adherence. Overall, women who maintained on-schedule Pap tests appeared to be generally healthier than women who did not obtain regular Pap smears. Compared with women who never smoked, current smokers were significantly more likely not to have regular Pap tests, a finding that is consistent with data from the 1998 NHIS[13] and the Women's Health Initiative.[12] This is particularly concerning because smoking is a recognized risk factor for cervical cancer.[40–42] Unfortunately, although smokers often acknowledge the health risks posed by smoking, they tend to minimize or deny their personal risk while attributing a greater degree of risk to other smokers.[43–48] This so-called optimistic bias,[48–51] or sense of personal immunity to the health risks of smoking,[52–54] may operate with respect to other health behaviors as well. For example, compared with non-smokers, current smokers are less likely to have on-schedule mammograms and colorectal cancer screenings[12,38,55,56] and less likely to adhere to medical treatment.[57–59] A number of personality characteristics associated with smoking may also predispose smokers to neglect regular screenings. For example, compared with nonsmokers, smokers have been found to evidence greater depression, negative affect, anxiety sensitivity, and hostility[60–65]; a tendency toward sensation seeking and impulsivity[66–69]; deficient coping skills[70]; a present time perspective[71]; and a tendency to rationalize risk.[53]

Because unhealthy lifestyle behaviors have been noted to cluster together, it was not surprising that obesity was also strongly associated with not maintaining on-schedule screening. This too is concerning, as overweight women have significantly higher mortality rates from cervical cancer than normal weight women.[72,73] With one exception,[74] studies have consistently found an inverse relationship between BMI and cervical cancer screening. Obese women are more likely to delay medical care and less likely to have up-to-date Pap tests than normal weight women.[15,75–80]

Mood was another significant predictor of screening status. Women who experienced psychological distress to such an extent that it substantially interfered with activities of daily living were significantly less likely to adhere to screening guidelines. The few studies that have examined the relationship between depressed mood and cervical cancer screening have yielded inconclusive results. One family practice-based study found that depressed women were slightly more likely to be screened than women with a chronic physical health condition,[81] whereas other studies have reported no significant relationship between depression and cervical cancer screening.[82,83] A Canadian population-based study reported an interaction effect of age: compared with their nondepressed counterparts, younger depressed women were more likely to report a recent Pap test and middle-aged depressed women were less likely to report a recent Pap test.[84] Leiferman and Pheley[85] studied the effect of mental distress on preventive health behaviors in a community-based sample. Women who reported high levels of distress were significantly less likely to have had on-schedule Pap tests than women who were not distressed. Significantly lower rates of on-time Pap tests have been observed in women with psychiatric and substance use disorders.[86] Because we employed a broad definition of psychological distress that would include women with low-level dysphoria as well as women with major depressive disorder, our data suggest that even low

levels of psychological distress can interfere with cervical cancer screening. One could speculate that women with a mood disorder might have less energy and fewer cognitive resources to plan for and pursue preventive healthcare services, such as cancer screening.

A strength of this study was the use of a nationally representative dataset to compare screening maintainers with nonmaintainers. To the best of our knowledge, this is one of the only studies to address this question. There are, however, a number of potential limitations to this study. First, because HINTS is a cross-sectional survey, causation cannot be inferred. Furthermore, because screening status was based on self-report, prevalence estimates may be biased due to several factors: the telescoping phenomenon (which is the tendency to report events as having occurred more recently than they actually occurred),[87,88] social desirability,[89] and the possibility that women may have confused nonscreening gynecological procedures with Pap tests.[90] Numerous studies have found a lack of concordance between self-reported Pap smears and medical record data. In general, women tend to overreport Pap screening in a given time period and underestimate the time from the previous screening.[91–94] Consequently, Pap screening rates that are based on self-report likely overestimate screening prevalence,[95–98] and our prevalence data may reflect this tendency. Another potential limitation involves the use of single items to measure key constructs, such as proficiency in English and cancer information seeking, which may have lowered the reliability of these constructs and thereby diminished the chances of identifying significant relationships. Finally, the overall response rate for the survey was relatively low, although comparable to other national telephone surveys, which reflects the decreasing trend in response rates for these types of surveys.[99] It should be noted that HINTS is a random-digit-dial landline survey that does not capture cell phone users. Although an estimated 7.8% of U.S. households in 2005 were cell phone only subscribers,[100] noncoverage of these households in traditional landline surveys is thought to have only a slight impact on outcome.[100,101] There are, however, notable differences between landline and cell phone users. Compared with landline users, cell phone only users tend to be younger, less affluent, unmarried, and Hispanic.[100,102] With respect to health behaviors, cell phone only users appear more likely to consume alcohol, smoke, be psychologically distressed, and be uninsured than landline users.[101] Overall, rapidly declining telephone survey response rates coupled with the cost and logistics involved in conducting cell phone surveys pose a serious challenge to future telephone-based survey research.[102–104]

Despite these potential limitations, our findings corroborate and extend previous research on national cervical cancer screening practices. Consistent with other studies, our data underscore the critical importance of health insurance as a predictor of cancer screening. Based on the observation that women who were current smokers, obese, or experiencing a significant degree of psychological distress were significantly less likely to maintain regular cervical cancer screenings, we suggest that healthcare providers pay particular attention to the screening needs of these women. Although women who are smokers and women who are obese may have numerous medical visits for smoking and obesity-related diseases, providers should not assume that these women are obtaining appropriate gynecological care. Given the morbidity and mortality implications of smoking and obesity for cervical cancer, this is an especially important group of women on whom to focus screening efforts. Women experiencing significant enough psychological distress to cause mood interference may be a particularly difficult group to reach, given that they may have limited contact with the healthcare system. Although our measure of mood interference was relatively crude, we found that even low levels of distress were significantly associated with not maintaining regular screening. Future research should explore more fully the relationship of psychological vulnerability to screening behavior.

Disclosure Statement

The authors have no conflicts of interest to report.

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