

ORIGINAL RESEARCH

Nonadherence to Breast and Cervical Cancer Screening: What Are the Linkages to Chronic Disease Risk?

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PEER REVIEWED

Abstract

Background

Several preventive practices that reduce chronic disease risk have been associated with breast and cervical cancer screening, including maintenance of normal weight and avoidance of cigarette smoking. A history of certain chronic illnesses such as diabetes and cardiovascular disease has also been related to cancer screening. Nevertheless, studies that have attempted to identify women who are less likely to have had a recent breast or cervical cancer screening test have infrequently examined the associations of breast and cervical cancer screening with multiple health factors that influence chronic disease risk.

Methods

To clarify relationships between cancer screening and health behaviors and other factors that influence chronic disease risk, we examined the self-reported breast and cervical cancer screening practices of women in the United States by using data from the 1999 Behavioral Risk Factor Surveillance System. The women were described according to their recent use of mammography and the Papanicolaou test, physician visits within the past year, health insurance coverage, and preventive practices that reduce chronic disease risk.

Results

Overall, 74.5% (95% CI, 73.9%-75.1%) of the women in this sample aged 40 years or older (n = 56,528) had received a mammogram within the past 2 years. The percentage of women who had been screened for breast cancer, however, varied widely by factors associated with reducing the risk of chronic disease (e.g., cholesterol check in the past 2 years, blood pressure check in the past 2 years, normal weight, avoidance of cigarette smoking) and having access to health care (e.g., health insurance coverage, recent physician visit). Similarly, 84.4% (95% CI, 83.9%-84.9%) of all women aged 18 years or older who had not undergone a hysterectomy (n = 69,113) had received a Papanicolaou test in the past 3 years, and factors associated with reduced chronic disease risk and health care access were related to having had a recent Papanicolaou test.

Conclusion

The results of this study suggest that underscreened women who are at risk for breast and cervical cancer are likely to benefit from programs that identify and address coexisting prevention needs. The identification of coexisting prevention needs might assist in developing interventions that address multiple risks for chronic disease among women and might subsequently help improve the efficiency and effectiveness of prevention programs.

Background

Several preventive practices that reduce chronic disease risk have been associated with breast and cervical cancer screening in previous studies. These practices include maintaining a normal weight (1-3), avoiding cigarette smoking (4-6), and testing for cholesterol level (7).

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In addition to preventive practices, a history of certain chronic illnesses such as diabetes, obesity, and cardiovascular disease has been associated with cancer screening behaviors (8). For example, recent studies have found that obese women in the United States are less likely to adhere to cancer screening recommendations than normal weight women (2,3). In addition, obesity is associated with increased risks of several chronic diseases, including coronary heart disease, diabetes, and breast cancer (9-12).

Studies that have linked a history of chronic illness with cancer screening behavior (for example, women who are obese or who have had a prior cardiovascular event are less likely to have had a recent breast or cervical cancer screening test) frequently have not examined the association of cancer screening behavior with health-related behaviors that affect the risk of cardiovascular disease such as cholesterol and blood pressure checks, level of physical activity, and avoidance of cigarette smoking (7,13). Thus, researchers and clinicians do not completely understand the relationships between cancer screening and factors associated with chronic disease risk. Cardiovascular disease and cancer are the 2 most common causes of death among women in the United States (14).

Interrelationships between preventive health behaviors are partly due to individual contact with the medical care system. For example, women are more likely to have had a recent Papanicolaou (Pap) test if they have seen a physician in the past year or if a health care provider has recommended that they undergo the procedure (15,16). Engaging in regular health care has been shown to be a predictor of cancer screening among women. Additionally, physician visits for other chronic diseases may be related to an increased likelihood of cancer screening (8). Among older women who were studied as part of the Women's Health Initiative, breast and cervical cancer screening was inversely related to having diabetes and cardiovascular disease (8).

To clarify the relationships between cancer screening and health-related behaviors and other factors that influence chronic disease risk, we examined the self-reported breast and cervical cancer screening practices of women in the United States using data from the 1999 Behavioral Risk Factor Surveillance System (BRFSS). The preventive practices examined included screening mammography, Pap test, and other health-related behaviors. We examined possible correlates of screening among the women,

including whether they had received a cholesterol or blood pressure check in the past 2 years, had maintained normal weight, were physically active, or avoided cigarette smoking.

Methods

The data used in this study were from women who were interviewed as part of the 1999 BRFSS, a state-based telephone survey of adults aged 18 years or older (17). We used data from 1999 rather than more recent data because during that year the survey collected information about additional preventive health practices.

The BRFSS uses a random-digit-dialing technique and multistage cluster sampling in each participating state to sample noninstitutionalized adults who have telephones (18). Trained interviewers administered a computer-assisted interview. The interviews included questions about general health status, demographic and socioeconomic characteristics, height and weight, mammography, use of Pap tests, and other health-related behaviors, including alcohol use, cigarette smoking, testing for occult blood in the stool, and cholesterol or blood pressure checks. We asked each adult female respondent whether she had ever had a mammogram; we then asked those who responded positively how long it had been since their last mammogram. Next we asked similar questions about the Pap test. We also asked women whether they had undergone a hysterectomy.

We limited analyses of mammogram use to women aged 40 years or older ($n = 56,528$), whereas we limited analyses of Pap test use to women aged 18 years or older ($n = 69,113$). Women who reported that they had undergone a hysterectomy, and therefore did not have an intact uterine cervix, were excluded from the analyses of Pap test use. Data on physical activity were only available for respondents in Georgia, Hawaii, Illinois, Michigan, Nebraska, New Mexico, Ohio, Oklahoma, Tennessee, Utah, and Virginia ($n = 10,381$ for analyses of mammography and $n = 12,600$ for analyses of Pap test use in relation to physical activity).

Physical activity levels were categorized as physically inactive (no reported activity), irregular activity (any reported physical activity engaged in for either less than 20 minutes or less than 3 times per week), regular activity (any physical activity engaged in for 20 or more minutes

3 or more times per week), and regular and vigorous activity (any physical activity that likely required rhythmic contraction of large muscle groups at 50% of functional capacity for 20 or more minutes 3 or more times per week). Body mass index (BMI) was calculated using weight and height [weight (kg)/height squared(m)²] (14) and was categorized as underweight (BMI < 18.5), normal weight (BMI > 18.5 and < 25), overweight (BMI 25 to 29), and obese (BMI > 30) according to the International Obesity Task Force classification (19).

We examined the percentage of women who had had a recent mammogram or Pap test in relation to combinations of selected preventive health behaviors, based on the framework proposed by Langlie (Figure) (20). Selected preventive health behaviors included detecting disease or reducing the possibility of future disease (checking cholesterol level, checking blood pressure, and avoiding cigarette smoking) and health maintenance behaviors (maintaining normal weight and engaging in physical activity).

Behaviors That Serve to Detect Disease or Reduce the Possibility of Future Disease
Cholesterol check
Blood pressure check
Avoidance of cigarette smoking
Health Maintenance Behavior
Maintenance of normal weight
Physical activity

Figure. Categories of Health Behaviors Associated With Chronic Disease Risk That Were Examined in Relation to Mammography and Pap Testing. Adapted from Langlie JK (20).

Age-adjusted rates of screening test use were estimated using the direct method and the overall age distribution of U.S. women who responded to the 1999 BRFSS. In examining bivariate associations, levels of statistical significance were obtained using Cochran-Mantel-Haenszel chi-square tests. All analyses used SAS and SUDAAN to calculate 95% confidence intervals (CIs) and to allow for weighting of the estimates (21). The samples were weighted to compensate for the following 3 factors: 1) unequal sampling probability resulting from the unique number of telephones per household; 2) number of unique telephone numbers per primary sampling unit; and 3) poststratification by age, sex, and race. Using logistic regression tech-

niques and SUDAAN, we carried out a multivariate analysis of predictors of screening test use (21, 22). We used the logistic model to obtain point estimates of the predicted marginals, which were the multivariate-adjusted screening rates expressed as a percentage (22). Each covariate and explanatory variable in the model was tested for association with the response variable using a Wald chi-square test. All pairwise comparisons were performed using general linear contrasts (22).

Results

The overall response rates (Council of American Survey Research Organizations [23]) for the 1999 BRFSS among households of all races and ethnicities was 55.2%.

Mammography

Overall, 86.9% (95% CI, 86.4%-87.4%) of women aged 40 years or older reported receiving a mammogram at least once, after adjusting for age. In addition, 74.5% (95% CI, 73.9%-75.1%) of women aged 40 years or older reported receiving a mammogram within the past 2 years, after adjusting for age. Not having a mammogram within the past 2 years was associated with not being currently married, lower education level, lower household income, being currently unemployed, larger number of children or persons in household, poorer general health status, not having seen a physician within the past year, lack of health insurance coverage, lack of use of other screening tests including recent cholesterol or blood pressure check, obesity, physical inactivity, and current alcohol or cigarette consumption (Table 1). We found similar results in multivariate analysis, although a smaller sample of women was used because of missing data. However, the associations between recent mammography and blood pressure or cholesterol checks were less pronounced after adjusting for multiple factors associated with screening.

Pap testing

Approximately 94.2% (95% CI, 93.9%-94.5%) of all women aged 18 years or older without a history of hysterectomy reported having received a Pap test at least once, after adjusting for age. In addition, 84.4% (95% CI, 83.9% to 84.9%) of women aged 18 years or older had received a Pap test within the past 3 years, after adjusting for age. Not having had a Pap test within the past 3 years was associated with race/ethnicity, not being currently married, lower education level, lower household income, number of children or persons in household, not being cur-

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rently employed, poorer general health, not having seen a physician within the past year, lack of health insurance coverage, lack of use of other screening tests including recent cholesterol and blood pressure check, obesity, physical inactivity, and current alcohol or cigarette consumption (Table 2). Similar results were seen in multivariate analysis (in a somewhat smaller sample of women). However, the associations between a recent Pap test and a blood pressure check, a cholesterol check, and weight were less pronounced after adjusting for multiple factors associated with screening, and the association with employment status disappeared.

Breast and cervical cancer screening and factors associated with chronic disease risk

The percentage of women who had undergone a recent mammogram was examined in relation to combinations of selected behaviors associated with chronic disease risk. After adjusting for multiple factors associated with screening, only 22.5% (95% CI, 12.9%-32.1%) of the women who reported not having a cholesterol or blood pressure check within the past 2 years and who were current cigarette smokers had had a recent mammogram (Table 3). By comparison, 81.7% (95% CI, 80.9%-82.4%; $P < .001$) of the women who had had recent cholesterol and blood pressure checks and who were non-smokers had had a recent mammogram (Table 3). Because of missing data, the sample size available for multivariate analysis was smaller than the sample size available for age-adjusted results. Differences in the percentage of women who had had a recent mammogram were less pronounced across combined categories of weight and physical activity. For example, after adjusting for multiple factors associated with screening, similar proportions of women who were obese and physically inactive and women who had a normal weight and were physically active had had a recent mammogram [73.7% (95% CI, 69.2%-78.1%) vs. 75.5% (95% CI, 72.6%-78.5%), $P = .49$].

After adjusting for multiple factors associated with screening, only 54.5% (95% CI, 48.6%-60.5%) of the women who reported not having a cholesterol or blood pressure check within the past 2 years and who were current cigarette smokers had had a recent Pap test (Table 4). By comparison, 90.7% (95% CI, 90.1%-91.3%; $P < .001$) of the women who had had recent cholesterol and blood pressure checks and who were nonsmokers had had a recent Pap test (Table 4). Differences in the percentage of women who had had a recent Pap test were similar or less pronounced

across combined categories of weight and physical activity. For example, after adjusting for multiple factors associated with screening, 86.5% (95% CI, 83.4%-89.5%) of the women who were obese and physically inactive had had a recent Pap test (Table 4). Similarly, 86.4% (95% CI, 84.4%-88.4%; $P = .964$) of the women who had a normal weight and were physically active had had a recent Pap test (Table 4).

Discussion

The present analysis of relationships between breast and cervical cancer screening and other factors associated with chronic disease risk was guided by the framework proposed by Langlie for categorizing preventive health behaviors (20). Similar frameworks for understanding the relationships between cancer screening tests and other preventive health behaviors have been proposed by other authors (24-26). Preventive health behaviors include behaviors that serve to detect disease (e.g., mammograms), behaviors that reduce the possibility of future disease (e.g., cholesterol checks, maintenance of normal weight, avoidance of cigarette smoking), and behaviors that maintain health (e.g., exercise, diet) (20,24). These categories are not mutually exclusive. Simpler models or categorizations (e.g., primary and secondary prevention) have also been used.

Nonadherence to breast and cervical cancer screening was positively related to chronic disease risk factors, especially cigarette smoking and not participating in cholesterol and blood pressure checks. Associations with disease reduction and health maintenance behaviors, such as physical activity and maintenance of normal weight, were small and much weaker. (Data on physical activity were only available for respondents in 11 states.) Current cigarette smokers who had not had a recent cholesterol or blood pressure check were particularly unlikely to have had a recent mammogram or Pap test. These findings probably reflect, in part, individual factors — knowledge and attitudes, lack of contact with physicians, poor access to routine health care — although differences in cancer screening practices persisted in multivariate analysis after adjusting for such factors as recently seeing a physician and having health insurance coverage. The findings may also be partly explained by errors in self-reported medical testing. Individuals who under-report one test might be more likely to under-report other tests; conversely, any increase in reported screening (due, for example, to social

desirability bias) might act across screening tests.

These results agree with those of other studies that have found a relationship between having Pap tests and having medical checkups, other cancer screening tests, and cholesterol tests (7,8,24). For example, in a factor analysis of BRFSS data from Maryland, Liang et al observed a clustering of Pap tests, clinical breast examinations, and medical checkups among women of all ages (27). Among women older than 40 years, mammograms and cholesterol checkups were clustered (27).

In addition to lack of access to health services, possible explanations for clusters of health factors associated with chronic disease risk include socioeconomic factors that make a healthy lifestyle difficult to establish and maintain. Factors such as poverty, unemployment, and lower educational level have consistently been found to pose barriers to cancer screening (8). Consistent with other studies, age, higher education level, having health insurance coverage, and seeing a physician within the past year were positively associated with cancer screening in the current analysis (8,28). Healthy lifestyle behaviors and better socioeconomic status were also related to the likelihood of having had a recent medical checkup (28). In the current study, however, the associations between nonadherence to breast and cervical cancer screening and chronic disease risk factors persisted after adjusting for education level, number of children, number of persons in household, and other demographic and socioeconomic factors. Controlling for education, unemployment, and other factors reduced, but did not eliminate, the associations with cancer screening.

Prior studies have found that obese women are less likely to undergo breast and cervical cancer screening (1-3,29). Obese women may be more reluctant to undergo procedures such as pelvic examinations and clinical breast examinations that involve disrobing or the physical examination of their bodies (1-3). Obesity may also deter physicians from recommending procedures such as pelvic examinations because of potential technical difficulties (30). Although the results of the current study may agree statistically with results from prior studies (1-3,29) the magnitude of the associations with obesity are small, especially after physical activity and other factors are taken into account (< 1 percentage point difference between obese and normal weight women for Pap test and < 2 percentage point difference between obese and normal-weight women

for mammography).

Limitations of the current study include a low response rate and the fact that the telephone survey excluded individuals living in households without a telephone. Individuals without a household telephone may be more likely to have a lower income, to engage in unhealthy lifestyle practices, or to not adhere to recommendations for routine breast and cervical cancer screening (31). As a result, the estimates of breast and cervical cancer screening in the present study may be biased upwards. Information bias is also a possibility, because of the use of self-reported information about height, weight, cancer screening practices, and other factors. Nonetheless, studies of the reliability of cancer screening information collected as part of BRFSS have shown that self-reported information about screening mammography and Pap tests is reliable (32,33). Studies based on self-reporting have found that overweight participants underestimate their weight and all participants overestimate their height (34,35). However, self-reported weight has been found to be highly correlated with measured weight (34,35). (As previously mentioned, data on physical activity were only available for respondents in 11 states.)

The results of the current study are important because of the increasing prevalence of physical inactivity and obesity in the United States, which increase the risk of cancer and other chronic diseases, and because of the need to identify women who are rarely screened for breast and cervical cancer (36-38). Although the majority of women in the United States have received a mammogram and Pap test, innovative approaches for identifying and reaching underscreened populations are needed. The observation that women who have not received a recent mammogram or Pap test may also lack a recent cholesterol or blood pressure check suggests that underscreened women who are at risk for breast and cervical cancer are likely to benefit from programs that identify and address coexisting prevention needs. The identification of coexisting prevention needs might help to improve the efficiency and cost-effectiveness of prevention programs. One example of this approach is the Centers for Disease Control and Prevention's WISE-WOMAN program, which provides low-income, underinsured and uninsured women aged 40 to 64 years with chronic disease risk factor screening, lifestyle intervention, and referral services to prevent cardiovascular disease (39). Currently funded projects provide preventive services including blood pressure and cholesterol testing as well

as interventions to help women increase physical activity and improve nutrition.

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Tables

Table 1.
Percentage of Women Aged 40 years or Older Who Had Received a Mammogram in the Past 2 Years, According to Selected Demographic Characteristics and Screening Practices, Behavioral Risk Factor Surveillance System, 1999*

	Age-adjusted (n = 56,528)		Multivariate-adjusted [†] (n = 49,564)	
	%	95% Confidence Interval (%)	%	95% Confidence Interval (%)
Age (years)				
40-49	68.1	(67.0-69.2)	70.9	(69.6-72.1)
50-64	80.2	(79.3-81.1)	78.9	(78.0-79.9)
≥ 65	75.1	(74.0-76.1)	77.7 [‡]	(76.5-78.9)
Race/ethnicity				
White	75.0	(74.3-75.6)	74.8	(74.1-75.4)
Black	74.3	(72.3-76.3)	78.1	(76.5-79.8)
Hispanic	72.2	(69.1-75.3)	80.5	(78.5-82.5)
Asian and Pacific Islander	76.8	(71.1-82.5)	79.0	(74.7-83.3)
American Indian and Alaska Native	68.2	(61.6-74.9)	76.2	(71.6-80.8)
Other	65.7	(55.6-75.8)	72.2 [‡]	(63.3-81.2)
Marital status				
Married	78.4	(77.6-79.1)	77.4	(76.6-78.3)
Divorced or separated	70.9	(69.2-72.5)	74.7	(73.3-76.1)
Widowed	69.5	(67.1-72.0)	72.6	(70.9-74.2)
Never married	67.4 [‡]	(64.5-70.3)	71.7 [‡]	(69.5-73.9)
Educational attainment				
< High school graduate	63.2	(61.1-65.2)	72.9	(71.4-74.5)
High school graduate/GED	73.0	(72.0-74.0)	75.2	(74.3-76.1)
Some college/tech school	76.5	(75.4-77.6)	75.7	(74.7-76.8)
College graduate	82.7 [‡]	(81.6-83.7)	78.6 [‡]	(77.5-79.7)
Household income				
< \$15,000	60.5	(58.4-62.6)		(omitted from model) [†]
\$15,000-\$34,999	70.7	(69.5-71.8)		(omitted from model) [†]
≥ \$35,000	82.5	(81.5-83.5)		(omitted from model) [†]
Missing data	74.8 [‡]	(73.4-76.2)		(omitted from model) [†]
Employment status				
Currently employed	76.7	(75.5-78.0)	76.0	(75.1-76.9)
Homemaker or retired	73.3	(72.1-74.6)	75.3	(74.2-76.3)
Unemployed	65.7	(60.6-70.8)	75.0	(72.0-78.0)

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	Age-adjusted (n = 56,528)		Multivariate-adjusted [†] (n = 49,564)	
	%	95% Confidence Interval (%)	%	95% Confidence Interval (%)
Unable to work	69.2 [‡]	(66.0-72.4)	77.0	(74.8-79.2)
Number of children in household				
0	76.2	(75.5-76.9)	77.2	(76.3-78.0)
1	68.7	(64.9-72.5)	73.6	(71.8-75.4)
2	67.7	(62.5-72.8)	71.2	(68.7-73.8)
3 or more	60.9 [‡]	(52.7-69.2)	67.5 [‡]	(63.9-71.1)
Number of persons in household				
1	73.0	(71.9-74.0)	75.7	(74.4-77.1)
2	77.6	(76.8-78.5)	75.7	(74.7-76.7)
3	73.6	(71.5-75.6)	74.4	(72.8-76.1)
4 or more	69.3 [‡]	(66.3-72.4)	76.8	(74.9-78.6)
General health status				
Good to excellent	75.8	(75.1-76.4)	76.0	(75.3-76.7)
Fair or poor	69.8 [‡]	(68.3-71.2)	74.6 [§]	73.3-75.9)
Saw physician within past year				
Yes	81.6	(81.0-82.2)	77.8	(77.1-78.5)
No	46.2 [‡]	(44.5-47.9)	67.9 [‡]	(66.4-69.4)
Health insurance coverage				
Yes	77.1	(76.5-77.6)	76.2	(75.6-76.9)
No	52.1 [‡]	(48.1-56.1)	70.9 [‡]	(68.8-73.0)
Clinical breast exam in past 2 years				
Yes	87.1	(86.6-87.6)	84.9	(84.2-85.5)
No	29.8 [‡]	(28.4-31.2)	41.6 [‡]	(39.8-43.4)
Pap test in past 3 years[‡]				
Yes	83.0	(82.3-83.7)		(omitted from model) [†]
No	20.1 [‡]	(18.5-21.8)		(omitted from model) [†]
Blood stool test in past year[¶]				
Yes	93.2	(92.3-94.1)		(omitted from model) [†]
No	72.9 [‡]	(72.0-73.8)		(omitted from model) [†]
Blood pressure check past 2 years				
Yes	76.9	(76.3-77.4)	76.1	(75.5-76.7)
No	11.4 [‡]	(8.1-14.7)	62.7 [‡]	(58.1-67.3)
Cholesterol check in past 2 years				
Yes	82.2	(81.6-82.8)	78.1	(77.4-78.8)

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	Age-adjusted (n = 56,528)		Multivariate-adjusted [†] (n = 49,564)	
	%	95% Confidence Interval (%)	%	95% Confidence Interval (%)
No	48.3 [‡]	(46.8-49.9)	68.3 [‡]	(67.0-69.7)
Weight				
Underweight	61.7	(57.3-66.0)	69.7	(65.9-73.5)
Normal weight	75.4	(74.5-76.3)	76.0	(75.1-76.8)
Overweight	76.4	(75.3-77.4)	76.6	(75.7-77.5)
Obese	73.1 [‡]	(71.7-74.4)	74.6 [‡]	(73.5-75.8)
Physical activity[#]				
Physically inactive	69.4	(67.1-71.8)		(omitted from model) [†]
Irregular activity	74.6	(72.2-77.1)		(omitted from model) [†]
Regular activity	75.3	(72.8-77.7)		(omitted from model) [†]
Regular and vigorous activity	81.3 [‡]	(78.4-84.3)		(omitted from model) [†]
Diabetes				
Yes	74.7	(72.5-77.0)	74.3	(72.3-76.3)
No	74.6	(74.0-75.2)	75.9	(75.2-76.5)
Current alcohol use				
Yes	79.6	(78.7-80.5)		(omitted from model) [†]
No	71.1 [‡]	(70.3-71.9)		(omitted from model) [†]
Current cigarette smoker				
Yes	64.4	(62.7-66.0)	71.6	(70.3-72.9)
No	76.8 [‡]	(76.2-77.4)	76.7 [‡]	(76.1-77.4)

*Weighted population estimates adjusted for age. Women who responded "don't know" or "not sure" or who refused are excluded. The numbers of participants vary somewhat due to missing data.

[†]Adjusted for age, race/ethnicity, marital status, education, number of children in household, number of persons in household, employment status, general health status, physician visit within past year, health insurance coverage, blood pressure check in past 2 years, cholesterol check in past 2 years, weight, diabetes, and cigarette smoking. Household income, physical activity, and alcohol use were omitted from the multivariate model because of missing data.

[‡]P < .001.

[§]P < .05.

[‡]Excludes women who had had a hysterectomy.

[¶]Excludes women less than 50 years of age.

[#]Data on physical activity were only available for respondents in Georgia, Hawaii, Illinois, Michigan, Nebraska, New Mexico, Ohio, Oklahoma, Tennessee, Utah, and Virginia (n = 10,381).

Table 2.

Percentage of Women Aged 18 Years or Older Who Had Received a Pap Test in the Past 3 Years, According to Selected Demographic Characteristics and Screening Practices, Behavioral Risk Factor Surveillance System, 1999*

	Age-adjusted (n = 69,113)		Multivariate-adjusted [†] (n = 60,479)	
	%	95% Confidence Interval (%)	%	95% Confidence Interval (%)
Age (years)				
18-29	85.3	(84.3-86.3)	89.3	(88.5-90.1)
30-39	90.0	(89.3-90.8)	88.7	(87.9-89.6)
40-49	88.5	(87.7-89.4)	87.4	(86.5-88.4)
50-64	86.2	(85.1-87.2)	85.4	(84.3-86.5)
≥ 65	72.2	(70.7-73.7)	77.0 [‡]	(74.9-79.1)
Race/ethnicity				
White	85.0	(84.5-85.5)	85.7	(85.2-86.2)
Black	86.1	(84.6-87.7)	88.8	(87.7-90.0)
Hispanic	81.5	(79.3-83.8)	88.8	(87.6-89.9)
Asian and Pacific Islander	78.3	(73.5-83.0)	83.2	(80.4-86.0)
American Indian and Alaska Native	76.3	(69.6-83.0)	83.6	(80.0-87.2)
Other	73.4 [‡]	(66.0-80.8)	79.2 [‡]	(72.2-86.2)
Marital Status				
Currently married	88.7	(88.1-89.3)	89.2	(88.6-89.3)
Divorced or separated	83.6	(82.1-85.1)	86.7	(85.6-87.8)
Widowed	82.1	(79.8-84.4)	84.1	(82.6-85.5)
Never married	77.2 [‡]	(75.2-79.3)	81.7 [‡]	(80.0-82.3)
Educational attainment				
< High school graduate	74.5	(72.7-76.2)	84.5	(83.4-85.6)
High school graduate/GED	83.3	(82.5-84.1)	86.0	(85.3-86.7)
Some college or technical school	86.1	(85.2-87.0)	86.6	(85.8-87.4)
College graduate	89.7 [‡]	(88.8-90.5)	88.1 [‡]	(87.3-88.9)
Household income				
< \$15,000	75.1	(73.5-76.8)		(omitted from model) [†]
\$15,000-\$34,999	82.3	(81.4-83.2)		(omitted from model) [†]
≥ \$35,000	89.9	(89.0-90.7)		(omitted from model) [†]
Missing data	81.7 [‡]	(80.6-82.9)		(omitted from model) [†]
Employment status				
Currently employed	85.5	(84.4-86.6)	86.2	(85.6-86.9)
Homemaker or retired	85.1	(84.2-85.9)	86.4	(85.6-87.3)
Unemployed	79.2	(74.9-83.5)	87.5	(85.8-89.2)

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	Age-adjusted (n = 56,528)		Multivariate-adjusted [†] (n = 49,564)	
	%	95% Confidence Interval (%)	%	95% Confidence Interval (%)
Unable to work	79.0 [‡]	(76.0-82.0)	86.5	(84.3-88.7)
Number of children in household				
0	83.2	(82.5-83.8)	84.4	(83.5-85.3)
1	83.1	(80.1-86.2)	88.3	(87.3-89.3)
2	84.8	(81.3-88.4)	88.8	(87.6-90.0)
3 or more	79.9 [‡]	(72.5-87.4)	89.4 [‡]	(88.0-90.7)
Number of persons in household				
1	82.7	(81.7-83.7)	88.8	(87.9-89.7)
2	86.1	(85.3-86.8)	87.2	(74.7-76.7)
3	85.2	(83.6-86.7)	86.4	(85.4-87.4)
4 or more	81.3 [‡]	(78.9-83.7)	83.9 [‡]	(74.9-78.6)
General health status				
Good to excellent	85.2	(84.7-85.7)	86.5	(86.0-87.0)
Fair or poor	79.8 [‡]	(78.3-81.3)	85.7	(84.7-86.8)
Saw physician within past year				
Yes	90.4	(89.9-90.8)	88.5	(87.9-89.0)
No	64.6 [‡]	(63.2-66.0)	82.6 [‡]	(81.7-83.4)
Health insurance coverage				
Yes	86.6	(86.2-87.1)	86.7	(86.2-87.2)
No	66.8 [‡]	(64.0-69.7)	85.0 [§]	(84.0-86.0)
Mammogram in past 2 years[†]				
Yes	94.4	(93.9-94.8)		(omitted from model) [†]
No	49.4 [‡]	(47.8-51.0)		(omitted from model) [†]
Clinical breast exam in past 2 years[†]				
Yes	95.4	(95.1-95.7)	95.2	(94.8-95.5)
No	48.2 [‡]	(46.8-49.6)	63.4 [‡]	(62.0-64.9)
Blood stool test in past year[¶]				
Yes	93.8	(92.7-94.9)		(omitted from model) [†]
No	74.8 [‡]	(73.7-75.9)		(omitted from model) [†]
Blood pressure check in past 2 years				
Yes	86.9	(86.4-87.3)	87.1	(86.6-87.6)
No	30.2 [‡]	(27.2-33.2)	78.3 [‡]	(76.3-80.3)
Cholesterol check in past 2 years				
Yes	90.5	(90.0-90.9)	87.9	(87.3-88.6)

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	Age-adjusted (n = 56,528)		Multivariate-adjusted [†] (n = 49,564)	
	%	95% Confidence Interval (%)	%	95% Confidence Interval (%)
No	69.2 [‡]	(68.0-70.4)	84.6 [‡]	(83.9-85.3)
Weight				
Underweight	77.7	(74.7-80.8)	83.7	(81.8-85.7)
Normal weight	85.4	(84.7-86.0)	86.7	(86.1-87.3)
Overweight	85.5	(84.6-86.4)	86.5	(85.7-87.2)
Obese	83.9 [‡]	(82.7-85.1)	85.9 [#]	(84.9-86.8)
Physical activity**				
Physically inactive	80.8	(78.7-82.8)		(omitted from model) [†]
Irregular activity	86.5	(84.7-88.3)		(omitted from model) [†]
Regular activity	85.6	(83.6-87.5)		(omitted from model) [†]
Regular and vigorous activity	87.6 [‡]	(85.1-90.0)		(omitted from model) [†]
Diabetes				
Yes	82.6	(79.7-85.6)	84.9	(83.0-86.8)
No	84.5	(84.0-85.0)	86.4	(86.0-86.9)
Current alcohol use				
Yes	87.6	(86.9-88.3)		(omitted from model) [†]
No	81.8 [‡]	(81.1-82.5)		(omitted from model) [†]
Current cigarette smoker				
Yes	79.6	(78.3-81.0)	86.7	(85.8-87.5)
No	85.4 [‡]	(84.8-85.9)	86.3	(85.7-86.8)

*Weighted population estimates adjusted for age; women who responded "don't know" or "not sure" or who refused are excluded along with those who had had a hysterectomy.

[†]Adjusted for age, weight, race/ethnicity, marital status, education, number of children in household, employment status, general health status, physician visit within past year, health insurance coverage, blood pressure check in past 2 years, cholesterol check in past 2 years, diabetes, and cigarette smoking. Household income, physical activity, and alcohol use were omitted from the multivariate model because of missing data. Number of children in household was included in the model instead of number of persons in household to avoid problems with colinearity.

[‡]P < .001.

[§]P < .01.

[†]Excludes women less than 40 years of age.

[#]Excludes women less than 50 years of age.

[#]P < .05.

**Data on physical activity were only available for respondents in Georgia, Hawaii, Illinois, Michigan, Nebraska, New Mexico, Ohio, Oklahoma, Tennessee, Utah, and Virginia (n = 12,600).

Table 3.
Percentage of Women Aged 40 Years or Older Who Had Received a Mammogram in the Past 2 Years, According to Health Behaviors Associated With Chronic Disease Risk, Behavioral Risk Factor Surveillance System, 1999*

	Age-adjusted		Multivariate-adjusted [†]	
	%	95% Confidence Interval (%)	%	95% Confidence Interval (%)
Behaviors That Serve to Detect Disease or Reduce the Possibility of Future Disease	(n = 53,814)		(n = 50,041)	
Cholesterol check in past 2 years, blood pressure check in past 2 years, and no current cigarette smoking	83.6	(82.9-84.2)	81.7	(80.9-82.4)
Cholesterol check in past 2 years, blood pressure check in past 2 years, but current cigarette smoker	76.0	(74.3-77.7)	75.8	(74.1-77.4)
No cholesterol check in past 2 years, no blood pressure check in past 2 years, and current cigarette smoker	6.5	(2.6-10.5)	22.5	(12.9-32.1)
Health Maintenance Behavior[‡]	(n = 9831)		(n = 8796)	
Normal weight and physically active	77.6	(74.9-80.3)	75.5	(72.6-78.5)
Normal weight but physically inactive	68.8	(64.8-72.8)	75.1	(71.4-78.8)
Physically active but obese	70.0	(64.6-75.4)	72.2	(67.5-76.8)
Obese and physically inactive	69.0	(64.5-73.5)	73.7	(69.2-78.1)

*Weighted population estimates adjusted for age; women who responded "don't know" or "not sure" or who refused are excluded.

[†]Adjusted for age, race/ethnicity, marital status, education, number of children in household, number of persons in household, employment status, general health status, physician visit within past year, health insurance coverage, weight, and diabetes. Household income, physical activity, and alcohol use were omitted from the multivariate model because of missing data.

[‡]Data on physical activity were only available for respondents in Georgia, Hawaii, Illinois, Michigan, Nebraska, New Mexico, Ohio, Oklahoma, Tennessee, Utah, and Virginia.

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Table 4.

Percentage of Women Aged 18 Years or Older Who Had Received a Pap Test in the Past 3 Years, According to Health Behaviors Associated With Chronic Disease Risk, Behavioral Risk Factor Surveillance System, 1999*

	Age-adjusted		Multivariate-adjusted	
	%	95% Confidence Interval (%)	%	95% Confidence Interval (%)
Behaviors That Serve to Detect Disease or Reduce the Possibility of Future Disease	(n = 65,193)		(n = 60,761)	
Cholesterol check in past 2 years, blood pressure check in past 2 years, and no current cigarette smoking	90.8	(90.3-91.4)	90.7	(90.1-91.3) [†]
Cholesterol check in past 2 years, blood pressure check in past 2 years, but current cigarette smoker	89.0	(87.6-90.5)	89.8	(88.6-91.1) [†]
No cholesterol check in past 2 years, no blood pressure check in past 2 years, and current cigarette smoker	25.1	(19.2-31.0)	54.5	(48.6-60.5) [†]
Health Maintenance Behavior[‡]	(n = 12,004)		(n = 10,547)	
Normal weight and physically active	87.0	(84.9-89.0)	86.4	(84.4-88.4) [§]
Normal weight but physically inactive	80.0	(76.6-83.4)	86.5	(83.7-89.4) [§]
Physically active but obese	83.9	(79.5-88.3)	85.5	(81.9-89.2) [§]
Obese and physically inactive	83.6	(79.8-87.4)	86.5	(83.4-89.5) [§]

*Weighted population estimates adjusted for age; women who responded "don't know" or "not sure" or who refused are excluded.

[†]Adjusted for age, race/ethnicity, marital status, education, number of children in household, number of persons in household, employment status, general health status, physician visit within past year, health insurance coverage, weight, and diabetes. Household income, physical activity, and alcohol use were omitted from the multivariate model because of missing data.

[‡]Data on physical activity were only available for respondents in Georgia, Hawaii, Illinois, Michigan, Nebraska, New Mexico, Ohio, Oklahoma, Tennessee, Utah, and Virginia.

[§]Adjusted for age, race/ethnicity, marital status, education, number of children in household, number of persons in household, employment status, general health status, physician visit within past year, health insurance coverage, blood pressure check in past 2 years, cholesterol check in past 2 years, diabetes, and cigarette smoking. Household income and alcohol use were omitted from the multivariate model because of missing data.