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Cancer Screening in Women: BMI and Adherence to Physician Recommendations

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Abstract

Objectives—Reasons obese women are less likely to obtain mammograms and Pap smears are poorly understood. This study evaluated associations between body mass index (BMI) and receipt of and adherence to physician recommendations for mammography and Pap smear.

Methods—Data from the 2000 National Health Interview Survey (8289 women aged 40–74 years) were analyzed in 2006 using logistic regression. Women with prior hysterectomy were excluded from Pap smear analyses ($n=5521$). Outcome measures were being up-to-date with screening, receipt of physician recommendations, and women's adherence to physician recommendations for mammography and Pap smear.

Results—After adjusting for sociodemographic variables, health care access, health behaviors, and comorbidity, severely obese women ($\text{BMI} \geq 40 \text{ kg/m}^2$) were less likely to have mammography within 2 years (OR 0.50; 95% CI 0.37, 0.68) and Pap smear within 3 years (OR, 0.43; 95% CI, 0.27, 0.70). Obese women were as likely as normal weight women to receive physician recommendations for mammography and Pap smear. Severely obese women were less likely to adhere to physician recommendation for mammography (OR 0.49; 95% CI, 0.32–0.76). Women in all obese categories ($\text{BMI} \geq 30 \text{ kg/m}^2$) were less likely to adhere to physician recommendation for Pap smear (OR's ranged 0.17–0.28; $p < 0.001$).

Conclusions—Obese women are less likely to adhere to physician recommendations for breast and cervical cancer screening. Interventions focusing solely on increasing physician recommendations for mammography and Pap smears will probably be insufficient for obese women. Additional strategies are needed to make cancer screening more acceptable for this high-risk group.

Introduction

The prevalence of obesity, defined as body mass index ($\text{BMI} \geq 30 \text{ kg/m}^2$), among US adults has increased from 23% during 1988–1994 to 32% during 2003–2004. In addition, the

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prevalence of severe obesity ($\text{BMI} \geq 40 \text{ kg/m}^2$) increased from about 1 in 35 adult Americans to 1 in 20.^{1, 2} Obesity is associated with increased incidence of breast and cervical cancer,^{3, 4} later stage breast cancer diagnosis,⁵⁻⁸ and higher breast and cervical cancer mortality rates.^{9, 10}

Obese women, particularly those with $\text{BMI} > 35\text{--}40$, have lower rates of mammograms and Pap smears.¹¹⁻¹⁸ One of the strongest and most consistent predictors of cancer screening is a physician's recommendation.¹⁹⁻²¹ It is unclear if the lower rates of cancer screening in obese women are due to lack of physician recommendations or patients not adhering to physician recommendations. Factors associated with physician recommendations for mammography include having private insurance, higher income, higher education, younger age, greater number of visits, a regular physician, greater number of physicians seen, personal history of breast problems, a recent Pap smear, and taking medications.²²⁻²⁴ Factors associated with physician recommendations for Pap smear include younger age, being born in the US, and having contact with a specialist or general doctor in the past year.²⁵ It is unknown if physicians are less likely to recommend mammogram or Pap smears to obese women. Obese patients are stereotyped to have less willpower and be less concerned about their health than non-obese patients.^{26, 27} Physicians may subconsciously feel obese patients are less interested in preventive care, and thus be less likely to suggest cancer screening. Increasing BMI is associated with a greater number of different physicians seen,²⁸ so that physicians may assume that someone else will order cancer screening. In addition, physicians may be less likely to pursue pelvic examinations in severely obese patients due to technical difficulties or increased comorbidity.^{29, 30}

The degree to which obese women adhere to physician's recommendations for breast and cervical cancer screening is also unknown. Factors associated with adherence to mammography recommendation are having private insurance, being seen in family practice, and having a recent Pap smear.²² There are no studies exploring the relationship between BMI and adherence to doctors' recommendations for mammography or Pap smear. The purpose of this study is to determine if BMI is associated with receipt of and adherence to physician recommendations for mammography and Pap smear.

Methods

Study Population

This study, conducted in 2006, analyzed data collected from the 2000 National Health Interview Survey (NHIS), a cross-sectional in-person health survey conducted annually by the National Center for Health Statistics, Centers of Disease Control and Prevention (CDC).³¹ It uses a multistage, stratified, clustered sampling design to obtain health-related information of the U.S. population. In 2000, one adult, randomly selected from each of 43,437 households, answered a supplemental Cancer Control Module that fielded a number of questions relating to cancer screening ($n=32,374$). The response rate was 72% to the supplement and core surveys.³¹

Women age 40–74 years who responded to the Cancer Control supplement ($n=8289$) were included in this analysis. Women under the age of 40 were excluded because breast cancer screening is not recommended in women under age 40, and women under 40 tend to get Pap smear screening as part of their reproductive care, so obesity may not be as great a barrier to Pap smear screening in those younger than age 40. Women age 75 and over were excluded because physician agreement of screening tests in those over 74 years is not universal.³² Women who had hysterectomies were excluded from Pap smear outcomes. The Institutional Review Board of the University of Medicine and Dentistry of New Jersey-New Jersey Medical School approved the use of the NHIS database.

Outcome Measures

The outcome measures were: up-to-date in screening, physician recommendation, and patient adherence to physician recommendations. Up-to-date in screening was defined as the proportion of all respondents who had a clinical breast exam (CBE) within 2 years, mammogram within 2 years, or Pap smear within 3 years.^{33, 34} Physician recommendation was defined as the proportion of all women who received a recommendation to have mammogram or Pap smear. All women who received screening were assumed to have physician recommendations.^{22, 35} Women who didn't receive mammogram or Pap smears were asked the primary reason for not having the test. Women reporting a primary reason other than "doctor didn't recommend it" were asked whether their doctor recommended a mammogram or Pap smear in the last 12 months. Women were classified as not receiving a physician recommendation if they reported their "doctor didn't recommend it" as the primary reason, or they answered the follow-up question that they did not have a physician recommendation. Women who did not see a physician in the past year were excluded from the outcome of physician recommendation. Patient adherence to physician recommendations was defined as the proportion of women receiving physician recommendations who had a mammogram within 2 years or Pap smear within 3 years.

Independent Variables

The main independent variable of interest was BMI, defined as self-reported body weight (in kilograms) divided by self-reported height (in meters squared) at NHIS interview. Underweight women (BMI < 18.5) were excluded because they have lower rates of mammography and Pap smears, perhaps due to severe illness ($n=505$).¹³ Potential confounding variables included sociodemographics (age, race/ethnicity, marital status, educational level, region of country, income), access to care (health insurance, contact with primary care doctor, number of visits), health behaviors (smoking, exercise, alcohol use, vitamin use), and health risks (family history of breast or cervical cancer, comorbidity). Comorbidity was determined using the Charlson comorbidity index, a weighted index of 19 selected categories of disease that are associated with mortality and other important health outcomes.³⁶

Statistical Analysis

Using descriptive statistics and bivariable analyses, the sample was characterized based on published definitions of BMI categories: normal weight (18.5 to <25 kg/m²), overweight (25 to <30 kg/m²), obese class I (30 to <35 kg/m²), obese class II (35 to <40 kg/m²), and obese class III (≥ 40 kg/m²).³⁷ Prevalence of being up-to-date in screening, physician recommendation, and patient adherence to physician recommendation by BMI were compared using the chi-square test. A series of multivariable logistic regression models were built for each separate outcome: up-to-date in CBE, mammography, and Pap smear; physician recommendation for mammography and Pap smear; and patient adherence to mammography and Pap smear recommendations. First, an unadjusted model was developed that included only categories of BMI as the independent variable. Then, a fully adjusted model controlled for potential confounders. This full model was compared to a reduced model that used a backwards elimination variable selection procedure. Variables significantly associated with each outcome at the $p<0.10$ level were retained in this reduced model. Indicator variables for BMI were forced into the reduced model. Since there was no significant difference in the full and reduced models, the reduced models are presented for greater parsimony. Because authorities now recommend stopping Pap smears at age 65 if consistently normal,³⁴ analyses for all Pap models were repeated with only age group 40-64. Results were similar, so results for the whole sample are presented.

All analyses used SAS-callable SUDAAN (version 9.0, Research Triangle Institute, Research Triangle Park, North Carolina, 2005) to adjust for the complex sampling design. Results were

weighted to reflect the oversampling of African-Americans and Hispanics, the nonresponse rate, and population estimates from the U.S. Census. Adjusted odds ratios (ORs) and 95% confidence intervals were calculated. Statistical significance was set at $p < 0.05$.

Results

Table 1 shows the characteristics of women in the study sample by BMI categories. Overall, 42% were normal weight, 32% were overweight, and 26% were obese. Increasing BMI was significantly associated with age, Black race, lower education, lower incomes, Medicaid insurance, contact with a primary care doctor, greater number of visits, and higher number of comorbidities.

Table 2 shows unadjusted associations among BMI categories and each outcome. There were significant differences across BMI categories for all outcomes except physician recommendation for Pap smear. Rates were lowest for severely obese women for all outcomes. Compared with normal weight women, severely obese women had 9% to 10% lower prevalence of being up-to-date in clinical breast exams (69% vs. 78%), mammography (62% vs. 72%), and Pap smears (77% vs. 86%).

Table 3 shows adjusted results for each primary outcome by BMI categories from the reduced multivariate models. Compared with normal weight women, women in all obese categories were less likely to be up-to-date with CBE. Women in the severely obese category had 50% decreased odds of being up-to-date with mammogram and 57% decreased odds of being up-to-date with Pap smear. Although there was a significant difference across BMI categories for physician recommendation for mammograms in the unadjusted model, controlling for sociodemographics, insurance, health behaviors, and comorbidity eliminated this difference. Likewise, BMI was not statistically associated with physician recommendations for Pap smear. Severely obese women had 51% decreased odds of adhering to physician recommendations for mammogram. Women in all obese categories were less likely to adhere to physician recommendations for Pap smear.

Discussion

This study suggests that patient barriers are more important than physician barriers for decreased rates of Pap smears and mammograms in obese women, particularly severely obese women. Since physician recommendation is the strongest predictor of cancer screening in women, it is reassuring that physicians are as likely to recommend mammograms and Pap smears to obese as well as non-obese women. The lower prevalence of breast and cervical cancer screening in severely obese women is not due to lack of physician recommendations, but rather to lower adherence to physician recommendations.

Despite the success of the CDC's Breast and Cervical Cancer Early Detection Program in increasing screening in poor and minority women,³⁸ screening disparities still exist for another high-risk group: severely obese women. The reasons for this are unclear. Cancer screening may be a low priority for an obese woman in the context of other personal and family health priorities.³⁹ Obese women have greater economic and health burdens due to higher poverty, greater number of comorbid conditions, and greater need for physician visits.^{40, 41} However, after adjustment for income, comorbidity, and number of physician visits, associations between BMI, screening, and adherence to physician recommendations did not alter. Obese women have greater number of physician visits so they should have more opportunities for cancer screening. Instead, this study shows that despite obese patients having more visits to the physician, they were less likely to have mammograms and Pap smears. Obese persons have more contacts with primary care physicians and see physicians more frequently, presumably

to manage chronic conditions, but they might postpone preventive exams that do not address specific symptoms or present illnesses.

Another cause for disparities in cancer screening in obese women may be patient and clinician attitudes. Increasing weight has been associated with having negative opinions about one's appearance and reluctance to obtain pelvic examinations.^{29, 42} Obese women may have higher anxiety regarding physical privacy, embarrassment regarding weight, and perceptions of increased pain and discomfort from the procedures.⁴³⁻⁴⁵ In addition, obese women may delay preventive exams because they encounter negative attitudes or judgmental behavior from health professionals, they do not want to be weighed, or they do not want to receive lectures regarding weight.^{42, 46-48} Improving patient-physician relationships and interactions are needed to overcome these barriers.

There appears to be a "threshold effect" in the association of BMI with being up-to-date on mammography and adherence to physician recommendation for mammography. Only the most severely obese women had decreased odds of being up-to-date and adhering to physician recommendations for mammograms, while women in all obese categories were less likely to be up-to-date in CBE and adherent to recommendations for Pap smear. Clinical breast exams and Pap smears require disrobing in physician offices and being physically examined by physicians, so they may be considered to be more personally invasive and uncomfortable than obtaining a mammogram. Prior experience of pain and discomfort with procedures may dissuade obese women from obtaining cancer screenings.⁴² In addition, health care facilities may not be equipped for examining severely obese patients. Small size gowns, exam tables, and small speculums are barriers for obese women in receiving preventive health care.⁴²

Although rates for mammography and Pap smears for normal weight and less obese women are near Healthy People 2010 targets of 70% for mammograms and 90% for Pap smears,⁴⁹ rates for severely obese women lag behind (62.3% and 76.9%, respectively). While absolute differences of 9% to 10% in proportion of women receiving screening between severely obese and normal weight women may appear small, these findings are concerning given the increasing epidemic of severe obesity in the US^{1, 2} and the higher mortality rates for breast and cervical cancer in obese women.^{9, 10} To reach Healthy People 2010 objectives of reducing death rates from breast and cervical cancer, and increasing proportions of women receiving mammograms and Pap smears, targeting high-risk severely obese women to increase adherence to physician recommendations is needed.

This study has several limitations. All information were derived from self-report data. Concordance between self-reported data on cancer screening and medical record documentation has been found to be satisfactory for purposes of monitoring national level and trends in usage.⁵⁰⁻⁵³ A woman's recall of physician recommendation may be biased, but it is unlikely that reporting errors would differ across BMI categories. Additionally, patients may be subject to recall bias when reporting weight and height, with obese women overestimating height and underestimating weight more than thinner women.⁵⁴ This would decrease the ability to detect differences across BMI, so these results may underestimate true associations. Women who were up-to-date on screening were assumed to have received recommendations from their physicians, so women who self-referred for screening may have been misclassified. However, few women get mammograms without a recommendation.^{55, 56} Self-referral is more common at mobile mammography facilities and in women under age 40.⁵⁵ This sample population consisted of women over age 40, and only 2.29% ($n=153$) reported receiving screening in a mammogram van. Finally, it was not possible to control for all confounders or explanatory factors such as patients' health beliefs or attitudes, physician characteristics, or the nature of patient-physician relationships, which may influence cancer screening and adherence to screening recommendations.

In summary, this study shows physicians are as likely to recommend breast and cervical cancer screening to obese women as to non-obese women, but obese women are less likely to adhere to physician recommendations. Despite the critical role of physician recommendations in increasing cancer screening, interventions focusing solely on increasing physician recommendations of mammography and Pap smears will probably be insufficient for obese women. Qualitative studies are needed to examine specific barriers encountered by obese women to understand their reluctance to adhere to physician recommendations for mammograms and Pap smears. Research is needed on strategies to improve the clinician-patient interaction, how this dialogue can be modified when discussing cancer screening in obese women, and how medical facilities can be enhanced to better accommodate severely obese patients. In addition, follow-up is needed with patients once they are given advice to undergo cancer screening to ensure compliance. Since obese women are more likely to develop and die from breast and cervical cancer, additional strategies are needed to make cancer screening more acceptable for this high-risk group.

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Table 1

Characteristics of women in the study sample by BMI categories

[[Characteristic]]	[[Normal Weight]] [[BMI 18-24.9]]	[[Overweight]] [[BMI 25-29.9]]	[[Obese I]] [[BMI 30-34.9]]	[[Obese II]] [[BMI 35-39.9]]	[[Obese III]] [[BMI ≥ 40]]
[[Number of respondents]]	[[3,341]]	[[2,677]]	[[1,366]]	[[539]]	[[366]]
[[Estimated population size]]	[[20,141,927]]	[[15,534,164]]	[[7,564,252]]	[[2,987,242]]	[[1,822,053]]
Portion of weighted sample, %	[[41.9]]	[[32.3]]	[[15.7]]	[[6.2]]	[[3.8]]
Portion of weighted sample, %	[[41.9]]	[[32.3]]	[[15.7]]	[[6.2]]	[[3.8]]
[[Age]]	[[41.9]]	[[32.3]]	[[15.7]]	[[6.2]]	[[3.8]]
[[40-49]]	[[47.1]]	[[29.2]]	[[13.3]]	[[6.5]]	[[3.8]]
[[50-64]]	[[38.0]]	[[34.3]]	[[17.4]]	[[6.2]]	[[4.1]]
[[65-74]]	[[39.0]]	[[34.9]]	[[17.5]]	[[5.6]]	[[3.0]]
[[Race/ethnicity]]	[[31.3]]	[[38.2]]	[[19.0]]	[[7.1]]	[[4.4]]
[[Hispanic]]	[[31.3]]	[[38.2]]	[[19.0]]	[[7.1]]	[[4.4]]
[[White (non-Hispanic)]]	[[45.0]]	[[31.7]]	[[14.5]]	[[5.7]]	[[3.2]]
[[Black (non-Hispanic)]]	[[25.8]]	[[33.7]]	[[22.6]]	[[8.1]]	[[9.8]]
[[Other (non-Hispanic)]]	[[53.6]]	[[26.2]]	[[13.8]]	[[4.8]]	[[1.7]]
[[Educational level]]	[[31.1]]	[[34.6]]	[[20.1]]	[[9.1]]	[[5.2]]
[[High School or less]]	[[40.0]]	[[33.6]]	[[16.8]]	[[5.9]]	[[3.8]]
[[High school completed]]	[[41.7]]	[[32.0]]	[[15.0]]	[[7.3]]	[[4.0]]
[[Some college]]	[[53.1]]	[[29.5]]	[[11.9]]	[[3.0]]	[[2.5]]
[[College or greater]]	[[53.1]]	[[29.5]]	[[11.9]]	[[3.0]]	[[2.5]]
[[Income]]	[[34.3]]	[[31.2]]	[[19.4]]	[[9.1]]	[[6.1]]
[[Less than \$20,000]]	[[43.7]]	[[32.8]]	[[14.8]]	[[5.6]]	[[3.2]]
[[\$20,000 or greater]]	[[37.5]]	[[33.1]]	[[18.5]]	[[6.7]]	[[4.3]]
[[Health insurance]]	[[37.5]]	[[33.1]]	[[18.5]]	[[6.7]]	[[4.3]]
[[Medicare]]	[[26.9]]	[[33.7]]	[[20.3]]	[[9.4]]	[[9.9]]
[[Medicaid]]	[[44.9]]	[[31.8]]	[[14.3]]	[[5.8]]	[[3.3]]
[[Private]]	[[36.8]]	[[38.7]]	[[14.4]]	[[7.3]]	[[2.8]]
[[Other]]	[[38.8]]	[[33.0]]	[[17.4]]	[[6.8]]	[[4.0]]
[[Not covered]]	[[39.3]]	[[33.0]]	[[16.6]]	[[6.8]]	[[4.2]]
[[Contact with primary care doctor]]	[[49.2]]	[[30.8]]	[[13.1]]	[[4.5]]	[[2.5]]
[[Yes]]	[[49.2]]	[[30.8]]	[[13.1]]	[[4.5]]	[[2.5]]
[[No]]	[[49.2]]	[[30.8]]	[[13.1]]	[[4.5]]	[[2.5]]
[[Number of visits]]	[[49.7]]	[[31.7]]	[[13.4]]	[[3.4]]	[[1.8]]
[[0-1]]	[[42.6]]	[[33.0]]	[[14.9]]	[[6.3]]	[[3.3]]
[[2-5]]	[[34.4]]	[[32.3]]	[[18.8]]	[[8.3]]	[[6.1]]
[[Greater than 5 times]]	[[47.3]]	[[32.4]]	[[13.8]]	[[4.2]]	[[2.4]]
[[Comorbidity index]]	[[34.4]]	[[33.2]]	[[18.4]]	[[8.7]]	[[5.3]]
[[0]]	[[33.5]]	[[34.7]]	[[19.3]]	[[7.8]]	[[4.8]]
[[1]]	[[27.3]]	[[29.1]]	[[21.1]]	[[13.0]]	[[9.6]]
[[2]]					
[[≥3]]					

*
p < 0.001

BMI (body mass index)

Table 2 Unadjusted prevalence of screening, physician recommendation, and patient adherence to physician recommendation by BMI category

	[[Total]]	[[Total]]	[[Normal weight]]	[[Overweight]]	[[Obese I]]	[[Obese II]]	[[Obese III]]	p value
[[Total]]	[[Total]]	[[Total]]	[[BMI 18-24.9]] [*]	[[BMI 25-29.9]] [*]	[[BMI 30-34.9]] [*]	[[BMI 35-39.9]] [*]	[[BMI ≥ 40]] [*]	[[Total]]
[[Total]]	[[Total]]	[[Total]]	[[Total]]	[[Total]]	[[Total]]	[[Total]]	[[Total]]	[[Total]]
Up-to-date in clinical breast exam (within 2 years)	[[7836]]	[[76.3]]	[[77.5]]	[[76.9]]	[[75.7]]	[[70.8]]	[[68.6]]	[[0.0030]]
Up-to-date in mammogram (within 2 years)	[[7857]]	[[72.1]]	[[72.0]]	[[72.9]]	[[74.1]]	[[69.5]]	[[62.3]]	[[0.0084]]
Up-to-date in Pap smear (within 3 years)	[[5447]]	[[84.9]]	[[86.3]]	[[84.9]]	[[83.3]]	[[84.1]]	[[76.9]]	[[0.0155]]
[[Physician recommended mammogram]]	[[7291]]	[[83.6]]	[[83.2]]	[[84.7]]	[[85.4]]	[[80.0]]	[[77.1]]	[[0.0127]]
[[Physician recommended Pap]]	[[5129]]	[[91.6]]	[[92.3]]	[[91.8]]	[[90.8]]	[[91.4]]	[[86.1]]	[[0.1824]]
Adherence to mammogram recommendation	[[6042]]	[[92.5]]	[[93.2]]	[[92.8]]	[[92.3]]	[[91.1]]	[[84.6]]	[[0.0114]]
Adherence to Pap recommendation	[[4652]]	[[98.1]]	[[99.1]]	[[98.2]]	[[96.5]]	[[95.4]]	[[94.5]]	[[0.0002]]

* portion of weighted sample

BMI (body mass index)

Table 3
Adjusted odds ratios (OR) for screening, physician recommendation, and patient adherence to physician recommendation by BMI*

	[[Total N]]	[[Normal weight]] [[BMI 18-24.9]] [[OR]] [[p value]]	[[Overweight]] [[BMI 25-29.9]] [[OR (95% CI)]] [[p value]]	[[Obese I]] [[BMI 30-34.9]] [[OR (95% CI)]] [[p value]]	[[Obese II]] [[BMI 35-39.9]] [[OR (95% CI)]] [[p value]]	[[Obese III]] [[BMI ≥ 40]] [[OR (95% CI)]] [[p value]]
Up-to-date in clinical breast exam (within 2 years) ^d	[[4849]]	[[1.00]]	[[0.96 (0.79-1.17)]]	0.75 (0.59-0.96)	0.55 (0.38-0.78)	0.58 (0.38-0.88)
Up-to-date in mammogram (within 2 years) ^e	[[7544]]	[[1.00]]	[[0.7033]] [[0.95 (0.81-1.10)]]	0.0232 [[1.01 (0.83-1.23)]]	0.0008 [[0.79 (0.60-1.05)]]	0.0110 0.50 (0.37-0.68)
Up-to-date in Pap smear (within 3 years) ^f	[[3590]]	[[1.00]]	[[0.4763]] [[0.97 (0.74-1.27)]]	[[0.8978]] 0.65 (0.44-0.97)	[[0.1042]] [[0.73 (0.44-1.22)]]	<0.0001 0.43 (0.27-0.70)
Physician recommended mammogram ^d	[[4549]]	[[1.00]]	[[0.8235]] [[1.14 (0.90-1.44)]]	0.0344 [[1.07 (0.78-1.46)]]	[[0.2258]] [[0.91 (0.60-1.37)]]	0.0006 [[0.73 (0.44-1.19)]]
Physician recommended Pap ^e	[[3414]]	[[1.00]]	[[0.2658]] [[1.12 (0.80-1.58)]]	[[0.6724]] [[1.00 (0.62-1.63)]]	[[0.6438]] [[1.43 (0.67-3.07)]]	[[0.2067]] [[0.74 (0.40-1.34)]]
Adherence to mammogram recommendation ^f	[[5911]]	[[1.00]]	[[0.4981]] [[0.95 (0.72-1.25)]]	[[0.9921]] [[0.90 (0.63-1.30)]]	[[0.3589]] [[0.87 (0.55-1.38)]]	[[0.3172]] 0.49 (0.32-0.76)
Adherence to Pap recommendation ^g	[[4518]]	[[1.00]]	[[0.7076]] 0.52 (0.27-0.98)	[[0.5860]] 0.28 (0.13-0.59)	[[0.5590]] 0.21 (0.09-0.53)	0.0015 0.17 (0.07-0.39)
	[[1111]]	[[1111]]	0.0431	0.0009	0.0010	<0.0001

* Adjusted for:

^a race/ethnicity, education, marital status, income, region of country, insurance status, contact with primary care doctor, number of visits, smoking, alcohol, exercise, vitamin use, comorbidity

^b age, race/ethnicity, education, marital status, insurance status, contact with primary care doctor, number of visits, smoking, vitamin use, family history of breast cancer

^c age, race/ethnicity, education, marital status, income, region of country, insurance status, contact with primary care doctor, number of visits, smoking, alcohol, vitamin use

^d age, race/ethnicity, income, insurance status, smoking, alcohol, exercise, vitamin use, comorbidity

^e age, race/ethnicity, education, marital status, income, insurance status, alcohol, vitamin use

^f age, education, marital status, insurance status, smoking, family history of breast cancer

^g race/ethnicity, insurance status, vitamin use

BMI, body mass index