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Associations Between Obesity and Receipt of Screening Mammography, Papanicolaou Tests, and Influenza Vaccination: Results from the Health and Retirement Study (HRS) and the Asset and Health Dynamics Among the Oldest Old (AHEAD) Study

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Objectives. Obese Americans, who receive more care for chronic diseases, may receive fewer preventive services. We evaluated the association between body mass index (BMI) and receipt of screening mammography and Papanicolaou tests among middle-aged women and the association between BMI and receipt of influenza vaccination among the elderly.

Methods. We analyzed 2 datasets: the Health and Retirement Study (4439 women aged 50–61 years) and the Asset and Health Dynamics Among the Oldest Old (AHEAD) Study (4045 women and 2154 men aged 70 years or more).

Results. When BMI was greater than 18.5 kg/m^2, we found an inverse dose-response relationship between BMI and receipt of screening mammography and Pap tests among White, but not Black, middle-aged women. We found a similar association between BMI and influenza vaccination among the elderly.

Conclusions. Higher BMI was associated with less frequent receipt of preventive services among middle-aged White women and elderly White women and men. The Healthy People 2010 clinical preventive service goals remain elusive, especially for overweight and obese White persons. (*Am J Public Health.* 2005; 95:XXX–XXX. doi:10.2105/AJPH.2004.047803)

More than 60% of US adults are overweight or obese.[1] The role of obesity as a risk factor for morbidity and mortality is well-documented,[2–4] including its substantial economic costs.[5–7] In addition to health and economic burdens, obese persons experience important personal and social consequences.[8,9] They may pay higher premiums for life insurance, earn less income, and be less likely to be hired or promoted than non-obese persons.[6–9]

Little research has been carried out on the association between disparities in health care service use and body weight. Obese persons have more physician visits, receive more prescriptions, and incur more health care costs than non-obese persons.[5,10] However, there is evidence that obese persons receive *fewer* clinical preventive services.[11] In the 1994 National Health Interview Survey, fewer overweight and obese women (78%) compared with women of recommended weight (84%) had received cervical cancer screening during the previous 3 years; significantly lower rates also were seen for mammography screening among overweight and obese women aged 50 to 75 years.[12]

It is not clear whether similar patterns hold for preventive services among the elderly, who receive universal health coverage through Medicare. Epidemiological studies of influenza vaccination often do not consider obesity as a study variable, although a brief report on elderly persons in the 1987 Behavioral Risk Factor Surveillance System identified obesity as a predictor of not being vaccinated.[13] Additionally, obesity is more prevalent among Black persons than among White persons,[1] and there are racial disparities in access to and quality of health care services in general.[14] Therefore, we investigated whether the association between obesity and receipt of clinical preventive services is different among Black and White persons.

There is strong evidence that breast and cervical cancer screening is beneficial among middle-aged women and that influenza vaccination benefits the elderly.[15] Healthy People 2010[16] goals include (1) having 70% of middle-aged women receive mammograms every 2 years and 90% receive Papanicolaou (Pap) tests every 3 years, and (2) having 90% of the elderly immunized against influenza annually. There also is evidence that obese postmenopausal women are at increased risk for breast and cervical cancer and that they present with more advanced disease.[17,18] Similarly, obesity is associated with diabetes and chronic cardiopulmonary diseases, which are associated with increased morbidity and mortality from influenza.[19]

We evaluated the association between body mass index (BMI) and receipt of screening mammography and Pap tests among middle-aged women and the association between BMI and influenza vaccination among the elderly. We also evaluated whether these associations vary by race and whether the associations have changed over time.

METHODS

We used data from the Health and Retirement Study (HRS)[20] and the Asset and Health Dynamics Among the Oldest Old (AHEAD) Study.[21] The HRS is a nationally representative cohort study of health behaviors, disease and disability, medical care usage, and other topics. The baseline survey

was conducted in 1992 for the 1931–1941 birth cohort (and their spouses, regardless of age; N=5866 men and 6781 women). Follow-up interviews were conducted in 1994, 1996, 1998, and 2000 (average response rate=84.7%). Questions about clinical preventive services were included for all participants in waves 3 (1996) and 5 (2000). Our analysis included women who responded to questions about screening mammography and Pap tests in at least 1 wave (n=4439).

AHEAD is a companion study to the HRS. Wave 1 (1993; n=8222) included noninstitutionalized respondents aged 70 years and older (and their spouses, regardless of age) and oversampled persons aged 81 years and older. When a respondent was unable to participate, a proxy respondent was interviewed. Follow-up interviews were conducted in 1995, 1998, and 2000 (average response rate=87.6%). Receipt of influenza vaccination was reported in waves 2 (1995) and 4 (2000). Our analysis included men and women who answered the influenza vaccination question at least once. The useable sample (n=6199) was reduced by item nonresponse to variables used in the analyses; we excluded people who reported metastatic cancer, severe lung cancer, home oxygen therapy, race other than Black or White, or who had a proxy respondent. Both the HRS and AHEAD oversampled Black respondents and Florida residents.

Outcome measures. Questions about preventive services included the following: "Did you have a mammogram or X-ray of the breast to search for cancer in the last 2 years?"; "In the last 2 years, have you had any of the following medical tests or procedures: . . . a Pap [test] . . . a flu shot?" We determined the proportion of respondents who had received a preventive service at least once during the past 2 years.

Explanatory variables. These variables were primarily selected on the basis of earlier studies.[12,13] They were used to predict receipt of preventive services during the subsequent 2-year period. The main explanatory variable, BMI, was determined by self-reported weight and height and was categorized as follows: less than 18.5 kg/m^2 (underweight), 18.5 to 24.9 kg/m^2 (recommended weight), 25 to 29.9 kg/m^2 (overweight), 30 to 34.9 kg/m^2 (obesity, class I), 35 to 39.9 kg/m^2 (obesity, class II), and greater than or equal to 40 kg/m^2 (severe obesity, class III).[2]

Demographic and socioeconomic variables included age (5-year intervals), race (Black or White), education (completed/did not complete high school), birthplace (United States or other), marital status (married/unmarried), and household income (see note regarding household income in Table 1). HRS respondents who did not have health insurance were compared with those who had any health insurance. Most of the AHEAD participants were covered by Medicare, and respondents who had additional private insurance were compared with those who did not have additional insurance. Modifiable risk factors included smoking (current vs former smoker) and exercise (never vigorous exercise ≥3 times/<3 times per week). Health and disease variables included self-reported health (fair/poor/good/very good/excellent) and variables for diabetes mellitus, heart disease, lung disease, and (AHEAD only) cognitive impairment.[22] Participants who had been hospitalized during the past year were compared with those who had not. Number of outpatient visits during the past year (0–2, 3–5, and ≥6) indicated "exposure" to the health care system.

Statistical Analysis

The weighted proportions of respondents who reported receipt of each clinical preventive service were calculated by level of the explanatory variables, including BMI, age, and calendar year (wave). Because the outcome variables referred to receipt of clinical preventive services during the interval between the previous and current waves, we used the values of the explanatory variables from the wave preceding the value of the outcome variable (i.e., explanatory variables from 1993/1994 predicted outcomes in 1995/1996, and explanatory variables from 1998 predicted outcomes in 2000.)

Using logistic regression, we stacked observations for each respondent, who could provide 2 outcome values and 2 sets of explanatory values, and we adjusted for clustering of individual-level observations using Huber–White corrected standard errors.[23,24] We used BMI, survey wave, gender (for influenza

TABLE 1—Characteristics of the Samples: HRS, 1996, and AHEAD, 1995

	HRS 1996, % (n=4439)	AHEAD 1995, % (n=6199)
Demographics		
Age, y		
50–54	24.0	
55–59	44.0	
60–64	32.0	
70–74		40.7
75–79		29.1
80–84		20.5
85–89		9.7
Gender		
Male		37.4
Female	100.0	62.6
Race		
White	82.0	85.8
Black	18.0	14.2
Body Mass Index (kg/m^2)		
<18.5	3.4	4.1
18.5–24.9	37.6	45.1
25–29.9	33.8	37.8
30–34.9	16.7	10.5
35–39.9	5.5	2.4
≥40	3.1	0.1
Socioeconomics		
Completed high school	73.5	57.7
Married	59.9	51.7
Household income category[a]		
1	26.9	25.0
2	27.3	25.1
3	24.1	26.2
4	21.7	23.6
Health		
Smoker	21.0	8.8
Physical activity less than vigorous	54.8	70.4
Health poor or fair	20.0	30.1
Cognitively impaired		10.2
Health conditions		
Diabetes	2.0	12.7
Lung disease	1.0	3.9
Heart disease	1.8	28.5
Health Care		
Insurance status		
Uninsured	12.3	
Additional private insurance		60.1
Hospitalized in past year	14.3	19.4
Doctor visits in past year, no.		
0–2	34.5	40.3
3–5	27.7	33.7
≥6	37.8	26.0
Nursing home resident		6.5

Note. AHEAD = Asset and Health Dynamics Among the Oldest Old Study; HRS = Health and Retirement Study.
[a]HRS: 1995: (1) ≤$10 560, (2) $10 561–$18 000, (3) $18 001–$30 000, and (4) >$30 000; AHEAD 1996: (1) ≤$13 000, (2) $13 001–$31 600, (3) $31 600–$58 269, and (4) >$58 269.

TABLE 2—Receipt of Clinical Preventive Services Among Selected Subgroups: HRS, 1995-2000, and AHEAD, 1996-2000

	Mammography, Weighted %		Pap Test, Weighted %		Influenza Vaccination, Weighted %	
	1996 (n = 4439)	2000 (n = 4010)	1996 (n = 4434)	2000 (n = 4009)	1995 (n = 6199)	2000 (n= 4389)
Demographics						
Age, y						
50–54	72.5		74.4			
55–59	72.6	76.3	69.5	73.2		
60–64	70.8	79.0	63.0	70.3		
70–74					68.5	80.1
75–79					68.9	77.8
80–84					66.7	77.0
85–89					62.7	76.3
Gender						
Male					70.0	80.9
Female	72.4	78.1	68.8	69.6	66.2	75.1
Race						
White	72.3	78.2	68.6	69.6	69.4	78.3
Black	72.7	77.8	67.4	69.6	50.4	62.5
Body Mass Index (kg/m^2)						
< 18.5	75.4	75.4	71.6	66.9	62.7	70.9
18.5–24.9	74.5	78.4	71.4	73.0	68.4	78.4
25–29.9	72.2	79.0	68.5	70.0	68.6	77.2
30–34.9	66.8	76.0	63.2	66.0	63.7	75.5
35–39.9	68.3	77.8	61.6	66.2	64.2	69.7
≥40	65.1	71.4	57.6	53.6	55.9	57.5
Socioeconomics						
Education						
Completed high school	75.7	80.0	71.7	72.3	71.0	79.1
Not completed high school	59.6	70.1	56.8	60.4	62.5	73.0
Marital status						
Married	77.1	81.7	72.0	72.9	70.9	81.1
Not married	63.9	70.1	62.3	63.2	63.9	73.1
Household income category[a]						
1	58.5	74.7	58.6	66.1	59.0	69.0
2	69.6	73.7	65.6	64.3	66.5	77.1
3	76.1	78.0	70.2	69.4	68.1	78.3
4	85.2	86.0	79.7	80.3	76.2	81.3
Health						
Smoking						
Smoker	60.2	63.2	57.7	58.2	54.8	65.8
Nonsmoker	75.1	81.0	71.0	72.1	68.8	77.8
Physical activity						
Less than vigorous	71.0	76.3	66.0	66.8	66.7	74.8
Vigorous	74.5	79.6	71.3	72.9	71.4	81.0
Health status						
Excellent, very good, good	73.3	79.0	70.1	71.6	67.6	76.8
Poor or fair	66.3	74.0	60.1	62.6	67.8	77.4
Cognition						
Normal					68.8	78.0
Impaired					55.1	64.5
Health conditions						
Diabetes	64.5	75.1	55.5	64.0	70.1	77.7
No diabetes	72.1	78.2	68.5	70.3	67.4	77.0
Lung disease	71.7	82.9	63.5	67.3	69.5	78.7
No lung disease	72.0	77.6	68.3	69.7	67.6	76.9
Heart disease	71.7	79.6	63.4	70.0	73.2	81.8
No heart disease	72.0	77.6	68.3	69.6	65.4	75.7

Continued

only), and age as explanatory variables to develop simple multivariate models. We also developed comprehensive models that included all explanatory variables. To investigate whether disparities in receipt of clinical preventive services between recommended-weight and obese subjects had changed from 1995/1996 to 2000, we tested wave×BMI category interaction terms. To examine racial effects in greater detail, we developed separate models for Black and White respondents. We conducted all analyses with SAS, version 8.01 (SAS Institute Inc, Cary, NC), and STATA, version 6.0 (Stata Corp, College Station, Tex), software.

RESULTS

Table 1 shows characteristics of the study samples. Among the middle-aged women, 18.0% were Black, 33.8% were overweight, and 25.3% were obese. Among the elderly, 37.4% were men, 14.2% were Black, 37.8% were overweight, and 13% were obese. Table 2 shows the weighted proportions of respondents who reported receipt of each clinical preventive service during the past 2 years. Receipt of all 3 services decreased with increasing age, and influenza vaccination was more prevalent among men than among women.

From the reference category (recommended weight, i.e., BMI=18.5–24.9) through the overweight and obese categories, we observed inverse dose-response relationships between BMI and all 3 clinical preventive services. For example, in 1996, 74.5% of recommended-weight women, and only 66.8% of class I obese women, had received a screening mammography during the previous 2 years. Class III obese subjects had the lowest prevalence of screening mammography (65.1%). The same pattern held for screening mammography in 2000, although the absolute rate increased in each BMI category from 1996 to 2000. This trend of increasing use of clinical preventive services over time, but maintenance of the inverse association between BMI and clinical preventive service receipt, generally held across all of the services we examined. There also was a trend toward lower rates of receipt among underweight respondents.

TABLE 2—*Continued*

	Health Care					
Insurance status						
Uninsured	43.8	52.0	45.7	48.2		
Insured	75.4	80.1	71.1	71.5		
No additional private insurance					55.8	71.9
Additional private insurance					70.7	79.8
Hospitalization						
Not hospitalized in past year	71.6	77.6	68.7	70.1	66.6	75.8
Hospitalized in past year	74.4	78.8	65.6	67.2	72.2	79.6
Doctor visits in past year, no.						
0–2	59.3	63.0	58.6	56.7	59.6	61.7
3–5	78.7	82.4	74.1	75.0	72.8	77.0
≥6	78.8	83.4	72.9	73.9	74.0	81.2
Nursing home residency						
Not a nursing home resident					68.1	77.0
Nursing home resident					68.3	100.0

Note. AHEAD = Asset and Health Dynamics Among the Oldest Old Study; HRS = Health and Retirement Study; Pap = Papanicolaou.
[a] HRS: 1995: (1) ≤ $10 560, (2) $10 561–$18 000, (3) $18 001–$30 000, and (4) > $30 000; AHEAD 1996: (1) ≤ $13 000, (2) $13 001–$31 600, (3) $31 600–$58 269, and (4) > $58 269.

Results of the multivariate analysis generally confirmed the bivariate results, but the effects differed substantially by race. The inverse dose-response relationship between BMI and receipt of clinical preventive services in the recommended weight to obese range was consistent in all models for White respondents (Table 3). However, the effect was notably absent from all models for Black respondents (Table 4). Receipt of screening mammography and influenza vaccination, but not Pap tests, increased from 1995/1996 to 2000. Influenza vaccination was higher among men than among women.

Higher education, being married, higher income, not smoking, exercise, better health insurance, and more physician visits remained significant predictors of receipt of clinical preventive service in the multivariate models for White respondents. Normal cognition, heart disease, and residency in a nursing home during the past year were significantly associated with receipt of influenza vaccination. Similar effects were found in the models for Black respondents, but some effects were not significant (likely because of the smaller sample size).

Diabetes and heart disease may be intermediaries in the causal pathway from obesity to receipt of clinical preventive services: obese persons are more likely to have these conditions, and, because outpatient management of these conditions can be time consuming, there may be less time for clinical preventive services. In comprehensive models that excluded diabetes and heart disease (data not shown), however, there was little change in the effect of BMI. In multivariate models for White respondents that included interaction terms (data not shown), we found that the disparity in receipt of clinical preventive services between recommended-weight and obese persons did not decrease from 1995/1996 to 2000.

DISCUSSION

Despite the known risk of breast and cervical cancer among obese persons, increasing levels of obesity were associated with less frequent receipt of screening mammography and Pap tests among middle-aged White women, which confirms earlier cross-sectional investigations. Among elderly White respondents, higher BMI was similarly associated with less frequent receipt of influenza vaccination, arguably the most important clinical preventive service among that age group. This association between BMI and all 3 preventive services was absent among Black respondents.

Our findings have important clinical and public health implications. Delaying or avoiding screening may mean the difference between early and late diagnosis of cancer and is associated with poorer prognosis. There are similar morbidity and mortality implications in the case of influenza vaccination among the elderly.

The inverse association between BMI and clinical preventive services is an example of the *inverse care law,* which states that patients who need medical care the most are the ones least likely to receive it.[25] This phenomenon is prevalent in health care, particularly in primary care settings.[26–28] Criteria for the "law" fit our findings: obesity has been identified as a risk factor for breast and cervical cancer[17]; therefore, if screening were to target high-risk individuals, obese persons should have higher rates of screening. However, the rates among White obese respondents were lower.

The focus of our analysis was to identify and describe differences in rates of clinical preventive service receipt by differences in BMI. We also explored possible confounding factors of this association. The underlying reasons for decreasing receipt by increasing BMI are likely a combination of system, patient, and provider factors, and their relative importance may vary among preventive services.

Even after we considered the number of physician visits during the previous year, obesity was associated with less receipt of clinical preventive services among White respondents. Less preventive care among obese patients may seem inconsistent with increased use of health care services overall,[5,10] because more interactions with health care providers should provide more opportunities for clinical preventive service delivery. However, adequately addressing the multiple acute and chronic health problems experienced by obese patients is time consuming[29] and may leave less time per visit to address prevention, which also has been shown to require a large amount of physician time.[30] Also, many of the health services used by obese patients may be at the secondary- or tertiary-care levels and thus may be less focused on prevention.

In the case of cancer screening, test factors also may play a part. For example, vaginal speculum examinations and mammograms may be more difficult, painful, or time-consuming for obese women, which may lead to deferral of the exam. One study found that obese women were more reluctant to undergo pelvic examinations and, in turn, that physicians were less likely to pursue pelvic examinations when their patients were reluctant.[31]

TABLE 3—Adjusted Odds Ratios (ORs) for Receipt of Clinical Preventive Services: Multivariate Models, Whites

	Mammography		Pap Test		Influenza Vaccine	
	Simple Model OR (95%CI)	Comprehensive Model OR (95%CI)	Simple Model OR (95%CI)	Comprehensive Model OR (95%CI)	Simple Model OR (95%CI)	Comprehensive Model OR (95%CI)
Demographics						
Year 2000[a]	1.42 (1.26, 1.58)	1.25 (1.09, 1.42)	1.08 (0.98, 1.21)	0.99 (0.88, 1.12)	1.65 (1.48, 1.84)	1.41 (1.24, 1.61)
Age, y						
55–59[b]	0.97 (0.84, 1.12)	0.97 (0.83, 1.14)	1.15 (1.01, 1.32)	1.13 (0.98, 1.31)		
60–64[b]	0.95 (0.82, 1.10)	1.02 (0.86, 1.19)	0.90 (0.79, 1.03)	0.95 (0.82, 1.10)		
75–79[c]					0.98 (0.87, 1.11)	1.04 (0.90, 1.19)
80–84[c]					0.88 (0.77, 1.02)	0.95 (0.80, 1.11)
85–89[c]					0.88 (0.73, 1.06)	1.12 (0.89, 1.41)
Male[d]					1.30 (1.16, 1.44)	1.15 (1.01, 1.30)
Body Mass Index (kg/m^2)						
< 18.5[e]	0.89 (0.69, 1.16)	0.91 (0.66, 1.26)	0.79 (0.62, 1.00)	0.74 (0.55, 0.98)	1.01 (0.77, 1.32)	1.25 (0.89, 1.75)
25–29.9[e]	0.94 (0.82, 1.07)	0.90 (0.78, 1.05)	0.79 (0.70, 0.90)	0.78 (0.68, 0.89)	0.93 (0.83, 1.04)	0.91 (0.80, 1.03)
30–34.9[e]	0.81 (0.69, 0.95)	0.73 (0.60, 0.88)	0.69 (0.59, 0.80)	0.68 (0.57, 0.80)	0.80 (0.68, 0.95)	0.75 (0.62, 0.90)
35–39.9[e]	0.74 (0.57, 0.97)	0.69 (0.51, 0.93)	0.63 (0.49, 0.81)	0.59 (0.45, 0.78)	0.77 (0.54, 1.10)	0.67 (0.46, 0.99)
≥ 40[e]	0.67 (0.47, 0.94)	0.59 (0.40, 0.88)	0.44 (0.32, 0.61)	0.50 (0.35, 0.71)	0.42 (0.22, 0.77)	0.44 (0.22, 0.85)
Socioeconomics						
Completed high school[f]		1.29 (1.11, 1.50)		1.40 (1.22, 1.61)		1.14 (1.00, 1.29)
Married[g]		1.44 (1.26, 1.65)		1.26 (1.11, 1.43)		1.22 (1.08, 1.39)
Household income category[h]						
1		0.56 (0.46, 0.69)		0.71 (0.59, 0.85)		0.67 (0.56, 0.81)
2		0.57 (0.47, 0.70)		0.67 (0.56, 0.80)		0.77 (0.65, 0.90)
3		0.67 (0.56, 0.82)		0.74 (0.62, 0.87)		0.78 (0.67, 0.91)
Health						
Smoker[i]		0.51 (0.44, 0.59)		0.63 (0.55, 0.73)		0.61 (0.51, 0.74)
Physical activity vigorous[j]		1.02 (0.89, 1.15)		1.15 (1.02, 1.29)		1.23 (1.09, 1.39)
Health poor or fair[k]		0.85 (0.71, 1.02)		0.79 (0.68, 0.93)		0.93 (0.81, 1.08)
Cognitive impairment[l]						0.62 (0.47, 0.81)
Health conditions						
Diabetes		0.85 (0.64, 1.13)		0.87 (0.68, 1.12)		1.16 (0.96, 1.40)
Heart disease		1.00 (0.76, 1.31)		0.97 (0.76, 1.22)		1.29 (1.12, 1.49)
Lung disease		1.18 (0.79, 1.77)		0.94 (0.67, 1.33)		1.21 (0.91, 1.60)
Health Care						
Insurance status						
Uninsured[m]		0.33 (0.28, 0.40)		0.48 (0.40, 0.58)		
Additional private insurance[n]						1.47 (1.28, 1.68)
Hospitalized in past year[o]		1.00 (0.83, 1.21)		0.89 (0.75, 1.05)		1.02 (0.88, 1.18)
Doctor visits in past year, no.[p]						
3–5		2.36 (2.01, 2.77)		2.00 (1.72, 2.32)		1.85 (1.61, 2.14)
≥ 6		2.67 (2.28, 3.12)		2.16 (1.87, 2.49)		2.07 (1.79, 2.41)
Nursing home resident[q]						1.56 (1.09, 2.23)

Note. Pap = Papanicolaou; CI = confidence interval.
[a]Reference = year 1995/1996.
[b]Reference = aged 50–54 years.
[c]Reference = aged 70–74 years.
[d]Reference = female.
[e]Reference = 20.0–24.9 kg/m^2.
[f]Reference = did not complete high school.
[g]Reference = not married.
[h]Reference = household income category 4 (see Table 1 note).
[i]Reference = nonsmoker.
[j]Reference = less physical activity.
[k]Reference = excellent, very good, or good health.
[l]Reference = normal cognition.
[m]Reference = some health insurance.
[n]Reference = no additional private insurance.
[o]Reference = not hospitalized during past year.
[p]Reference = 0–2 doctor visits during past year.
[q]Reference = not a nursing home resident.

TABLE 4—Adjusted Odds Ratios (ORs) for Receipt of Clinical Preventive Services: Multivariate Models, Blacks

	Mammography		Pap Test		Influenza Vaccine	
	Simple Model OR (95%CI)	Comprehensive Model OR (95%CI)	Simple Model OR (95%CI)	Comprehensive Model OR (95%CI)	Simple Model OR (95%CI)	Comprehensive Model OR (95%CI)
Demographics						
Year 2000[a]	1.43 (1.12, 1.82)	1.30 (0.98, 1.72)	1.09 (0.87, 1.37)	1.07 (0.82, 1.38)	1.78 (1.38, 2.30)	1.23 (0.90, 1.68)
Age, y						
55–59[b]	1.05 (0.77, 1.43)	1.17 (0.84, 1.65)	0.91 (0.68, 1.22)	0.94 (0.69, 1.30)		
60–64[b]	0.94 (0.69, 1.29)	0.98 (0.69, 1.37)	0.93 (0.70, 1.25)	0.98 (0.71, 1.35)		
75–79[c]					1.16 (0.87, 1.56)	1.22 (0.87, 1.71)
80–84[c]					1.23 (0.88, 1.73)	1.22 (0.82, 1.83)
85–89[c]					0.93 (0.61, 1.42)	0.88 (0.53, 1.49)
Male[d]					1.26 (0.96, 1.66)	1.55 (1.11, 2.16)
Body Mass Index (kg/m^2)						
< 18.5[e]	0.76 (0.41, 1.39)	0.71 (0.33, 1.53)	0.95 (0.53, 1.69)	0.98 (0.47, 2.05)	0.66 (0.38, 1.14)	0.71 (0.35, 1.41)
25–29.9[e]	1.39 (1.01, 1.93)	1.13 (0.79, 1.62)	1.66 (1.22, 2.27)	1.50 (1.07, 2.12)	1.18 (0.89, 1.58)	1.10 (0.79, 1.53)
30–34.9[e]	1.33 (0.93, 1.90)	0.97 (0.65, 1.45)	1.40 (1.00, 1.96)	1.22 (0.84, 1.77)	1.18 (0.83, 1.67)	0.99 (0.66, 1.49)
35–39.9[e]	1.54 (0.95, 2.49)	1.03 (0.61, 1.76)	1.49 (0.96, 2.33)	1.13 (0.70, 1.85)	1.93 (1.05, 3.55)	1.39 (0.69, 2.78)
≥ 40[e]	1.31 (0.78, 2.19)	1.07 (0.60, 1.92)	0.89 (0.56, 1.41)	0.75 (0.45, 1.26)	0.74 (0.29, 1.89)	0.40 (0.13, 1.27)
Socioeconomics						
Completed high school[f]		1.03 (0.77, 1.36)		0.92 (0.71, 1.20)		1.27 (0.92, 1.77)
Married[g]		1.01 (0.76, 1.36)		1.07 (0.81, 1.40)		0.76 (0.55, 1.04)
Household income category[h]						
1		0.62 (0.37, 1.06)		0.68 (0.42, 1.10)		0.63 (0.40, 1.00)
2		0.71 (0.42, 1.20)		0.63 (0.39, 1.02)		0.81 (0.51, 1.28)
3		0.85 (0.49, 1.49)		0.80 (0.48, 1.33)		0.59 (0.36, 0.95)
Health						
Smoker[i]		0.64 (0.47, 0.88)		0.63 (0.47, 0.85)		0.45 (0.28, 0.73)
Physical activity vigorous[j]		1.09 (0.83, 1.43)		1.37 (1.05, 1.77)		0.92 (0.66, 1.29)
Health poor or fair[k]		1.02 (0.74, 1.40)		0.87 (0.65, 1.16)		1.42 (1.05, 1.92)
Cognitive impairment[l]						0.80 (0.56, 1.13)
Health conditions						
Diabetes		0.99 (0.64, 1.51)		0.79 (0.54, 1.16)		0.90 (0.62, 1.28)
Heart disease		0.86 (0.50, 1.46)		0.99 (0.61, 1.60)		1.12 (0.78, 1.61)
Lung disease		1.05 (0.41, 2.70)		0.76 (0.34, 1.73)		0.86 (0.33, 2.27)
Health Care						
Insurance status						
Uninsured[m]		0.50 (0.36, 0.70)		0.75 (0.54, 1.06)		
Additional private insurance[n]						1.03 (0.77, 1.40)
Hospitalized in past year[o]		0.79 (0.54, 1.14)		0.83 (0.59, 1.17)		1.20 (0.84, 1.71)
Doctor visits in past year, no.[p]						
3–5		1.81 (1.28, 2.57)		1.99 (1.42, 2.79)		1.45 (1.00, 2.09)
≥ 6		2.50 (1.81, 3.47)		2.44 (1.79, 3.32)		2.53 (1.74, 3.68)
Nursing home resident[q]						1.07 (0.48, 2.37)

Note. OR = odds ratio; CI = confidence interval.
[a]Reference = year 1995/1996.
[b]Reference = aged 50–54 years.
[c]Reference = aged 70–74 years.
[d]Reference = female.
[e]Reference = 20.0–24.9 kg/m^2.
[f]Reference = did not complete high school.
[g]Reference = not married.
[h]Reference = household income category 4 (see Table 1 note).
[i]Reference = nonsmoker.
[j]Reference = less physical activity.
[k]Reference = excellent, very good, or good health.
[l]Reference = normal cognition.
[m]Reference = some health insurance.
[n]Reference = no additional private insurance.
[o]Reference = not hospitalized during past year.
[p]Reference = 0–2 doctor visits during past year.
[q]Reference = not a nursing home resident.

Obese persons tend to have lower income and education and are less likely to be employed and have health insurance.[6–9,32] However, influenza vaccination was significantly lower among White obese persons who were Medicare beneficiaries and therefore had no explicit financial constraints to care. People who have lower levels of education also may be less informed about the availability and the benefits of preventive services. However, the association between obesity and receipt of clinical preventive services remained strong among White respondents in the multivariate models, even after we adjusted for socioeconomic variables.

Our findings may reflect social stigma, perceived maltreatment by health care providers, and health care avoidance.[33,34] Although obese persons see physicians more frequently for chronic disease care, overweight is associated with reluctance to see health care professionals in general.[35] Overweight women have reported delaying or avoiding interaction with the health care system because of "not wanting to get on the provider's scale" and "knowing they would be told to lose weight."[36] Additionally, for both screening mammography and Pap tests, the woman must be undressed in another person's presence, which may be more uncomfortable when dealing with the stigma of excess body weight.

Patient factors also may explain the racial differences we observed. Compared with other groups, Black women have the highest prevalence of obesity in the United States,[1] but they may experience less culturally based pressure to diet for appearance's sake. Compared with overweight White women, overweight Black women are more likely to be satisfied with their weight and to consider themselves attractive.[37–39] These differing attitudes may explain why the negative effects of BMI on receipt of preventive clinical services we observed among White patients were absent among Black patients.

Negative societal and personal attitudes toward overweight and obesity ("antifat bias"[8]) also can be found among health care providers. Such attitudes may affect their conscious and unconscious responses to overweight and obese patients.[40–42] Physicians and nurses have attributed obesity to laziness, self-indulgence, lack of intelligence, and lack of self-control.[9] When asked to rank dozens of social and disease status characteristics to which they responded most negatively, physicians ranked obesity fourth, after drug addiction, alcoholism, and mental illness.[9]

Many interventions have been developed to increase rates of clinical preventive service delivery.[43,44] However, before effective interventions that target obese patients can be designed, the ways in which system, patient, and provider factors interact to result in delayed or missed opportunities for clinical preventive health service delivery among this population must be studied further. The ultimate reasons for the disparities we observed cannot be disentangled easily with relatively general health data sets, such as the HRS and AHEAD.

Our study has a few limitations. Information about preventive clinical services was derived from self-report. However, similar questions about influenza and screening mammography have been validated previously,[45,46] and self-reported height and weight correlate well with measured height and weight.[47] If heavier persons are more likely to underreport BMI,[48] the odds ratios presented here are likely to be underestimates of true associations. Second, as with most large population studies, there may be some residual confounding because of imperfect measurement of socioeconomic status and smoking. Third, because the questionnaires referred to the period "within the last 2 years," the proportions of respondents who reported receiving clinical preventive services are higher than annual rates. These individuals may have received one or more of each service during the past 2 years; therefore, we cannot simply divide the reported rates by 2 to obtain the annual rates. Thus, the corresponding annual rates lie somewhere between our reported rates and half of these rates. Finally, it is possible that both obesity and lower rates of clinical preventive service use reflect a lack of concern for, or attention to, health issues in general. The HRS and AHEAD did not include measures of the health beliefs, attitudes, or cultural views of patients or providers regarding obesity and medical and preventive services. Such measures may provide deeper insight into the weight disparities and racial differences we observed.

Confirming earlier, smaller investigations, and despite the known increased risk of breast and cervical cancer associated with obesity, higher BMI was associated with less frequent receipt of screening mammography and Pap tests among middle-aged White women. Among elderly White men and women, higher BMI was similarly associated with less frequent receipt of influenza vaccination. This decreased use of clinical preventive services likely contributes to the increase in adverse health outcomes of obesity. Whether caused by system, patient, or provider factors, our findings represent an example of the "inverse care law" and may even reflect antifat bias. The Healthy People 2010[16] clinical preventive service goals remain elusive, especially for overweight and obese White persons. ■

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Contributors

T. Østbye originated the study, supervised all aspects of its implementation, and drafted the main text of the article. D.H. Taylor assisted with the study design and data analyses. K.M. Krause drafted parts of the article. All the authors originated ideas, interpreted findings, and reviewed drafts of the article.

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