The Effect of Comorbid Illness on Receipt of Cancer Screening by Older People

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OBJECTIVES: To identify associations between the type and number of diagnoses and receipt of screening for breast, cervical, and colorectal cancer by older people.

DESIGN: Sixth annual follow-up of a community-based survey with 4,162 participants aged 65 and older at baseline in 1986.

SETTING: Piedmont area of North Carolina

PARTICIPANTS: Two thousand two hundred twenty-five subjects with a mean age of 79 who responded in 1992.

MEASUREMENTS: Self-reported receipt of clinical breast examination, mammography, Papanicolaou (Pap) smear, and fecal occult blood testing (FOBT) within the 2 years before the survey.

RESULTS: Hip fracture was associated with lower rates of mammography (odds ratio (OR) = 0.53, 95% confidence interval (CI) = 0.32–0.87) and cognitive impairment with lower rates of FOBT (OR = 0.71, 95% CI = 0.54–0.94). Hypertension was associated with higher rates of breast examination (OR = 1.56, 95% CI = 1.18–2.07), Pap smear (OR = 1.41, 95% CI = 1.09–1.83), and FOBT (OR = 1.37, 95% CI = 1.12–1.66) and a trend toward increasing rates of mammography (OR = 1.28, 95% CI = 0.98–1.69). The presence of three or more comorbid conditions was associated with an increased rate of mammography (OR = 1.35, 95% CI = 1.06–1.71), breast examination (OR = 1.46, 95% CI = 1.12–1.89), and Pap smear (OR = 1.31, 95% CI = 1.04–1.65).

CONCLUSIONS: With few exceptions, the presence of comorbid conditions is not associated with a decreased rate of receipt of screening. In fact, hypertension and the presence of a higher number of comorbid conditions are associated with a higher rate of receipt of cancer screening. This finding may be due to an increase in the frequency of office visits increasing the opportunity for cancer screening. **J Am Geriatr Soc 50:1651–1658, 2002.**

Key words: cancer screening; clinical breast exam; comorbid illness; fecal occult blood testing; mammography; older people; Pap smear

Incidence of and mortality rates from breast, cervical, and colorectal cancer peak in late life.[1,2] As a result, healthcare providers should consider the inclusion of older patients in scheduled screening for each of these malignancies. Indeed, studies indicate that older patients may experience a significant mortality benefit from cancer screening.[3–6] Nonetheless, older people are screened much less frequently than younger people.[7–15] This discrepancy stems, in part, from the presence of many well-established socioeconomic barriers to health care, including lower levels of income and education and the lack of private health insurance.[16] It may also result from the consideration of clinical factors that decrease an individual's potential benefit from a screening procedure, including specific diagnoses and overall health status.[17,18] Satariano et al. have demonstrated that, in older patients diagnosed with primary breast cancer, those with two or more comorbid conditions tend to die earlier of causes other than breast cancer after controlling for stage and therapy.[19] One may conclude that diagnosing an early stage cancer, particularly in an asymptomatic individual with multiple comorbid illnesses, contributes little to the length or quality of life remaining.

In the early 1990s, awareness of cancer screening was on the rise. The United States Preventive Services Task Force had recently issued its first *Guide to Clinical Preventive Services,* and Congress had approved reimbursement under Medicare for cervical and breast cancer screening. Likely as a result of these events, overall rates of cancer screening, particularly for breast and cervical cancers, rose

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sharply during this period, but, with this tide of interest and enthusiasm, limited consideration was given to the role of age and comorbidity in physicians' decisions of whether to offer cancer screening to their older patients. Even now, nearly a decade later, relatively little evidence exists about the specific effect of comorbid illness on the receipt of cancer screening in older persons. We analyzed information available from a community-based cohort of older persons in North Carolina to examine the effect of the number and type of comorbid conditions on rates of receipt of cancer screening in older individuals in 1992. We hypothesized that community-dwelling older people with more comorbid conditions would have lower rates of cancer screening than their healthier counterparts.

METHODS

Survey Background

Information for this study was taken from the Piedmont Health Survey of the Elderly (PHSE). The PHSE is part of a multisite, collaborative research program, the Established Populations for Epidemiologic Studies of the Elderly.[20,21] The institutional review board at Duke University Medical Center approved the design of the PHSE. Study participants provided informed consent after explanation of the project and before entry to the study.

Participants and Data Sources

A four-stage household-based sampling design was used for assembly of a probability sample of 5,226 people aged 65 and older living in a five-county area of North Carolina. African Americans were oversampled to represent at least 50% of the study population. At baseline in 1986, 4,162 persons completed the survey. This original cohort was 54% African American and 67.2% female and had a mean age of 72.[21] Between January 1986 and June 1987, each study respondent participated in a 90-minute, in-home baseline interview. The initial questionnaire inquired about demographics, social and physical functioning, chronic conditions and related health problems, and health habits and health service use.[20] Proxy respondents answered for participants unable to answer for themselves because of physical or mental limitations. Follow-up interviews were conducted annually between 1986 and 1992.

At the time of the 1992 survey, the total study population had decreased to 2,839 participants with a mean age of 78 and a demographic composition otherwise similar to the original group. These surviving participants were questioned for the first time about their use of cancer screening tests. Specifically, the survey inquired about the receipt of clinical breast examination, mammography, Papanicolaou (Pap) smear, and fecal occult blood testing (FOBT). Participants were asked a brief series of questions regarding each screening procedure. Questions inquired about whether participants had ever had the procedure and, if so, when. If respondents had had the procedure within the last 24 months, they were questioned about the regularity and frequency of the test. Answers to these questions served as the basis of outcome measures in this study.

For our analyses, we excluded patients with the diagnosis of breast, cervical, or colorectal cancer at or before 1992 (n = 227). Diagnoses were based on self-report of a history of one or more of these malignancies at or before the 1992 follow-up survey. Additionally, for all analyses, we excluded respondents with incomplete data on the outcomes of interest. This exclusion was performed separately for each of the screening tests, resulting in slightly different population sizes for each. Figure 1 illustrates the selection of respondent data for analysis based on the exclusions described above.

Variables

The primary outcome variables for this analysis were the self-report of receipt of each of the four screening procedures (mammography, clinical breast examination, Pap smear, and FOBT) in the 2 years preceding the 1992 survey.

Predictor variables included the self-report of the presence of comorbid conditions in or before 1992, including myocardial infarction, stroke, cancer (other than breast, cervical, or colorectal), hip fracture, hypertension, arthritis, chronic lung disease, and diabetes mellitus. We also included measures of depression and cognitive impairment. The presence of depression was determined by a score of 9 or greater on the 20-point Center for Epidemiologic Studies—Depression Scale, administered at the time of the survey.[22] Cognition was assessed with the Short Portable Mental Status Questionnaire, with determination of cognitive impairment adjusted for education and race.[23] We also performed an unweighted count of the number of comorbid conditions and

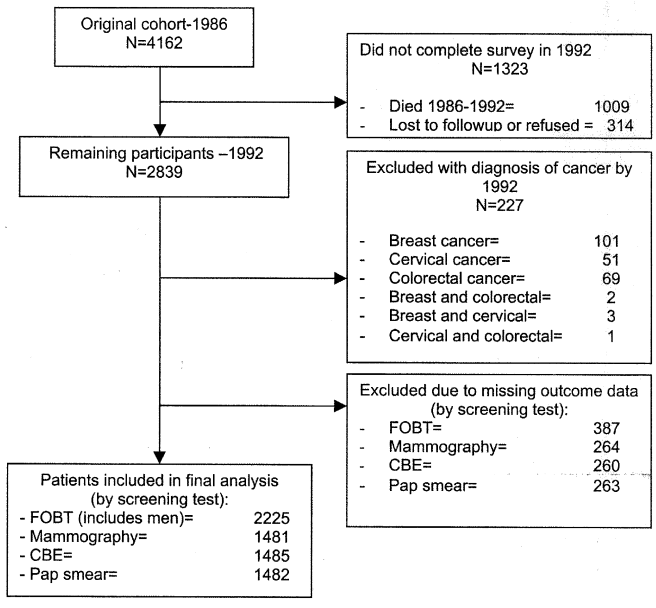

Figure 1. Flow diagram of participants included in the analysis of receipt of cancer screening. We excluded patients with the diagnosis of breast, cervical, or colorectal cancer at or before 1992 (n = 227). Diagnoses were based on self-report of a history of one or more of these malignancies at or before the 1992 follow-up survey. Additionally, for all analyses, we excluded respondents with incomplete data on the outcomes of interest. This exclusion was performed separately for each of the screening tests, resulting in slightly different population sizes for each. CBE = clinical breast examination; FOBT = fecal occult blood testing.

collapsed this number into a dichotomous measure with a cutpoint based on a median value of 3 for the population (≥3 comorbid conditions vs 0–2 comorbid conditions). In each analysis, we controlled for several demographic and socioeconomic factors, which prior studies have identified as important determinants of receipt of cancer prevention measures.[18,24] These included age, gender (for FOBT alone), race, education, income, insurance status, functional status, urban/rural residence, whether a proxy was used to obtain the information, and the patient's ability to identify a primary care provider. Age was examined as a continuous variable. Race was designated as white (0) or non-white (1), with 99% of nonwhites being African American. Education was divided into those with 11 or more years of school versus those with less. Income was dichotomized into those making $15,000 or more versus those making less than $15,000, with imputation of missing data via mean substitution (n = 337). Insurance status was designated as private insurance (1) versus no private insurance (0), with Medicare and Medicaid included in the latter. Functional status was represented by scores of 0 (highest functioning) to 5 (lowest functioning) on the Older American Resources and Services questionnaire of instrumental activities of daily living.[25]

In cases with incomplete data on covariates other than income (n = 88), the value of the missing item was coded as the mean value for continuous and ordinal measures and the mode for dichotomous variables. In addition, for the regression analysis, an indicator variable was created to identify whether information had been imputed for a given respondent so that bias for nonresponse could be assessed.

Multivariate Analyses

Regression models were constructed for each screening procedure to determine the association between comorbid conditions and receipt of screening. As indicated above, all models used the self-report of receipt of the given screening procedure as the dependent variable and controlled for demographic and socioeconomic factors. We created two separate models for each screening procedure. Model 1 included the self-report of the specific comorbid conditions on or before 1992, including myocardial infarction, stroke, cancer, hip fracture, hypertension, arthritis, chronic lung disease, and diabetes mellitus. It also included dichotomous measures of the presence of cognitive impairment and depression. Model 2 included a count of the total number of conditions. This model was run with the count as a dichotomous variable with a cutpoint between zero and two and three or more conditions. In this model, variables indicating the presence of individual comorbidities were not included.

Statistical Analysis

We examined the relationship between receipt of each screening procedure in 1992 as a dichotomous outcome (receipt within the last 2 years vs no receipt within the last 2 years) and the predictor variables for the two models for each screening procedure. Comparisons of the proportion of patients receiving and not receiving screening for each of the predictor variables were made using chi-square analysis. Logistic regression was run on each of the models, generating odds ratios (ORs) for receipt of screening with 95% confidence intervals (CIs). All models were tested for significant interactions between age and any of the individual comorbid conditions or total count variables. Models were also screened for colinearity by examining variance inflation factors for each variable. Analyses were performed using SAS Statistical Software, version 8.0 (SAS Institute, Inc., Cary, NC).

RESULTS

Baseline characteristics of participants included in this analysis are presented in Table 1. The information for women is also presented separately because men were excluded from the analyses of mammography, clinical breast examination, and Pap smear. The mean age was 79 at the time of the survey in 1992. According to the design of the PHSE, slightly more than half the sample was black. Also of note, most participants had less than a high school education and lived on less than $15,000 per year. Despite this, almost half had some form of private insurance. The average number of comorbid conditions was 2.71. Patients reported high rates of hypertension (69.4%) and diabetes mellitus (24.3%). Many had a history of vascular events, including myocardial infarction (22.6%) and stroke (14.8%). The group also had high rates of cognitive impairment (21.5%) and depression (9.0%). Women, as a separate cohort, were slightly older, poorer, and less frequently privately insured. They reported higher rates of hypertension and arthritis, but had similar rates of vascular disease.

Of those who responded to questions about receipt of cancer screening maneuvers, 74% had been screened in the last 2 years with clinical breast examination, 58% with Pap smear, 54% with FOBT, and 44% with mammography. Examination of rates of screening by 5-year age grouping revealed significantly lower rates among older age groups for each screening test. ($P < .01$ for each procedure) (Figure 2). Rates were lowest for screening with mammography, with

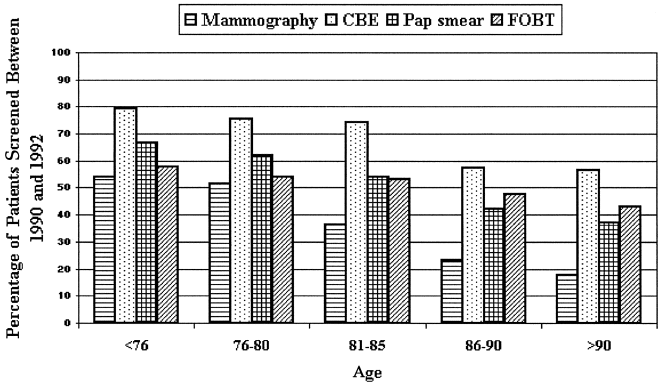

Figure 2. Rate of receipt of recent cancer screening by age. Primary outcome variables for this analysis were the self-report of receipt of each of the four screening procedures (mammography, clinical breast examination (CBE), Papanicolaou (Pap) smear, and fecal occult blood testing (FOBT)) in the 2 years preceding the 1992 survey. Population sizes were as follows: Mammography: Total = 1,481, <76 = 477, 76–80 = 432, 81–85 = 324, 86–90 = 181, >90 = 67; CBE: Total = 1,485, <76 = 479, 76–80 = 436, 81–85 = 322, 86–90 = 180, >90 = 68; Pap smear: Total = 1,482, <76 = 479, 76–80 = 434, 81–85 = 323, 86–90 = 177, >90 = 69; FOBT: Total = 2,225, <76 = 845, 76–80 = 644, 81–85 = 415, 86–90 = 233, >90 = 88.

Table 1. Baseline Characteristics

Variable	Women* (n = 1,481)	Men (n = 747)	All Participants (n = 2,225)
Age, mean ± SD	79.7 ± 5.93	77.2 ± 5.31	79.0 ± 5.83
Gender, % female	—	—	66.8
Race, %			
White	42.6	45.8	43.8
Non-white	57.4	54.2	56.2
Education <11 years, %	77.9	76.0	77.1
Income <$15,000/year, %	88.4	67.1	82.8
Private insurance, %	45.4	52.4	47.6
Number of comorbid illnesses, mean ± SD	2.80 ±1.45	2.59 ± 1.53	2.79 ± 1.49
≥3 comorbid illnesses, %	55.9	48.3	53.3
Primary care, % "yes"	93.9	90.5	92.8
Myocardial infarction, %	21.1	24.1	22.6
Stroke, %	14.6	15.5	14.8
Hypertension, %	73.8	61.5	69.4
Diabetes mellitus, %	24.6	22.4	24.3
Cancer, %	8.6	16.7	11.8
Broken hip, %	8.2	3.7	6.7
Chronic lung disease, %	7.7	12.7	9.4
Arthritis, %	71.1	55.4	65.8
Depressed, %	9.8	6.6	9.0
Cognitive impairment, %	23.1	17.8	21.5
Proxy response, %	12.7	9.9	12.2

*The characteristics shown are those of the women included in the analysis of receipt of fecal occult blood testing. No significant differences existed between this group and those included in the analyses of receipt of mammography, clinical breast exam, and Papanicolaou smear.
SD = standard deviation.

the most pronounced difference noted between ages 76 and 80 (52%) and 81 and 85 (36%). Rates of clinical breast examination were highest in each age range relative to other tests, but were significantly lower in those aged 86 and older.

Table 2 shows the association of comorbid illnesses with screening rates for each of the four screening procedures. Individual diseases were rarely significantly associated with a lower rate of screening. Hip fracture was associated with a significantly lower rate of receipt of mammography (OR = 0.53, 95% CI = 0.32–0.87). Likewise, cognitive impairment was associated with a lower rate of receipt of FOBT (OR = 0.71, 95% CI = 0.54–0.94) and a trend toward lower rates of mammography, clinical breast examination, and Pap smear. A diagnosis of hypertension was associated with a significantly higher rate of receipt of clinical breast examination (OR = 1.56, 95% CI = 1.18–2.07), Pap smear (OR = 1.41, 95% CI = 1.09–1.83), and FOBT (OR = 1.37, 95% CI = 1.12–1.66). A trend towards a higher rate of mammography was also seen in patients with hypertension (OR = 1.28, 95% CI = 0.98–1.69).

When individual comorbid conditions were replaced in the model with a count of the number of illnesses, as shown in Table 3, the presence of three or more conditions predicted a significant increase in receipt of mammography (OR = 1.35, 95% CI = 1.06–1.71), clinical breast examination (OR = 1.46, 95% CI = 1.12–1.89), and Pap smear (OR = 1.31, 95% CI = 1.04–1.65). This effect was not seen with FOBT (OR = 1.09, 95% CI = 0.91–1.31).

Tests for interactions between age and comorbidity revealed only one significant term. Age and hypertension interacted with respect to receipt of Pap smear such that the age-related decline in rates of cervical cancer screening in patients without hypertension was more pronounced that in those with hypertension. Examination of variance inflation factors for each model revealed no evidence of significant colinearity between variables.

Among covariates, advancing age was consistently associated with a lower rate of screening. Lack of private health insurance and failure to identify a primary care resource were also associated with lower rates of screening for all four procedures. Additionally, the indicator variable for imputation was associated with a lower rate of receipt of screening for all tests. Indeed, the population of patients with imputed values was older and had higher rates of proxy response and higher rates of cognitive impairment and stroke. Despite the significance of this variable in the model, parameter estimates for predictor variables remained unaffected by the use of imputed values.

DISCUSSION

Older patients suffer from high rates of comorbid conditions, which may increase the risk and potentially decrease the benefit of screening for occult malignancies. Most guidelines currently recommend that healthcare providers consider quantity and quality of life remaining in making decisions to offer screening to older patients,[1,18] but the true

Table 2. Model 1: Odds of Screening by Comorbid Condition

		Mammography (n = 1,481)	Clinical Breast Examination (n = 1,485)	Papanicolau Smear (n = 1,482)	Fecal Occult Blood Testing (n = 2,225)
		Women Only			Total Population
Model 1	Variable	Adjusted Odds Ratio (95% Confidence Interval)			
Predictor variables	Myocardial infarction	1.15 (0.86–1.53)	1.12 (0.81–1.53)	1.09 (0.82–1.44)	1.24 (0.99–1.55)
	Stroke	1.09 (0.76–1.57)	0.98 (0.67–1.42)	1.07 (0.76–1.51)	1.25 (0.95–1.63)
	Hypertension	1.28 (0.98–1.69)	1.56 (1.18–2.07)*	1.41 (1.09–1.83)*	1.37 (1.12–1.66)*
	Diabetes mellitus	1.05 (0.80–1.38)	0.90 (0.67–1.21)	0.94 (0.72–1.22)	0.90 (0.73–1.12)
	Cancer	1.33 (0.87–2.03)	0.87 (0.55–1.37)	0.93 (0.62–1.40)	1.16 (0.87–1.55)
	Broken hip	0.53 (0.32–0.87)*	0.98 (0.62–1.55)	0.94 (0.61–1.45)	0.85 (0.59–1.23)
	Chronic lung disease	1.43 (0.94–2.17)	1.55 (0.92–2.60)	1.00 (0.66–1.52)	0.85 (0.63–1.15)
	Arthritis	1.15 (0.89–1.48)	1.25 (0.95–1.64)	1.11 (0.75–1.65)	0.93 (0.77–1.12)
	Depression	1.22 (0.82–1.81)	1.21 (0.77–1.91)	1.21 (0.81–1.81)	1.09 (0.78–1.51)
	Cognitive impairment	0.95 (0.66–1.35)	0.83 (0.58–1.19)	0.75 (0.54–1.05)	0.71 (0.54–0.94)*
Covariates	Age†	0.94 (0.92–0.96)*	0.96 (0.94–0.98)*	0.95 (0.93–0.97)*	0.97 (0.95–0.98)*
	Race‡	1.35 (1.04–1.76)*	1.18 (0.88–1.57)	1.14 (0.88–1.47)	0.98 (0.80–1.19)
	Education§	1.45 (1.05–1.99)*	1.10 (0.76–1.59)	1.34 (0.97–1.85)	1.25 (0.98–1.59)
	Income‖	1.66 (1.13–2.42)*	1.40 (0.87–2.27)	1.04 (0.71–1.53)	1.03 (0.79–1.33)
	Health insurance¶	1.67 (1.28–2.17)*	1.75 (1.30–2.36)*	1.82 (1.40–2.37)*	1.38 (1.12–1.69)*
	Primary care#	2.07 (1.25–3.43)*	2.20 (1.38–3.52)*	1.75 (1.10–2.77)*	1.60 (1.13–2.27)*
	Urban vs rural	2.04 (1.62–2.57)*	1.24 (0.96–1.59)	1.16 (0.93–1.45)	1.36 (1.14–1.62)*
	Function (MIADLs)**	0.94 (0.87–1.03)	0.97 (0.87–1.06)	1.03 (0.95–1.11)	1.18 (1.10–1.26)*
	Proxy response	0.64 (0.36–1.51)	0.94 (0.56–1.58)	0.74 (0.45–1.23)	0.92 (0.61–1.39)
	Imputation	0.31 (0.17–0.55)*	0.25 (0.15–0.39)*	0.30 (0.18–0.49)	0.33 (0.22–0.48)*
	Gender	—	—	—	0.98 (0.80–1.19)

*$P < .05$.
†Per year.
‡Non-white versus white.
§≥11 years versus <11 years.
‖≥$15,000/year versus <$15,000/year.
¶Private insurance versus no private insurance.
#Identification of primary care source versus none.
**Modified instrumental activities of daily living (MIADLs): 0 (no deficits) to 5 (total dependence).

effect of medical illnesses on decisions to screen for cancer remains unclear.

Prior studies on this topic have focussed on breast cancer screening with mammography. Burack et al. examined responses of more than 1,700 participants in the National Health Information Survey and compared recent versus remote recipients of mammography with respect to health status, including self-rated health, physical function, and healthcare access.[26] In a multivariate analysis, none of these items were associated with recent receipt of cancer screening. In a similar study, Blustein et al. examined data collected from 2,352 older women via the Medicare Benificiary Survey.[27] The authors analyzed patients' reports of general health, function, comorbid illnesses, and sociodemographic characteristics. Receipt of mammography was determined by review of Health Care Financing Administration (now called Center for Medicaid and Medicare Sources) claims data. In a comparison of recently screened patients (<2 years) with remote users or nonrecipients, age was strongly correlated with lower rates of screening. The authors also found that functional limitations, stroke, hip fracture, and cognitive impairment predicted a significantly lower rate of receipt of screening, but hypertension, myocardial infarction, and diabetes mellitus did not appear to have a significant influence on the rate of screening. Although both studies identified age as the strongest correlate of rate of receipt of breast cancer screening, Blustein et al.'s[27] work offered evidence that healthcare providers and patients do consider specific comorbid conditions in making decisions to screen.

In this study, we further examined the association between comorbid illness and receipt of cancer screening for a broader range of screening tests, including clinical breast examination, Pap smear, and FOBT. In addition to individual diagnoses, we tested the association between the number of comorbid conditions and receipt of screening. We expected a decline in screening rates as comorbid conditions increased. We found that, for the majority of conditions, there was no significant association with screening rates. Consistent with Blustein et al., we did find a decreased rate of receipt of mammography in those with history of hip fracture. Moreover, the effect of cognitive impairment appeared consistently to predict a lower rate of receipt of screening, after controlling for proxy status. Alternatively, the presence of

Table 3. Model 2: Odds of Cancer Screening by Total Number of Comorbid Conditions

		Mammography (n = 1,481)	Clinical Breast Examination (n = 1,485)	Papanicolau Smear (n = 1,482)	Fecal Occult Blood Testing (n = 2,225)
		Women Only			Total Population
Model 2	Variable	Adjusted Odds Ratio (95% Confidence Interval)			
Predictor variable	≥3 comorbid conditions	1.35 (1.06–1.71)*	1.46 (1.12–1.89)*	1.31 (1.04–1.65)*	1.09 (0.91–1.31)
Covariate	Age†	0.93 (0.91–0.95)*	0.96 (0.94–0.98)*	0.95 (0.93–0.97)*	0.96 (0.95–0.98)*
	Race‡	1.42 (1.10–1.82)*	1.26 (0.96–1.66)	1.24 (0.97–1.58)	0.99 (0.82–1.20)
	Education§	1.39 (1.02–1.90)*	1.04 (0.72–1.49)	1.28 (0.93–1.76)	1.20 (0.95–1.52)
	Income‖	1.69 (1.16–2.47)*	1.46 (0.90–2.35)	1.08 (0.74–1.59)	1.06 (0.82–1.37)
	Health insurance¶	1.64 (1.26–2.13)*	1.77 (1.31–2.38)*	1.86 (1.43–2.41)*	1.38 (1.13–1.70)*
	Primary care#	2.12 (1.29–3.50)*	2.34 (1.47–3.71)*	1.83 (1.17–2.89)*	1.66 (1.18–2.34)*
	Urban vs rural	2.02 (1.60–2.54)*	1.24 (0.96–1.58)	1.17 (0.94–1.46)	1.37 (1.15–1.63)*
	Function (MIADLs)**	0.94 (0.87–1.02)	0.95 (0.87–1.04)	1.01 (0.93–1.09)	1.17 (1.09–1.25)*
	Proxy response	0.53 (0.32–0.90)*	0.76 (0.48–1.20)	0.58 (0.37–0.91)*	0.75 (0.52–1.07)
	Imputation	0.30 (0.17–0.53)*	0.23 (0.14–0.36)*	0.28 (0.17–0.46)*	0.32 (0.22–0.47)*
	Gender	—	—	—	0.98 (0.81–1.18)

*$P < .05$.
†Per year.
‡Non-white versus white.
§≥11 years versus <11 years.
‖≥$15,000/year versus <$15,000/year.
¶Private insurance versus no private insurance.
#Identification of primary care source versus none.
**Modified instrumental activities of daily living (MIADLs): 0 (no deficits) to 5 (total dependence).

hypertension predicted a higher rate of screening with all procedures except mammography. Additionally, those with three or more comorbid conditions appeared to have a significantly higher rate of receipt of screening for breast and cervical cancer than those with two or fewer conditions.

Our findings raise several important points regarding cancer screening in older people. With few exceptions, the presence of comorbid illness does not appear to significantly decrease the rate of receipt of screening. Although most screening recommendations direct healthcare providers to consider health status and life expectancy in making decisions to offer cancer screening, age still seems to be the most influential determinant. There may be several explanations for this phenomenon. In primary care practice, there is little time to estimate each individual's candidacy for screening, particularly older patients with multiple medical problems. As a result, physicians may be more likely to make these decisions based on demographic characteristics, particularly age. In addition, few validated tools exist to help determine how comorbid illness affects life expectancy. Again, clinicians make difficult decisions based on little or no evidence. Age becomes a convenient surrogate. The ultimate effect of such practice may be that healthy older people who may be good candidates for screening may not be offered this important preventive measure. Likewise, providers may be offering screening to other older patients with multiple comorbid conditions who have little chance of benefiting from such procedures and, in fact, may experience significant harm. Indeed, we found that older patients with hypertension and three or more comorbid conditions may receive more screening procedures, particularly for breast and cervical cancer. This unexpected finding may indicate that more frequent contact with healthcare providers increases the likelihood of receiving screening. Conditions such as hypertension require regular office visits to assess control of blood pressure and monitor the effectiveness of medications. With their increased number of contacts, providers may be more likely to offer them screening. To truly test this hypothesis would require quantifying the actual healthcare "opportunities," particularly the number of visits to outpatient care settings.

In exception to the above findings, an increased number of comorbid conditions (≥3) was not associated with an increase in reported receipt of FOBT. Unlike mammography, clinical breast examination, and Pap smear, the patient, not a healthcare professional, performs FOBT. As a result, older patients with multiple comorbid conditions may find this test more difficult to complete than other procedures. This may explain the lack of a positive correlation between the number of comorbid conditions and receipt of FOBT.

There are several potential limitations to this study. First, the PHSE was designed to provide information on the health status and care of older persons living in the southeast United States, particularly African Americans. Indeed, a prior publication has explored the issue of race and receipt of cancer prevention services.[28] Questions may arise about the generalizability of our findings in this population with respect to comorbid illness and cancer screening. In comparing this group with the Medicare beneficia-

ries in Blustein et al.'s study, we found that our cohort was poorer, had less education, and was less likely to have private insurance. In terms of comorbid illnesses, they had higher rates of hypertension, diabetes mellitus, and vascular events. Although demographics and disease rates may vary slightly from national norms, the cohort is composed of community-dwelling older people with an array of common diagnoses and disabilities. Moreover, by virtue of surveying a less-advantaged population, it may offer information on a group not normally included in epidemiological research. Second, the cross-sectional design of the study presents limitations in drawing a clear causal link between the diagnosis of comorbid conditions and the decision to screen. There is no guarantee that the decision to screen for cancer did not precede the diagnosis of a given illness, particularly the occurrence of a myocardial infarction, stroke, broken hip, or depression. In focusing our analysis on those who received screening in the 2 years before the survey and by including mostly chronic conditions, we have limited the potential effect of this problem. Third, we relied on patient self-report to ascertain screening status. Self-report of preventive services may be inaccurate or even exaggerated, particularly in patients who are aware of appropriate screening schedules.[29] Indeed, breast cancer screening rates reported in our study are higher than those found by Blustein et al.[27] from Medicare claims data. This may reflect a bias among patients with more comorbid illnesses to overreport the rate of receipt of screening. Additionally, because the PHSE was not designed to differentiate between screening and diagnostic procedures, inclusion of all tests performed within the last 24 months may have inflated our estimates of screening rates. In an analysis designed to assess racial differences in screening using the same dataset, Hegarty et al. used a more conservative definition of "recent screening," including only those respondents who confirmed receipt of the procedure in the previous 2 years and reported having had the test regularly.[28] Predictably, rates of screening for all tests were consistently higher in our analysis than those reported by Hegarty et al. Nonetheless, when we reanalyzed our models using the more conservative definition of receipt of screening, parameter estimates for predictor variables remained largely unchanged. We chose to use the more liberal definition of receipt of screening because we felt that it provided an accurate estimate of the actual rates of testing. Indeed, mammography rates found in this study closely approximate those published by the Center for Health Statistics for 1993.[30] Fourth, our survey was conducted in the early 1990s. At that time, Congress was just beginning to recognize the importance of prevention and screening. They had just approved Medicare funding for Pap smear and mammography in 1990 but would not include colorectal cancer screening until 1997. In the interim, controlled trials supporting cancer screening measures have been published.[1] As a result, guidelines have been developed and disseminated, including those by the American Geriatrics Society on screening for breast and cervical cancer in older women.[31] In addition, the PHSE did not inquire about endoscopic screening for colorectal cancer, which has subsequently been supported by limited evidence. Despite these problems, this study raises important questions about the delivery of preventive services to older patients. In fact, recent developments, such as expanded reimbursement and guidelines, may make these findings more relevant than ever.

A healthcare provider's decision to offer cancer screening to an older patient should include careful consideration of comorbid conditions, function, and quality of life to identify those who are most likely to benefit from early detection of breast, cervical, or colorectal cancer. This analysis raises suspicion that these decisions are not being driven by patients' health status but by elements affecting access and exposure to care. Our findings further emphasize the need for more research into the formulation and presentation of decisions to offer preventive services to older patients.

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