The Underuse of Screening Services Among Elderly Women With Diabetes

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OBJECTIVE — To determine whether the use of nondiabetes-related preventive services (mammography, colorectal cancer screening, and bone density testing) among elderly diabetic women is different from the use among nondiabetic women.

RESEARCH DESIGN AND METHODS — Using a representative sample of the U.S. elderly female population and the linked Surveillance, Epidemiology, and End Results (SEER)-Medicare files, we identified women with or without diabetes who were ≥67 years of age on 1 January 1999. All women with a prior history of cancer were excluded. Bivariate and multivariate analyses were used to compare the rates of preventive service use and to understand the factors influencing their use in the next 2–4 years.

RESULTS — Women with diabetes were less likely to have a mammogram (odds ratio [OR] 0.83 [95% CI 0.78–0.88]), colorectal cancer screening (0.79 [0.70–0.88]), and bone density testing (0.63 [0.58–0.69]). Women with diabetes seen by endocrinologists had significantly higher rates of bone density testing than women seen by primary care physicians. Women seen by obstetrician/gynecologists had the highest rates of use of all three services.

CONCLUSIONS — Elderly women with diabetes are less likely to receive cancer and osteoporosis screening than women without diabetes. Physicians treating these patients need to assure that they receive all recommended preventive services appropriate for their age. Additional national guidelines, practice-based improvements, and patient education targeting those at greatest risk of not receiving these services may be needed to achieve parity.

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Increasing use of diabetes preventive services (A1C and serum lipid monitoring, proteinuria assessment, and dilated eye and foot examination) recommended by the American Diabetes Association (ADA) and others are now frequently reported by the National Centers For Disease Control and Prevention (CDC) and other researchers (1–8). Less frequently reported is the use of other recommended preventive services appropriate for the entire population, including those with diabetes, such as cancer and osteoporosis screening. Tabaei et al. (9) reported that 73% of diabetic women in managed care plans in Michigan had mammograms and that 56% had Pap (Papanikolaou) smears in the prior 2 or 3 years, respectively. Increased use of diabetes process and quality-of-care measures were associated with increased use of these two screening services (9). Mammography and Pap smear use in women without diabetes was not reported. Comparing Ontario women between 50 and 67 years of age with diabetes to those without diabetes, Lipscombe et al. (10) found a significantly lower rate of biennial mammography use among the women with diabetes (adjusted OR 0.68 [95% CI 0.67–0.69]).

This study examines the use of mammography in a larger U.S. population of women with diabetes as well as two other preventive services: screening for colorectal cancer and bone density testing.

RESEARCH DESIGN AND METHODS

— The primary source of data was the Sumdenom file from the merged Surveillance Epidemiology and End Results (SEER)-Medicare data files created in 2003 (11). This file contains a random sample of 5% of women ≥65 years of age living in SEER areas who had no history of cancer from 1973 to 1999 (n = 109,138). Further, we used the Medicare claims files to exclude women who developed cancer from 2000 to 2002, the end of our study period (n = 9,700). This resulted in 99,438 women available to study.

Consistent with other studies using Medicare data, we excluded those beneficiaries who did not have both Medicare Part A and Part B (n = 7,909), were enrolled in managed care (n = 31,781) or a hospice program (n = 2,541), had end-stage renal disease (n = 39), or did not reside in the SEER areas during the entire study period (n = 2,626). This resulted in 54,542 eligible women.

Medicare claims data from 1997 to 1998 were used to identify women with diabetes on 1 January 1999. We used our validated algorithm that we recently reported (12) had a sensitivity of 90%, a specificity of 97%, and a positive predictive value of 93% for identifying Medicare beneficiaries with diabetes (13). A total of 8,232 women ≥67 years of age were identified as having diabetes.

Medicare national claims history and outpatient files were used to determine the study outcomes, 1999–2000 for mammography and bone density testing and 1999–2002 for colorectal cancer screening. These periods were based on Medicare reimbursement policy: 24 months for bone density testing, 48 months for colorectal cancer screening, and 24 months for mammography (the commonly used period in literature).

The Healthcare Financing Administration Common Procedure Coding Sys-

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Abbreviations: ADA, American Diabetes Association; CDC, Centers for Disease Control and Prevention; CMS, Centers for Medicare and Medicaid Services; HCPCS, Healthcare Common Procedure Coding System; SEER, Surveillance, Epidemiology, and End Results.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

tem (HCPCS) codes 76090–76092, G0202–G0207, and G0236 and the ICD-9-CM code V76.12 were used to identify mammograms. HCPCS codes G0104–G0106 and G0120–G0122 or HCPCS codes 44388, 44389, 44392, 44394, 45378, 45380, 45383–45385, 45300, 45305, 45308, 45309, 45315, 45320, 45330, 45331, 45333, 45338, 45339, 74270, and 74280 accompanied by ICD-9-CM codes V76.41 and V76.51 were used to identify colorectal cancer screening. Bone density testing was identified using HCPCS codes G0130–G0133, 76070, 76071, 76075, 76076, 76078, 76977, 78350, and 78351 and ICD-9-CM procedure code 88.98 (8).

In addition to age and race, two other covariates that could influence the use of these services were obtained from the Sumdenom file: Medicaid program participation and rural residence. The 2000 U.S. Census Bureau ST3 file was used to determine the median household income for each person's zip code of residence. The Medicare claims files from 1997 to 1998 were used to determine whether a person had been hospitalized, and, if so, whether in a teaching or a nonteaching hospital; the specialties of physicians providing care to the beneficiary; comorbidities; and the average annual number of physician visits.

Using the specialty identification codes available in the Medicare data, physicians were grouped into primary care (01 general practice, 08 family practice, 11 internal medicine, 38 geriatric medicine, and 70 multispecialty group practice), ob/gyn (16 ob/gyn), endocrinology (46 endocrinologist), and other (all other provider codes). If a woman was ever seen by an endocrinologist or if ever seen by an ob/gyn, she was put in the appropriate group. If she was seen by both of these specialists, she was put in the endocrinologist plus ob/gyn group. Among the remaining women, those seen by a primary care physician were put in that group. Those women not included in the prior groups were put into the category "other," which included women who had no physician visit in 1997 or 1998 (<1%).

Consistent with the recommendation of Klabunde et al. (14), we examined the Medicare files to identify comorbidities and used the Charlson Index to categorize and weigh them. Because all individuals with diabetes would have a Charlson score ≥1, diabetes was excluded when calculating the Charlson scores.

As a measure of diabetes preventive service use, we adopted the method of Tabaei et al. (9) and simply summed the diabetes preventive services received by diabetic women in 1997 and 1998 that we could measure using the Medicare administrative data (A1C and LDL cholesterol testing and eye examination).

We used the propensity score matching method to create an appropriate comparison population of women with no history of diabetes (15). These latter women were also identified in the SEER-Medicare Sumdenom file. The propensity score for having diabetes or not having diabetes for each woman was obtained from logistic regression in which all of the covariables mentioned above were used as predictors. Each woman with diabetes was matched with an elderly woman without diabetes living in the same SEER area whose propensity score was nearest to that of the person with diabetes but within 0.5 of the SD of the score of the person with diabetes (one-to-one nearest neighbor method). The psmatch2 module in Stata 9.1 was used for this matching procedure (16).

Analyses were performed on the matched cohorts (8,197 in each group). Univariate and bivariate analyses were performed to describe and compare the populations and their use of services. Differences between cohorts were tested using the *Z* test. Multivariate logistic regression analyses were carried out on the cohort of women with diabetes for each preventive service to examine the impact of the covariates described above upon receipt of each service while simultaneously adjusting for the others. To adjust for possible geographical difference between SEER areas, we used the generalized estimate equation model with geographic areas as the cluster variable. Differences were deemed statistically significant if the 95% CI did not include 1.00. All statistical analyses used SAS (SAS GENMOD, version 9.1 for Windows; SAS Institute, Cary, NC).

RESULTS — The distributions of the demographic, clinical, and health service characteristics of those with diabetes and the comparison population were similar, except that even after the propensity score matching, a slightly higher percentage of women without diabetes was seen by primary care physicians (Table 1).

Women with diabetes were less likely than those without diabetes to receive each of the three services (Table 2). The crude and age-adjusted rate ratios (women with diabetes/women without diabetes) were 0.92 for mammography, 0.83 for colorectal cancer screening, and 0.70 for bone density testing ($P < 0.0001$ for each service). Multivariate analysis, which included all women in the study and was adjusted for all of the covariates in Table 2, confirmed all three findings with significantly different adjusted ORs of 0.83 (95% CI 0.78–0.88) for mammography, 0.79 (0.70–0.88) for colorectal screening, and 0.63 (0.58–0.69) for bone density testing.

For the two cancer screening tests, the age-adjusted rates among diabetic women were significantly lower for almost all of the patient and health service characteristics compared with the rates among those without diabetes. The only exceptions were for those subgroups that tended to have the lowest rates: women ≥85 years of age, those of black or "other" races/ethnicities, those in a state Medicaid-operated programs, and those seen by "other" physicians (Table 2). For bone density testing, the age-adjusted rates were significantly lower for all of the subcategories of patient and health service characteristics among women with diabetes compared with those without diabetes. For those patient and health services characteristics in which significant differences ($P < 0.05$) in the age-adjusted rates were found between those with diabetes and those without, the rates among those with diabetes were generally between 65 and 77% of the rates among the women without diabetes.

Among diabetic women, having visited an endocrinologist and/or an ob/gyn increased the use of each of the preventive services compared with visiting only primary care physicians. Among women with diabetes, age-adjusted mammography rates were 14% greater among women who had seen an endocrinologist (40.7 of 100) than among women who had seen primary care physicians (35.9 of 100; $P = 0.0418$). Women with diabetes who saw endocrinologists were 78% more likely to have bone density testing (19.7 of 100 vs. 11.1 of 100; $P < 0.0001$), but no more likely to have colorectal cancer screening. However, those women with diabetes who visited an ob/gyn had the highest rates of use for all three preventive services. Compared with those who saw only primary care physicians, the rates were 69% higher for mammography, 59% higher for colorectal cancer screening, and twice as great for bone

Table 1—*Study subject characteristics*

	With diabetes	Without diabetes	*P*
Total	8,197 (100.0)	8,197 (100.0)	
Age group (years)			
67–74	3,549 (43.3)	3,509 (42.8)	0.0585
75–84	3,453 (42.1)	3,384 (41.3)	
85+	1,195 (14.6)	1,304 (15.9)	
Race			
White	5,968 (72.8)	6,010 (73.3)	0.7237
Black	1,041 (12.7)	1,011 (12.3)	
Other	1,188 (14.5)	1,176 (14.3)	
Rural residence			
No	7,238 (88.3)	7,239 (88.3)	0.9806
Yes	959 (11.7)	958 (11.7)	
State Medicaid program			
No	5,782 (70.5)	5,805 (70.8)	0.6932
Yes	2,415 (29.5)	2,392 (29.2)	
Median household income of zip code ($)			
<40,000	2,900 (35.4)	2,925 (35.7)	0.8792
40,000–51,999	2,844 (34.7)	2,846 (34.7)	
≥52,000	2,453 (29.9)	2,426 (29.6)	
Hospitalization history			
Not hospitalized	4,744 (57.9)	4,723 (57.6)	0.3308
Hospitalized (nonteaching)	1,581 (19.3)	1,651 (20.1)	
Hospitalized (teaching)	1,872 (22.8)	1,823 (22.2)	
Charlson score			
0	2,007 (24.5)	2,038 (24.9)	0.6763
1	1,473 (18.0)	1,498 (18.3)	
≥2	4,717 (57.5)	4,661 (56.9)	
Medical specialty			
Primary care	6,201 (75.6)	6,444 (78.6)	<0.0001
Endocrinologist	491 (6.0)	357 (4.4)	
Ob/gyn	998 (12.2)	950 (11.6)	
Endocrinologist plus ob/gyn	151 (1.8)	130 (1.6)	
Other	356 (4.3)	316 (3.9)	
Average number of physician visits per year			
0–4	2,398 (29.3)	2,396 (29.2)	0.0976
5–9	2,955 (36.0)	3,017 (36.8)	
10–14	1,606 (19.6)	1,583 (19.3)	
≥15	1,238 (15.1)	1,201 (14.7)	
Number of different diabetes preventive services received			
0	926 (11.3)		
1	2,193 (26.8)		
2	2,983 (36.4)		
3	2,095 (25.6)		

Data are *n* (%).

density testing ($P < 0.0001$ for each comparison). They were 49, 50, and 12% higher, respectively, among those who saw an ob/gyn compared with those who saw an endocrinologist ($P < 0.0001$, $P = 0.0001$, and $P = 0.3058$, respectively). The rates among those few women who visited both an endocrinologist and an ob/gyn were not significantly different from the rates among those who saw only an ob/gyn.

The multivariate analysis performed only on those women with diabetes (Table 3) confirmed the importance of visiting an ob/gyn compared with only visiting a primary care physician to achieve the highest rates of preventive service use. The adjusted relative odds of receiving a service among those who visited an ob/gyn ranged from 1.57 for colorectal screening to 2.80 for mammography. Only for bone density testing did visiting an endocrinologist result in significantly increased use of service over visiting only primary care physicians.

The multivariate model showed the following consistent results across all three screening rates: rates decreased with age and were lower for those in state Medicaid administered programs, were hospitalized in the prior 2 years, had the highest Charlson scores, and had less than five physician visits per year in the prior 2 years compared with those with

Table 2—*Crude, age-specific, and age-adjusted rates of preventive service use among elderly Medicare women*

	Mammogram			Colorectal cancer screening			Bone density testing		
	With diabetes	Without diabetes	*P**	With diabetes	Without diabetes	*P**	With diabetes	Without diabetes	*P**
Crude rate	39.8	42.8	<0.0001	14.9	17.8	<0.0001	13.0	18.3	<0.0001
Age-specific rates (total)									
67–74 (ref.)	52.0	55.5	0.0029	19.7	23.8	<0.0001	16.7	22.8	<0.0001
75–84	37.1	41.3	0.0004	13.4	16.5	0.0004	12.2	17.7	<0.0001
85+	11.5	12.7	0.3319	4.9	4.8	0.9793	4.1	7.5	0.0002
Age-adjusted rates (total)	39.6	43.0	<0.0001	14.8	17.9	<0.0001	12.9	18.3	<0.0001
Race									
White	41.4	45.9	<0.0001	15.5	19.1	<0.0001	13.6	19.8	<0.0001
Black	36.8	37.3	0.8305	15.6	15.6	0.9733	6.6	9.1	0.0338
Other	33.5	33.8	0.8705	11.3	13.9	0.0549	14.8	19.0	0.0068
Rural residence									
No	39.9	43.0	0.0001	14.9	17.8	<0.0001	13.6	19.4	<0.0001
Yes	37.3	42.8	0.0132	14.2	18.0	0.0215	7.5	10.3	0.0296
State Medicaid program									
No	44.5	48.9	<0.0001	16.3	20.5	<0.0001	14.3	20.8	<0.0001
Yes	27.5	28.2	0.5825	11.2	11.1	0.9130	9.5	12.2	0.0023
Median household income of zip code ($)									
<40,000	36.3	39.3	0.0175	14.0	16.7	0.0040	10.2	15.1	<0.0001
40,000–51,999	40.7	43.1	0.0741	14.6	17.4	0.0039	14.4	18.7	<0.0001
≥52,000	42.2	47.4	0.0003	16.1	19.7	0.0010	14.6	21.9	<0.0001
Hospitalization history									
Not hospitalized	44.7	46.8	0.0406	16.5	19.5	0.0001	13.9	20.2	<0.0001
Hospitalized (nonteaching)	30.3	36.7	0.0001	11.4	14.4	0.0109	11.6	15.3	0.0021
Hospitalized (teaching)	33.8	38.3	0.0042	13.0	16.1	0.0076	11.4	15.9	0.0001
Charlson score									
0	45.8	50.1	0.0065	15.9	20.5	0.0001	12.9	19.3	<0.0001
1	42.4	46.9	0.0137	16.9	19.2	0.1074	14.4	20.9	<0.0001
≥2	36.0	38.4	0.0155	13.7	16.0	0.0015	12.4	17.0	<0.0001
Medical specialty									
Primary care	35.9	39.5	<0.0001	13.7	16.1	0.0001	11.1	16.4	<0.0001
Endocrinologist	40.7	48.6	0.0219	14.5	19.5	0.0545	19.7	25.4	0.0496
Ob/gyn	60.7	66.1	0.0135	21.7	27.3	0.0041	21.9	29.7	0.0001
Endocrinologist plus ob/gyn	67.4	70.5	0.5779	22.3	29.4	0.1763	20.5	29.4	0.0829
Other	30.8	26.1	0.1783	10.8	14.3	0.1682	4.9	8.0	0.1048
Average number of physician visits per year									
0–4	27.2	30.6	0.0101	9.9	12.2	0.0092	6.2	10.9	<0.0001
5–9	43.8	46.4	0.0415	15.5	18.9	0.0005	12.9	18.0	<0.0001
10–14	45.0	47.7	0.1220	17.6	20.5	0.0339	16.1	21.7	<0.0001
≥15	45.1	51.9	0.0008	18.7	22.6	0.0166	21.0	29.3	<0.0001
Number of different diabetes preventive services received									
0	19.7	NA		8.7	NA		6.2	NA	
1	32.7	NA		12.0	NA		9.7	NA	
2	41.4	NA		15.1	NA		14.0	NA	
3	52.3	NA		19.7	NA		17.3	NA	

Data are percentages. **P* values for the difference between women with and without diabetes.

more visits, or did not have any diabetes preventive service in the prior 2 years. In addition, there were significant decreasing trends for all three services with increasing Charlson scores. Increasing trends were associated with an increasing number of physician visits and with receiving an increasing number of diabetes preventive services.

CONCLUSIONS — The dominant finding is that elderly women with diabetes had significantly lower preventive health service use rates than women without diabetes. The lower use of these three preventive services are important findings because women with diabetes are reported to be at a higher risk for colorectal cancer incidence and mortality (17,18) and face the same risks for breast cancer and osteoporosis. The most striking pos-

Table 3—*ORs and 95% CIs for patient and health service covariates among women with diabetes*

	Mammogram		Colorectal cancer screening		Bone density testing	
	OR (95% CI)	*P**	OR (95% CI)	*P*	OR (95% CI)	*P*
Age (per 10 years)	0.41 (0.38–0.43)		0.53 (0.50–0.57)		0.59 (0.52–0.66)	
Race						
White (ref.)						
Black	1.10 (0.94–1.29)		1.18 (0.94–1.48)		0.43 (0.36–0.50)	
Other	0.84 (0.75–0.93)		0.74 (0.59–0.91)		1.22 (1.05–1.41)	
Rural residence						
No						
Yes	1.00 (0.73–1.36)		1.04 (0.85–1.26)		0.71 (0.58–0.87)	
State Medicaid program						
No						
Yes	0.56 (0.50–0.61)		0.77 (0.72–0.83)		0.67 (0.54–0.82)	
Median household income of zip code ($)						
<40,000 (ref.)		0.6454		0.5214		0.7907
40,000–51,999	1.05 (0.93–1.19)		0.97 (0.82–1.15)		1.05 (0.90–1.23)	
≥52,000	1.06 (0.83–1.34)		1.07 (0.88–1.29)		0.95 (0.64–1.41)	
Hospitalization history						
Not hospitalized (ref.)						
Hospitalized (nonteaching)	0.61 (0.52–0.72)		0.69 (0.59–0.80)		0.87 (0.76–0.98)	
Hospitalized (teaching)	0.62 (0.53–0.74)		0.74 (0.63–0.86)		0.71 (0.60–0.84)	
Charlson score						
0 (ref.)		<0.0001		0.0009		<0.0001
1	0.87 (0.76–0.99)		1.04 (0.90–1.20)		1.05 (0.87–1.27)	
≥2	0.65 (0.58–0.72)		0.81 (0.71–0.92)		0.84 (0.78–0.92)	
Medical specialty						
Primary care (ref.)						
Endocrinologist	1.07 (0.85–1.34)		0.92 (0.71–1.20)		1.63 (1.35–1.96)	
Ob/gyn	2.80 (2.36–3.31)		1.57 (1.38–1.79)		1.73 (1.42–2.13)	
Endo plus ob/gyn	3.04 (2.33–3.96)		1.36 (0.76–2.42)		1.35 (1.09–1.66)	
Other	1.01 (0.84–1.22)		0.93 (0.61–1.43)		0.59 (0.31–1.13)	
Average number of physician visits per year						
0–4 (ref.)		<0.0001		<0.0001		<0.0001
5–9	1.82 (1.61–2.05)		1.50 (1.30–1.72)		1.68 (1.51–1.86)	
10–14	2.09 (1.87–2.32)		1.84 (1.53–2.22)		2.23 (2.00–2.50)	
≥15	2.26 (1.89–2.69)		2.15 (1.61–2.88)		3.03 (2.51–3.66)	
Number of different diabetes preventive services received						
0 (ref.)		<0.0001		<0.0001		0.0125
1	1.76 (1.43–2.18)		1.26 (1.07–1.47)		1.40 (0.86–2.26)	
2	2.29 (1.75–3.00)		1.50 (1.32–1.70)		1.84 (1.14–2.98)	
3	3.42 (2.57–4.55)		1.95 (1.67–2.28)		2.20 (1.41–3.42)	

**P* values are for a linear trend test of ORs.

itive finding among those with diabetes was the association of receiving care from an ob/gyn with the highest rates of preventive service use. Our findings are consistent with recent reports regarding mammography use among the managed-care enrollees (Michigan) (9) and younger women (Ontario) (10) cited earlier. This study extends those findings to elderly Medicare beneficiaries living in the widely located more-representative SEER areas.

Others have also reported higher rates of mammography among women who visited ob/gyns in studies that included women with and without diabetes. The reasons for the strong positive associations are not clear (19,20). Wallace et al. (20) suggested that primary care physicians may defer to ob/gyns for female-specific screening. While this might explain differences we found for mammography and bone density testing, it would not apply to our findings regarding colorectal cancer screening. Also, deferring this care to ob/gyns would not be good policy or practice for the elderly because we found that only 12% of elderly women visited an ob/gyn over a 2-year period. Thus, leaving screening or screening motivation/scheduling to ob/gyns would be inadequate. Receipt of cancer screening care scheduling or motivation from endocrinologists would not solve the problem either because too few women with diabetes (6.0%) were seen by endocrinologists. If we are to achieve the "best practice" levels of care seen in women treated by ob/gyns, then the use of these services will have to be promoted more effectively by primary care physicians and others. While we found the strongest associations with visiting an ob/

gyn, we are reluctant to attribute causality because it may be that the women who see or seek these physicians may be more prevention oriented. Nonetheless, our study met the criteria recently listed for addressing selection bias in studies such as ours (21).

Among women with diabetes, perhaps the most disturbing finding was that those who were in Medicaid-administered programs were only about two-thirds as likely to receive any of the services (Table 2). The relative odds in the multivariate analysis were similar: 0.56 for mammography, 0.77 for colorectal screening, and 0.67 for bone density testing (Table 3). Women in these programs are likely to be nursing home residents with multiple chronic conditions with fewer visits to endocrinologists or ob/gyns, which might explain the lower age-adjusted rates. However, this would not explain why there was such a large difference after adjusting for all of the covariates.

It is not surprising that the use of the screening services declined with age. This has been reported for mammography (22) and bone density testing (23), and it likely reflects the strict adherence to guidelines to mammography published by organizations other than Centers for Medicare and Medicaid Services (CMS), as well as patient and physician preferences. Bynum et al. (22) reported that health status, as measured by the propensity to die, was independently associated with screening mammography use in the Medicare population. In our fully adjusted analysis, we, too, found that those with the highest Charlson scores were significantly less likely to receive any of the three services (adjusted OR 0.65 for mammography, 0.81 for colorectal cancer screening, and 0.84 for bone density testing).

Among postmenopausal women, bone mineral density is highest among blacks, and osteoporotic fracture rates, including hip fracture, are highest among whites (23,24). In addition, postmenopausal black women do not perceive osteoporosis as a health risk (25). These factors may explain the large difference in the bone density measurement rates by race.

There are several ways in which parity might be achieved in the use of preventive services we examined (1). The ADA should include specific recommendations for cancer screening and bone density testing in the Standards of Medical Care in Diabetes (26). This should be combined with specific recommendations for people with diabetes in guidelines from federal or national organizations that promote the use of prevention services but are not primarily or uniquely concerned with diabetes such as the CDC, the National Cancer Institute, the American Cancer Society, and the CMS. An example of such joint advocacy leading to success in the promotion of preventive services among people with diabetes was the effort to encourage influenza and pnuemococcal immunization. During the 1990s, the CDC, the CMS, and the ADA all stressed that elderly individuals with diabetes should be vaccinated (26–28). As a result, in 2001, rates of influenza and pneumococcal vaccination were higher in individuals with diabetes ≥65 years of age compared with the total elderly population (influenza, 72.4 vs. 67.3%; pneumococcal, 65.8 vs. 62.5%) (29). To our knowledge, there has been no particular advocacy for cancer or osteoporosis screening among women with diabetes (2). Office-based interventions to identify individuals with diabetes and their preventive service needs should be expanded. Examples of these interventions include electronic reminder systems, specific guidelines for disease management, and disease management programs involving different types of providers (3). Physician awareness of patients with low health literacy needs to increase. Interventions should be implemented to address these needs in individuals with diabetes who are at a higher risk of not receiving preventive services. In our study, individuals with low literacy were likely overrepresented in the group who were state Medicaid program beneficiaries, a group that had among the lowest rates of preventive service use. Over 33% of the elderly are reported to have marginal or inadequate health literacy (30), and people with low health literacy are less likely to achieve tight glycemic control and more likely to have poor glycemic control (31). Elderly Medicare beneficiaries with inadequate health literacy are less likely to receive preventive services (mammograms, Pap smears, and influenza and pneumococcal vaccination) (32). Practicing physicians and residents routinely overestimate patients' literacy levels (33–35). Fortunately, there have been reports of interventions successful at improving diabetes care directed at people with diabetes with low health literacy (36,37), as well as successful training programs to increase literacy knowledge among family medicine residents (38).

The major strengths of this study include the large size of the population studied, the use of SEER areas that are representative of the U.S. population, the accuracy of the SEER diagnoses, and the ability to exclude women with histories of breast and colorectal cancer from the study. These latter women would likely have had mammograms or colorectal tests that were part of follow-up for their cancer that would not be screening examinations. Excluding these women increased the probability that the tests we counted were truly for screening. An additional strength of the study is that the propensity score matching made the diabetes and nondiabetes study groups more comparable in terms of the observable characteristics. Thus, the differences we found between these two groups in the use of preventive services were more likely due to having diabetes and less likely due to potential confounders. Our study could be strengthened in several ways. Because of data limitations, we were obliged to use zip code–level rather than individual-level income information, which introduces the possibility of ecologic bias. Also, we did not have information to measure practice characteristics such as size and volume, use of information systems, or availability of diabetes care management programs.

In conclusion, elderly women with diabetes are less likely than women without diabetes to receive the three recommended preventive services we examined. If we are to achieve parity, then it may be necessary to issue additional guidelines emphasizing preventive care and initiate practice-based improvements targeting those at greatest risk of not receiving these services.

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