Title

Income-related differences in the use of evidence-based therapies in older persons with diabetes mellitus in for-profit managed care

Journal

JOURNAL OF THE AMERICAN GERIATRICS SOCIETY, 51(5)

ISSN

0002-8614

Authors

Brown, AF
Gross, AG
Gutierrez, PR
et al.

Publication Date

2003-05-01

DOI

10.1034/j.1600-0579.2003.00211.x

Peer reviewed

Income-Related Differences in the Use of Evidence-Based Therapies in Older Persons with Diabetes Mellitus in For-Profit Managed Care

Arleen F. Brown, MD, PhD, Amy G. Gross,† Peter R. Gutierrez, MS,* Luohua Jiang, MS,* Martin F. Shapiro, MD, PhD,* and Carol M. Mangione, MD, MSPH**

OBJECTIVES: To determine whether income influences evidence-based medication use by older persons with diabetes mellitus in managed care who have the same prescription drug benefit.

DESIGN: Observational cohort design with telephone interviews and clinical examinations.

SETTING: Managed care provider groups that contract with one large network-model health plan in Los Angeles County.

PARTICIPANTS: A random sample of community-dwelling Medicare beneficiaries with diabetes mellitus aged 65 and older covered by the same pharmacy benefit.

MEASUREMENTS: Patients reported their sociodemographic and clinical characteristics. Annual household income (≥$20,000 or <$20,000) was the primary predictor. The outcome variable was use of evidence-based therapies determined by a review of all current medications brought to the clinical examination. The medications studied included use of any cholesterol-lowering medications, use of 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitors (statins) for cholesterol lowering, aspirin for primary and secondary prevention of cardiovascular disease, and angiotensin-converting enzyme (ACE) inhibitors in those with diabetic nephropathy. The influence of income on evidence-based medication use was adjusted for other patient characteristics.

RESULTS: The cohort consisted of 301 persons with diabetes mellitus, of whom 53% had annual household income under $20,000. In unadjusted analyses, there were lower rates of use of all evidence-based therapies and lower rates of statin use for persons with annual income under $20,000 than for higher-income persons. In multivariate models, statin use was observed in 57% of higher-income versus 30% of lower-income respondents with a history of hyperlipidemia ($P = .01$) and 66% of higher-income versus 29% of lower-income respondents with a history of myocardial infarction ($P = .03$). There were no differences by income in the rates of aspirin or ACE inhibitor use.

CONCLUSION: Among these Medicare managed care beneficiaries with diabetes mellitus, all of whom had the same pharmacy benefit, there were low rates of use of evidence-based therapies overall and substantially lower use of statins by poorer persons. **J Am Geriatr Soc 51:665–670, 2003.**

Key words: diabetes; managed care; evidence-based medications; income; cost sharing

Several therapies reduce the complications and mortality associated with diabetes mellitus (DM).[1,2] Lipid-lowering agents such as fibrates,[3] 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitors (statins),[4,5] and aspirin[6] provide primary and secondary prevention of cardiovascular disease (CVD), whereas angiotensin-converting enzyme (ACE) inhibitors prevent the development or progression of nephropathy[7] and reduce morbidity[8,9] and mortality.[10] However, in older persons, prior data suggest underuse of evidence-based cardiovascular therapies such as statins for hyperlipidemia[11] and after myocardial infarction,[12] aspirin after myocardial infarction,[13–15] and ACE inhibitors.[15] The reasons for this apparent undertreatment in elders at risk for CVD is unclear, but income and insurance status may influence use of recommended therapies.

In Medicare beneficiaries with chronic disease, not having prescription drug coverage is associated with lower rates of evidence-based medication use.[16–18] Even older

From the *Division of General Internal Medicine and Health Services Research, UCLA School of Medicine, Los Angeles, California; and †Hahnemann University School of Medicine, Philadelphia, Pennsylvania.

Dr. Brown was supported by the Robert Wood Johnson Clinical Scholars Program, the Minority Faculty Development Program (Grant 037214), and the Agency for Healthcare Research and Quality Grant F32 HS00132. Dr. Mangione was supported by the Robert Wood Johnson Generalist Scholar Program (Grant 029250) and the Agency for Healthcare Research and Quality (Grant 1RO1 HS09424). Project infrastructure was provided by the Robert Wood Johnson Foundation (Grant 032072). Ms. Gross was supported by the John A. Hartford/AFAR Medical Student Geriatric Scholars Program.

Address correspondence to Arleen F. Brown, MD, PhD, 911 Broxton Plaza, UCLA GIM and HSR, Box 95–1736, Los Angeles, CA 90095. E-mail: abrown@mednet.ucla.edu

0002-8614/03/$15.00

persons with outpatient prescription drug coverage may be at additional risk for not receiving recommended therapies when they face high levels of cost sharing for prescription medications.[19]

This study examined the influence of income on the use of evidence-based therapies by older persons with type 2 DM who are covered by the same pharmacy benefit, with a higher copayment for proprietary than generic medications. Because no generic forms were available for statins, it was hypothesized that poorer persons would have lower rates of statin use than higher income persons but comparable rates of aspirin and ACE inhibitor use, which were available in less-expensive, generic form.

METHODS

Patient Population

This observational cohort study was conducted in a randomly selected sample of Medicare managed care beneficiaries identified through the DM registry of a large for-profit network-model health plan between June 1998 and October 1999. Participants were cared for in one of 11 physician groups in Los Angeles County that contract with the participating health plan, and all received the same pharmacy benefit. All patients faced a copayment of $5 for each generic prescription medication filled and $10 for each proprietary prescription medication, with a maximum drug benefit of $2,000 per year. Latinos, African Americans, and Medicaid recipients were oversampled by three times to ensure adequate representation for subgroup analyses. Persons who were diagnosed with DM after age 30, took oral antidiabetic agents or insulin, were aged 65 and older, had been continuously enrolled in the health plan for a minimum of 18 months, and were able to give informed consent for research participation were eligible for the study. Patients were excluded from the study if they were nursing home residents, did not speak English, or could not complete the telephone interview because of illness or difficulty hearing.

Data Collection

Telephone interviews were conducted with all study participants. Data collection included sociodemographic and clinical characteristics, comorbid illness using self-reported comorbidity,[20] and health status using the Medical Outcomes Study Short Form 12.[21] Participants who agreed to come to the University of California at Los Angeles (UCLA) for the clinical examination portion of the study were asked to bring all their current prescription medications. Trained research assistants who were masked to the study objectives reviewed and documented these medications. Study subjects also underwent a clinical examination that included measurement of vital signs, detailed eye and foot examination, phlebotomy for hemoglobinA_{1c} and serum creatinine measurements, and a urine test for microalbumin level.

Statistical Analyses

Definition of Indicated Medication Use for High Cholesterol, Coronary Heart Disease, and Diabetic Nephropathy

Persons with high cholesterol were identified through self-report. Coronary heart disease (CHD) was defined as self-report of past myocardial infarction (MI), coronary artery bypass surgery, or percutaneous transluminal coronary angioplasty. Diabetic nephropathy was defined as proteinuria on the urine dipstick or a spot-urine albumin-to-creatinine ratio of greater than 30 μg/mg as measured in the study examination.

Medical Comorbidity

An unweighted sum of chronic medical conditions was computed for all study participants. Estimates of medical comorbidity were derived from a score that excluded DM. For analyses that included the entire study population, the unweighted comorbidity sum included high blood pressure, asthma, chronic obstructive lung disease, peptic ulcer disease (PUD), MI, congestive heart failure, kidney disease, dialysis, liver disease, hematological diseases, cancer, depression, degenerative arthritis, rheumatoid arthritis, and stroke. For the subgroup with CHD, MI was excluded from the unweighted comorbidity score because this was the index condition rather than a comorbidity in these analyses. For persons with diabetic nephropathy, the score did not include kidney disease or dialysis. For aspirin use, the comorbidity score did not include PUD, but self-reported PUD was used as an adjuster in the models of aspirin use.

Model Specifications

The dependent variables evaluated were medication use for primary and secondary prevention of CVD and diabetic nephropathy. The therapies under evaluation included the use of any cholesterol-lowering agents for all patients in the cohort, for persons who reported elevated cholesterol, and for persons with CHD; statin use for all patients in the cohort, persons with elevated cholesterol, and those with CHD; aspirin use for primary and secondary prevention of CVD; and ACE inhibitor and angiotensin receptor blocker (ARB) use to prevent progression of proteinuria. The primary predictor variable was income, reported in categories from $0 to $4,999, $5,000 to $19,999, $20,000 to $39,999, $40,000 to $59,999, $60,000 to $79,999, and $80,000 or more per year in 1998–99. To test whether lower-income Medicare managed care enrollees with DM were less likely to receive indicated medications for the primary and secondary prevention of CVD and diabetic nephropathy, based on the observed distribution of the data and sample size considerations, annual household income was dichotomized at $20,000. To ensure that the observed relationships between medication use and income were not a function of the $20,000 cutpoint, income as an ordered categorical variable was also evaluated.

For bivariate and multivariate analyses, the data were weighted to reflect the original eligible populations in the fielded samples, thereby adjusting for oversampling of African Americans, Latinos, and Medicaid recipients. Weighted bivariate tests of association comparing evidence-based medication use by income were performed using chi-square tests, and comparisons were considered statistically significant if the P-value was $\leq .05$. The tables show the actual numbers before applying the weights and weighted percentages and means. The chi-square analyses for the full sample tested the association between income and use of any lipid-lowering agent, statins, aspirin, and ACE inhibitors. All classes of lipid-lowering agents, statins alone, and aspirin

were evaluated in the entire study population, persons with known high cholesterol, and those with known CHD. ACE inhibitor use was evaluated with and without ARB use, because, although it is now known that ARBs have similar beneficial effects as ACE inhibitors,[22] at the time these data were collected, evidence was not available on the long-term cardiovascular and renal protective effects of the ARBs. ACE inhibitor use and ARB use were also evaluated in persons with diabetic nephropathy, which was defined as evidence of microalbuminuria or proteinuria, excluding persons on hemodialysis. Because small numbers of enrollees received Medicaid benefits, supplemental insurance both with and without Medicaid was evaluated.

A number of individual sociodemographic and clinical characteristics could have confounded the relationship between income and medication use; therefore, weighted multivariate models were constructed using logistic regression to examine the main effect of income while controlling for other characteristics. All models were adjusted for age, sex, race/ethnicity, Medicaid and other supplemental insurance coverage, education, medical comorbidity, and health status using the physical component summary (PCS-12) and mental component summary (MCS-12) of the Medical Outcomes Study Short Form 12.[21]

Several models were constructed to evaluate the use of lipid-lowering therapy overall and specifically the use of statins, which are more costly than many of the other cholesterol-lowering agents but are taken once daily. First, regression models described the use of lipid-lowering agents overall and statins specifically in the entire study sample. These models were repeated in three subgroups: persons with high cholesterol, known CHD, and a prior MI. All aspirin models were adjusted for PUD, which may be a relative contraindication to aspirin use. Additionally, because the combination of aspirin and warfarin increase the risk of bleeding, the multivariate model of aspirin use excluded the study participants on warfarin. A model was constructed using the entire study sample to evaluate the relationship between ACE inhibitor use and income. The model was subsequently refined to exclude participants on dialysis and to include only those with clinical evidence of diabetic nephropathy in the study's laboratory examination.

Predicted probabilities were generated from the logistic regression models by setting the values of the covariates in the model to their mean values for the entire study population. Predictions were then made setting the indicator for low income to zero (annual household income ≥$20,000) or one (annual household income <$20,000). This resulted in predictions for a hypothetical "mean" person under the two income levels. The standard errors of these predicted probabilities were obtained by propagating the estimated covariance matrix of the logistic regression coefficients through the logistic transform via the delta method.[23] These analyses were repeated by allowing the covariates to vary; no significant difference was found in the outcomes. The results presented here use the mean values for the covariates. All analyses were performed using Stata, Version 7.0 (Stata Corporation, College Station, TX).

RESULTS

Study Sample

There was a 65% response rate among the 474 persons invited to participate in the medication study. Data on in-

Table 1. Sociodemographic and Clinical Characteristics of Medicare Managed Care Study Participants by Income

Characteristic	Annual Household Income ≥$20,000 (n = 140)	Annual Household Income <$20,000 (n = 161)	*P*-value
Age, mean ± SD	74.2 ± 4.7	75.7 ± 6.6	**.02**
Female, n (%)	42 (34)	98 (62)	**<.001**
White, n (%)	81 (64)	73 (50)	.02
Latino, n (%)	30 (20)	34 (22)	.69
African American, n (%)	17 (7)	35 (16)	**.005**
Asian Pacific Islander, n (%)	10 (8)	7 (4)	.21
High school graduate, n (%)	120 (88)	98 (54)	**<.001**
Medicaid, n (%)	6 (2)	16 (3)	.14
Supplemental insurance, n (%)	10 (8)	2 (1)	**<.001**
Live alone, n (%)	28 (22)	63 (37)	**.01**
Comorbidity score (unweighted), mean ± SD	2.7 ± 1.7	3.0 ± 1.9	.13
PCS-12, mean ± SD	42.6 ± 11.5	38.8 ± 11.1	**.004**
MCS-12, mean ± SD	55.6 ± 7.3	53.1 ± 10.8	**.02**
Hyperlipidemia, n (%)	74 (55)	75 (52)	.64
Coronary heart disease, n (%)	43 (35)	49 (34)	.96
Prior myocardial infarction, n (%)	23 (19)	35 (23)	.36
Proteinuria or microalbuminuria, n (%)	63 (45)	82 (54)	.18
Mean number of medications, mean ± SD	5.6 ± 3.0	5.9 ± 3.1	.40

Note: Sample was weighted to reflect the original eligible populations in the fielded sample, adjusting for oversampling of African Americans, Latinos, and Medicaid recipients (unweighted n, weighted means and percentages).

come were missing for five of the study participants, leaving 469 patients eligible for these analyses. Persons who completed the examination were more likely to be male, white, higher income, and more educated and have more comorbid conditions and worse physical well-being than those who did not participate in the examination (data not shown). The 301 participants included 161 (53%) persons who had an annual household income under $20,000. Table 1 details the distribution of sociodemographic and clinical characteristics by annual household income. Persons who reported annual household income under $20,000 were older, more likely to be female and African American, and less likely to be white and have graduated from high school or have supplemental insurance other than Medicaid. Lower income persons also had lower mean PCS-12 and MCS-12 scores, although there were no differences by income in other clinical characteristics.

Medication Use: Prevalence Data

Table 2 presents medication use by income in selected clinical cohorts. Of all older persons with DM in the study, 18% of lower-income persons and 30% of those with income of $20,000 or more used statins ($P = .03$). Higher rates of use of cholesterol-lowering medication were observed for secondary prevention, but there was still significant variation in use by income. Of persons with high cholesterol, statins were being taken by only 35% of lower-income persons compared with 53% of persons with annual income over $20,000 ($P = .03$). Lower-income persons with a history of CHD reported significantly lower rates of taking any cholesterol-lowering medication (35% vs 57%) and statins (31% vs 55%). Finally, of persons with a history of prior MI, 29% of low-income and 65% of higher-income persons used statins ($P = .01$). No differences were observed in aspirin use in any of these subgroups. Moreover, in persons with evidence of proteinuria by history or physical examination, no difference by income in ACE inhibitor or ARB use was observed.

Multivariate Analyses of Evidence-Based Medication Use

Results of the multivariate analyses for medication use in the cohort are presented in Table 3. All models are adjusted for sociodemographic and clinical characteristics and health status. Lower rates of use of statins were observed in lower-income subgroups of patients with hyperlipidemia (30% vs 57%, $P = .01$) and CHD (29% vs 66%, $P = .03$) and a trend toward lower rates was observed in the cohort overall (18% vs 28%, $P = .06$). The relationships between income and statin use did not change appreciably when income was evaluated in four categories ($0–4,999, $5,000–19,999, $20,000–39,999, and >$40,000). There were no differences by income in the adjusted rates of aspirin or ACE inhibitor use (with or without ARBs). No significant differences were found in the results when supplemental insurance did not include Medicaid beneficiaries.

Because patient education may mediate the effect of income, the effect of education on the use of appropriate therapies for all models was evaluated. In adjusted analyses, education was not associated with use of statins, any lipid-lowering agents, or ACE inhibitor and/or ARB use, but persons who had not graduated from high school had lower rates of aspirin use in the cohort overall (11% vs

Table 2. Unadjusted Medication Use of 301 Medicare Managed Care Study Participants by Income

Medication	Annual Household Income, n (%) ≥$20,000	Annual Household Income, n (%) <$20,000	*P*-value
Any cholesterol-lowering medication			
All participants (n = 301)	42 (31)	38 (22)	.08
If high cholesterol (n = 149)	39 (56)	32 (40)	.08
If coronary heart disease (n = 95)	24 (57)	18 (35)	**.05**
If prior myocardial infarction (n = 58)	15 (65)	10 (29)	**.01**
Statin*			
All participants (n = 301)	40 (30)	32 (18)	**.03**
If high cholesterol (n = 149)	37 (53)	28 (35)	**.04**
If coronary heart disease (n = 95)	23 (55)	16 (31)	**.02**
If prior myocardial infarction (n = 58)	15 (65)	10 (29)	**.01**
Aspirin			
All participants (n = 301)	34 (26)	38 (22)	.50
If high cholesterol (n = 149)	26 (37)	21 (28)	.27
If coronary heart disease (n = 95)	21 (48)	25 (44)	.71
If prior myocardial infarction (n = 58)	10 (46)	16 (40)	.67
Angiotensin-converting enzyme inhibitor or angiotensin receptor blocker			
All participants (n = 301)	68 (51)	80 (50)	.82
Proteinuria† (n = 116)	27 (54)	29 (45)	.34

Note: Sample was weighted to reflect the original eligible populations in the fielded sample, adjusting for oversampling of African Americans, Latinos, and Medicaid recipients (unweighted n, weighted percentages).

* 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitor.

† Evidence of proteinuria on clinical examination; excludes patients on dialysis.

Table 3. Adjusted Predicted Probabilities of Evidence-Based Medication Use by Income by Elders with Diabetes Mellitus Enrolled in Medicare Managed Care

Medication	Annual Household Income, n (%)		*P*-value
	≥$20,000	<$20,000	
Any cholesterol-lowering medication			
All participants (n = 301)	29	21	.18
If high cholesterol (n = 149)	59	34	**.02**
If coronary heart disease (n = 95)	51	38	.27
If prior myocardial infarction (n = 58)	78	42	**.03**
Statin*			
All participants (n = 301)	28	18	.06
If high cholesterol (n = 149)	57	30	**.01**
If coronary heart disease (n = 95)	51	32	.11
If prior myocardial infarction (n = 58)	66	29	**.03**
Aspirin†			
All participants (n = 288)	22	24	.80
If high cholesterol (n = 144)	38	33	.70
If coronary heart disease (n = 88)	45	56	.46
If prior myocardial infarction (n = 53)	56	48	.74
Angiotensin-converting enzyme inhibitor or angiotensin receptor blocker			
All participants (n = 301)	46	46	.96
Proteinuria‡ (n = 116)	46	41	.81

Note: Adjusted for age, gender, race/ethnicity, education, supplemental insurance or Medicaid, living alone, and appropriate clinical characteristics.
* 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitor.
† Excludes persons taking warfarin. Also adjusted for peptic ulcer disease.
‡ Evidence of proteinuria on clinical examination; excludes patients on dialysis.

28%, $P = .01$), in persons with CHD (13% vs 67%, $P = .001$), and in those with a prior MI (6% vs 74%, $P = .02$) than those with more education. There were no interactions observed between income and education for any of the outcomes.

DISCUSSION

This study examined the use of statins, aspirin, and ACE inhibitors by older persons with DM enrolled in a managed care plan that provided the same pharmacy benefit to all Medicare enrollees and required higher copayments for branded than generic medications. Low rates of use were found for all evidence-based therapies studied. Nevertheless, although these rates did not differ by income for aspirin and ACE inhibitors, poorer persons were less likely to use statins than those with higher income. The lower rate of use of statins by poorer persons with CVD suggests that, even in the setting of equal pharmacy benefits, poorer persons are at risk for not receiving indicated therapies. It was also found that less-educated persons were less likely to use aspirin, both the cohort overall and among those with CHD or prior MI.

The low absolute rates of use of evidence-based cardiovascular and renal therapies are consistent with prior studies of this age cohort.[13–15,18,24] This study highlights sociodemographic differences among older persons that may have implications for DM care. Even though all patients in this study had the same copayment of $5 per generic prescription medication and $10 for proprietary prescription medication, there were significantly lower rates of statin use by the poorest study participants. The use of statins by the poorer participants, which were proprietary at the time these data were collected, may have been lower as a result of patient factors or provider behavior.

Copayments are a well-characterized demand-management strategy in managed care settings. The price-elasticity of demand for medications and other services for elders and Medicaid enrollees has been evaluated in prior research, and low-income persons appear to be particularly sensitive to cost sharing.[25] A reduction in use of essential medications by Medicaid beneficiaries has been observed after a copayment increase of only 50 cents.[25,26] Simulation models suggest that poor Medicare beneficiaries under fee-for-service and managed care spend a higher proportion of their income on out-of-pocket expenses than higher-income enrollees.[27] Because patients in the study were on an average of five or more medications, they may have been at high risk for reaching the annual $2,000 prescription drug limit early, leaving them responsible for the full cost of their medications through the end of the year. Thus, copayments and other out-of-pocket costs for prescription medications may represent a substantial percentage of their income. Lower-income persons may also make different choices about their medications than those with higher incomes, because of characteristics that could not be measured, such as cultural norms, trust in one's healthcare provider, and different utilities. Another explanation for the observed differences may be that providers do not prescribe these indicated therapies for poor elders with DM.

This study has the following limitations. Annual household income was measured, but there was no information

on the number of people residing in the household, although the analyses were adjusted for living alone. Additionally, there was no information on out-of-pocket medication costs and other health expenses, which may have influenced patient medication use. Although adjustment was made for supplemental insurance, there were no data on which patients, other than the Medicaid patients, who were enrolled in small numbers, had a supplemental drug benefit. Reliance on self-report of data on chronic conditions may be another potential limitation of this study. For example, it is likely that there was underreporting of elevated cholesterol, but it was not known whether persons with lower income were less likely to accurately report hyperlipidemia. Finally, the study only included English speakers. Therefore, the results may not generalize to Latinos who exclusively speak Spanish, for whom language may represent an additional barrier to the receipt of appropriate care.

These findings have several clinical and policy implications. More research is needed on the reasons for the low rates of use of evidence-based therapies by elders with DM and for provider education on the use of evidence-based therapies in this vulnerable population. Research is also needed to evaluate whether these management differences in elders with DM result in different clinical, quality-of-life, and cost outcomes. Further study is needed to evaluate the factors that mediate the observed relationships between income and appropriate medication use. This study also has important implications for the debate over Medicare prescription drug benefits. Between 1999 and 2001, the number of Medicare + Choice plans that provided a pharmacy benefit fell from 62% to 47%, and the percentage of those plans offering an annual drug benefit of more than $1,000 fell from 36% to 22%.[28] Proposed Medicare prescription drug coverage plans[29] are less generous than the plan that was studied, which had a maximum annual drug benefit of $2,000 and relatively low copayments. The findings of low overall use of evidence-based medications and a decrement in the use of higher-cost medications by poorer elders with DM suggest a need for additional prescription drug coverage for Medicare beneficiaries with chronic conditions, particularly low-income patients.

REFERENCES

1. American Diabetes Association. Standards of medical care for patients with diabetes mellitus. Diabetes Care 2002;25:213–229.
2. Steiner G. Risk factors for macrovascular disease in type 2 diabetes. Classic lipid abnormalities. Diabetes Care 1999;22(Suppl. 3):6–9.
3. Elkeles RS, Diamond JR, Poulter C et al. Cardiovascular outcomes in type 2 diabetes. A double-blind placebo- controlled study of bezafibrate. The St. Mary's, Ealing, Northwick Park Diabetes Cardiovascular Disease Prevention (SENDCAP) Study. Diabetes Care 1998;21:641–648.
4. Sacks FM, Pfeffer MA, Moye LA et al. The effect of pravastatin on coronary events after myocardial infarction in patients with average cholesterol levels. Cholesterol and Recurrent Events Trial investigators. N Engl J Med 1996; 335:1001–1009.
5. Pyorala K, Pedersen TR, Kjekshus J et al. Cholesterol lowering with simvastatin improves prognosis of diabetic patients with coronary heart disease. A subgroup analysis of the Scandinavian Simvastatin Survival Study (4S). Diabetes Care 1997;20:614–620.
6. EDTRS Investigators. Aspirin effects on mortality and morbidity in patients with diabetes mellitus. Early Treatment Diabetic Retinopathy Study report 14. JAMA 1992;268:1292–1300.
7. Lewis EJ, Hunsicker LG, Bain RP et al. The effect of angiotensin-converting-enzyme inhibition on diabetic nephropathy. The Collaborative Study Group. N Engl J Med 1993;329:1456–1462.
8. Maschio G, Alberti D, Janin G et al. Effect of the angiotensin-converting-enzyme inhibitor benazepril on the progression of chronic renal insufficiency. The Angiotensin-Converting Enzyme Inhibition in Progressive Renal Insufficiency Study Group. N Engl J Med 1996;334:939–945.
9. Efficacy of atenolol and captopril in reducing risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 39 UK Prospective Diabetes Study Group. BMJ 1998;317:713–720.
10. Heart Outcomes Prevention Evaluation Study Investigators. Effects of ramipril on cardiovascular and microvascular outcomes in people with diabetes mellitus: Results of the HOPE Study and MICRO-HOPE Substudy. Lancet 2000;355:253–259.
11. Lemaitre RN, Furberg CD, Newman AB et al. Time trends in the use of cholesterol-lowering agents in older adults. The Cardiovascular Health Study. Arch Intern Med 1998;158:1761–1768.
12. Jackevicius CA, Anderson GM, Leiter L et al. Use of the statins in patients after acute myocardial infarction: Does evidence change practice? Arch Intern Med 2001;161:183–188.
13. Krumholz HM, Radford MJ, Ellerbeck EF et al. Aspirin in the treatment of acute myocardial infarction in elderly Medicare beneficiaries. Patterns of use and outcomes. Circulation 1995;92:2841–2847.
14. McLaughlin TJ, Soumerai SB, Willison DJ et al. Adherence to national guidelines for drug treatment of suspected acute myocardial infarction: Evidence for undertreatment in women and the elderly. Arch Intern Med 1996;156:799–805.
15. Ganz DA, Lamas GA, Orav EJ et al. Age-related differences in management of heart disease: A study of cardiac medication use in an older cohort. Pacemaker Selection in the Elderly (PASE) Investigators. J Am Geriatr Soc 1999; 47:145–150.
16. Adams AS, Soumerai SB, Ross-Degnan D. The case for a medicare drug coverage benefit. A critical review of the empirical evidence. Annu Rev Public Health 2001;22:49–61.
17. Adams AS, Soumerai SB, Ross-Degnan D. Use of antihypertensive drugs by Medicare enrollees: Does type of drug coverage matter? Health Aff 2001;20: 276–286.
18. Federman AD, Adams AS, Ross-Degnan D et al. Supplemental insurance and use of effective cardiovascular drugs among elderly medicare beneficiaries with coronary heart disease. JAMA 2001;286:1732–1739.
19. Soumerai SB, McLaughlin TJ, Ross-Degnan D et al. Effects of a limit on Medicaid drug-reimbursement benefits on the use of psychotropic agents and acute mental health services by patients with schizophrenia. N Engl J Med 1994;331:650–655.
20. Katz JN, Chang LC, Sangha O et al. Can comorbidity be measured by questionnaire rather than medical record review? Med Care 1996;34:73–84.
21. Ware JE, Kosinski M, Keller SD. How to Score the SF-12 Physical and Mental Health Summary Scale, 2nd Ed. Boston, MA: The Health Institute, New England Medical Center, 1995.
22. Brenner BM, Cooper ME, de Zeeuw D et al. Effects of losartan on renal and cardiovascular outcomes in patients with type 2 diabetes and nephropathy. N Engl J Med 2001;345:861–869.
23. Moon AMGFA. Introduction to the Theory of Statistics. New York: McGraw-Hill, 1963.
24. Soumerai SB, McLaughlin TJ, Spiegelman D et al. Adverse outcomes of underuse of beta-blockers in elderly survivors of acute myocardial infarction. JAMA 1997;277:115–121.
25. Nelson AA Jr, Reeder CE, Dickson WM. The effect of a Medicaid drug copayment program on the utilization and cost of prescription services. Med Care 1984;22:724–736.
26. Reeder CE, Nelson AA. The differential impact of copayment on drug use in a Medicaid population. Inquiry 1985;22:396–403.
27. Gross DJ, Alecxih L, Gibson MJ et al. Out-of-pocket health spending by poor and near-poor elderly Medicare beneficiaries. Health Serv Res 1999;34: 241–254.
28. Gold M. Medicare + Choice: An interim report card. Health Aff 2001;20: 120–138.
29. Gluck M. A Side-by-Side Comparison of Selected Medicare Prescription Drug Coverage Proposals. Menlo Park, CA: The Henry J. Kaiser Family Foundation, 1999.