POLICY

Association of Income and Prescription Drug Coverage With Generic Medication Use Among Older Adults With Hypertension

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Objective: To determine whether low-income seniors and those without prescription drug coverage are more likely to use generic cardiovascular drugs than more affluent and better insured adults.

Study Design: Cross-sectional analysis.

Methods: We used data from the 2001 Medicare Current Beneficiary Survey. Analyses included noninstitutionalized survey respondents over age 65 years with hypertension who used ≥1 multisource cardiovascular drugs (N = 1710). We examined the association of income and prescription coverage with use of generic versions of multisource drugs from 5 classes: angiotensin-converting enzyme (ACE) inhibitors, β-adrenergic receptor antagonists (β-blockers), calcium channel blockers, α_1-adrenergic receptor antagonists (α-blockers), and thiazide diuretics.

Results: Rates of generic medication use were 88.5% (β-blockers); 92.8% (thiazides); 58.7% (calcium channel blockers); 60.7% (ACE inhibitors); and 52.6% (α-blockers). In multivariate analysis of generic medication use aggregated across the 5 drug classes, individuals with incomes below 200% of the federal poverty level were modestly more likely to use generic medications compared with seniors with incomes above 300% the poverty level. Seniors who lacked prescription coverage were more likely to use generics than those who had employer-sponsored coverage, although the association was of marginal statistical significance (relative risk = 1.29, 95% confidence interval = 1.00, 1.60).

Conclusion: Seniors with low incomes or no prescription coverage were only somewhat more likely to use generic cardiovascular drugs than more affluent and insured seniors. These findings suggest that physicians and policy makers may be missing opportunities to reduce costs for Medicare and its economically disadvantaged beneficiaries.

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Cost is a major barrier to care for many elderly patients in the United States. Recent studies have demonstrated that up to 41% of low-income seniors avoid filling prescription medications owing to cost.[1-3] This behavior has potentially important public health implications, including worse blood glucose control in diabetic patients[4] and an increased risk of angina, heart attacks, and strokes among patients with cardiovascular disease.[5]

Although the new Medicare prescription drug benefit (Part D) has the potential to help older adults realize meaningful savings on prescription medications,[6] costs will remain a significant barrier to care for many, including dual-eligible beneficiaries (Medicare-Medicaid beneficiaries), who face mandatory copayments that could limit their access to needed medications.[7] In addition, patients may receive prescriptions from their doctors for medications that are not covered by their Part D plans (PDPs). Numerous PDPs coexist in each region—47 in New York State alone. With so many plans available, physicians are not likely to know whether a medication is covered by their patient's PDP when they write a new prescription, as suggested by recent research.[8,9]

Substituting generic equivalents for brand name drugs is a safe step toward reducing out-of-pocket drug expenditures for patients with Medicare and other types of prescription drug coverage.[10,11] It also may ensure that the prescriptions physicians write for patients are covered even when the details of the PDP's formulary are unknown. However, generic agents remain relatively underused,[12,13] despite advocacy for their use[14] and increasing efforts to promote generic prescribing through modalities such as formularies[15] and mandatory generic substitution.[16]

Previous studies have demonstrated the potential for millions of dollars in savings on prescription drug spending for the Medicaid program[12,17] and for managed care populations[11] with greater use of generic drugs, but there have been no nationally representative studies of generic medication use by Medicare beneficiaries, and none that focus exclusively on the elderly. Moreover, none have examined the association between generic drug use and patients' income and prescription coverage status. These issues are of great policy and clinical importance because of the potential impact on medication spending by Medicare, Medicare PDPs, and Medi-

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care beneficiaries with Part D coverage. For these reasons, we sought to examine the extent of generic medication use by elderly Medicare beneficiaries and to determine the association of generic use with these beneficiaries' income and prescription drug coverage. Based on the economic theory of demand for healthcare,[18] we hypothesized that low-income seniors and those without prescription coverage would use generic equivalents of brand name drugs more frequently than seniors with higher incomes and prescription drug coverage, after taking into account other demographic and health status variables, and the number of prescription drugs used.

We examined generic cardiovascular drug use in a nationally representative sample of elderly Medicare beneficiaries with hypertension. We used hypertension as a model of chronic disease because of its high prevalence in the United States, the wide availability of generic cardiovascular drugs, and the large prescription drug expenditures associated with this condition, estimated at $18.4 billion in 1998.[19]

METHODS

Data Source

We conducted cross-sectional analyses of data from the 2001 Medicare Current Beneficiary Survey (MCBS), a nationally representative, rotating panel survey of institutionalized and community-dwelling Medicare beneficiaries who are followed for 3 years.[20] MCBS staff conduct 12 interviews in the participants' homes over the course of their participation. Response rates for the MCBS average 82% for the initial baseline survey and 71% in the last survey round.

Study Subjects

We included community-dwelling adults who reported a history of hypertension and who used at least 1 multisource cardiovascular drug in 2001. Multisource drugs are agents available in both their original brand name and equivalent generic formulations. To ensure at least 1 year in Medicare, our analyses focused on individuals age 66 years and older. We excluded individuals with end-stage renal disease or fewer than 12 months of Medicare Part B coverage, and those who did not participate in all MCBS survey rounds in 2001.

Outcome Measures

We determined the proportion of individuals who used 1 or more generic cardiovascular drugs during the year. Intraclass substitution of medications may not be appropriate for all patients because of differences in efficacy or side effects. Therefore, we only examined the use of multisource drugs in all analyses. We first examined the use of 1 or more generic cardiovascular drugs from among multisource agents in 5 drug classes. The 5 drug classes included angiotensin-converting enzyme (ACE) inhibitors, β-adrenergic receptor antagonists (β-blockers), calcium channel blockers, α_1-adrenergic receptor antagonists (α-blockers), and thiazide diuretics (**Table 1**). We then separately examined use of generics among multisource drugs within each of the 5 drug classes. We used the US Food and Drug Administration (FDA) Orange Book to identify all generic options within each drug class and only categorized drugs as generic if an application for the generic version was approved by the FDA prior to January 1, 2001.[21] β-Blockers and calcium channel blockers included extended-release agents, which we categorized separately from the parent compound.

Data on prescription medication use in the MCBS are collected by self-report and validated by interviewers' inspection of medication containers, pharmacy receipts, or other documentation provided by respondents. Medication names are recorded verbatim and are checked for accuracy by MCBS staff. We coded medications as generic if the generic version was available in 2001 and the generic name was recorded by the interviewer. Medications, including single and combination agents, were coded as brand name if the interviewer recorded the brand name. The medication was coded as generic for cases in which individuals used both generic and brand name versions of the same drug.

Main Independent Variables

Our analyses focused on 2 independent variables: income and prescription coverage. We examined 5 levels of household income (combined income of survey respondent and spouse, if applicable): less than 100% of the federal poverty level, 100% to 149%, 150% to 199%, 200% to 299%, and 300% or more. We categorized prescription drug coverage as employer sponsored, Medicaid, self-purchased plans (Medigap), self-purchased or Medicare HMO plans, other programs (eg, state-sponsored pharmacy assistance programs and charitable programs), Veterans Administration (VA) coverage, or no prescription coverage (traditional fee-for-service Medicare only). Because Medicare beneficiaries may have more than 1 source of drug coverage, we designated prescription drug coverage according to the source of coverage that paid the largest share of each beneficiary's drug costs.

In our analyses we adjusted for additional variables that may influence access to or use of generic or brand name medications. Because the likelihood of using a generic drug may increase with the number of drugs used, we adjusted for the total number of cardiovascular drugs

from the 5 drug classes, as well as the total number of medications used outside of the 5 drug classes. Because some physicians express concerns about lesser efficacy and greater risk of side effects with generic medications compared with their brand name versions,[22] we also included asthma, coronary artery disease (CAD), congestive heart failure (CHF), and chronic renal insufficiency (CRI) because many hypertension drugs can exacerbate or improve these conditions. Asthma and CAD were determined using survey data (self-report), whereas CHF and CRI were identified through Medicare Part B claims because these conditions were not assessed during interviews. Subjects were considered to have CHF or CRI if these diagnoses were listed on 1 or more outpatient claims (*International Classification of Diseases, Ninth Revision,* Clinical Modification codes available on request). Health status was represented by the sum of common chronic comorbid illnesses (asthma, osteoarthritis or rheumatoid arthritis, cancer, CAD, CHF, CRI, diabetes, osteoporosis, and stroke, but not hypertension) and a dichotomous variable for general health (poor, fair, or good vs very good or excellent). In addition, we adjusted for variables that might affect attitudes toward or knowledge of generic medications, including age, sex, race, Hispanic ethnicity, and education. Finally, we examined urban residence and census region because access to generic and brand name medications may differ regionally through variations in prescription plan formularies, pharmaceutical advertising, availability of free samples, or provider practice.

Table 1. Cardiovascular Drugs Included in the Analyses*

Angiotensin-converting enzyme inhibitors (2/10)
Captopril
Enalapril
β-Adrenergic receptor antagonists (10/14)
Acebutolol
Atenolol
Betaxolol
Bisoprolol
Labetalol
Metoprolol†
Nadolol
Pindolol
Propanolol†
Timolol
Calcium channel blockers (4/9)
Diltiazem
Nicardipine
Nifedipine
Verapamil
α_1-Adrenergic receptor antagonists (3/3)
Doxazosin
Prazosin
Terazosin
Thiazide diuretics (2/2)
Chlorthalidone
Hydrochlorothiazide

*Numbers in parentheses indicate the number of multisource agents available per total number of drugs in the class.
†Generic extended-release version not available as of January 1, 2001.

Statistical Analysis

We determined the bivariate associations between the dependent and independent variables using a weighted χ^2 test. We used weighted multivariable logistic regression to model generic medication use as a function of income and prescription drug coverage, controlling for other individual characteristics, and converted the adjusted odds ratios to adjusted relative risks (ARRs).[23] We fit 1 model of any generic use among the 5 drug classes and 5 individual models of generic use within each drug class. To account for the complex sampling design of the MCBS, all analyses utilized sampling weights and were performed using SUDAAN statistical software (version 9.2, RTI International, Cary, NC). This study was approved by the Mount Sinai School of Medicine institutional review board.

RESULTS

Of the 12 864 individuals in the 2001 MCBS, 4540 (35.3%) were community-dwelling Medicare beneficiaries age 66 years and older with hypertension who used 1 or more hypertension medications. Our analytic sample consisted of the subgroup of 1710 (37.7%) adults that used at least 1 multisource agent, representing approximately 5.5 million adults nationally. The sample's characteristics are shown in **Table 2**. More than half (54.3%) had incomes below 200% of the federal poverty level, and employer-sponsored benefits were the most common source of prescription drug coverage (28.3%). One fifth of respondents had no prescription coverage.

As shown in the **Figure**, the most commonly used multisource drugs were β-blockers (57.9%), followed by calcium channel blockers (40.7%), thiazide diuretics (23.2%), ACE inhibitors (19.7%), and α-blockers (7.6%). The greatest opportunities for generic substitution existed for ACE inhibitors, calcium channel blockers, and α-blockers; just one half to two thirds of multisource drugs used within each of these classes were generic (60.7%, 58.7%, and 52.6%, respectively). In contrast, generics were used by the majority of individuals

Table 2. Subject Characteristics and Patterns of Generic and Brand Name Cardiovascular Drug Use Across 5 Drug Classes*

Characteristic	All Subjects (N = 1710)	Used ≥1 Generic Agent (n =1357; 79.5%)	Used Brand Name Agents Only† (n = 353; 20.5%)	Adjusted Relative Risk (95% CI)‡
Age, y				
66-74	44.2	44.8	42.1	Reference
75-84	43.0	42.7	44.1	0.83 (0.66, 1.01)
≥85	12.8	12.6	13.8	0.83 (0.60, 1.11)
Female	36.0	36.5	34.2	1.10 (0.87, 1.37)
Race				
White	85.0	85.3	83.6	Reference
Black	10.5	10.3	11.4	0.75 (0.54, 1.01)
Other	4.5	4.3	5.0	0.88 (0.51, 1.39)
Hispanic ethnicity	6.5	5.9	8.6	0.64 (0.40, 0.96)§
Education				
College graduate	5.1	4.8	6.4	Reference
Some college	29.8	29.4	31.4	0.91 (0.59, 1.32)
9-12 years	47.4	48.6	42.6	0.96 (0.64, 1.37)
≤8 years	17.1	16.7	18.6	0.80 (0.48, 1.23)
Urban residence	75.3	73.9	80.9‖	0.77 (0.59, 1.07)
Census region				
West	16.3	16.9	14.3	Reference
Northeast, Puerto Rico	22.4	20.9	28.0§	0.75 (0.51, 1.07)
South	35.3	35.1	35.9	0.97 (0.67, 1.33)
Midwest	26.0	27.1	21.9	1.12 (0.76, 1.55)
Poor/fair general health	25.4	24.8	28.2	0.80 (0.60, 1.03)
No. chronic diseases¶				
0-1	39.5	39.9	38.2	Reference
2	28.0	28.3	26.9	1.10 (0.84, 1.41)
≤3	32.5	31.9	34.9	1.12 (0.79, 1.52)
Asthma or COPD	14.2	12.2	21.7#	0.49 (0.35, 0.68)#
Diabetes	20.5	20.4	21.0	0.92 (0.70, 1.18)
Coronary artery disease	35.1	35.0	35.3	0.93 (0.71, 1.20)
Congestive heart failure	6.7	6.9	5.9	1.25 (0.79, 1.80)
Chronic renal insufficiency	2.8	2.9	2.6	1.25 (0.58, 2.10)
No. cardiovascular drugs				
1	58.3	50.7	87.6#	Reference
2	34.9	41.1	10.8#	3.01 (2.57, 3.42)#
≥3	6.8	8.2	1.6#	2.85 (1.77, 3.47)#
No. additional drugs				
0-1	12.3	10.6	18.6#	Reference
2-3	20.5	20.8	19.2	1.61 (1.17, 2.06)‖
4-5	20.6	20.6	20.5	1.59 (1.13, 2.07)‖
6-8	23.4	24.9	17.9‖	2.01 (1.55, 2.45)#
≥9	23.2	23.1	23.9	1.96 (1.44, 2.46)‖
Household income (% of federal poverty level)				
≥300	26.6	25.6	30.4	Reference
200-299	19.2	18.9	20.1§	1.03 (0.73, 1.40)
150-199	14.4	15.2	11.1	1.40 (1.03, 1.83)§
100-149	19.6	19.5	19.8	1.28 (0.98, 1.62)
<100	20.3	20.8	18.6	1.45 (1.03, 1.89)§
Source of drug coverage				
Employer	28.3	27.2	32.7	Reference
Medicaid	8.5	8.0	10.2	0.83 (0.52, 1.24)
Medigap	11.0	11.0	10.8	1.07 (0.78, 1.40)
HMO	18.7	19.7	14.9§	1.40 (1.05, 1.78)§
Veterans Administration	3.6	4.4	0.5‖	2.84 (1.83, 3.27)‖
Other	7.8	7.5	8.9	1.08 (0.74, 1.49)
None	22.2	22.2	22.0	1.29 (1.00, 1.60)

*Values in columns 2-4 are column percentages and may not sum to 100% due to rounding errors. All values are weighted to reflect the sampling design of the Medicare Current Beneficiary Survey.
†Bivariate comparisons, weighted χ^2.
‡The outcome in column 4 is any use of a generic medication in 1 or more of the 5 cardiovascular drug classes compared with the exclusive use of brand name agents from these drug classes, determined by weighted logistic regression (N = 1710).
§$P < .05$.
‖$P < .01$.
¶Excludes hypertension.
#$P < .001$.
CI indicates confidence interval; COPD, chronic obstructive pulmonary disease.

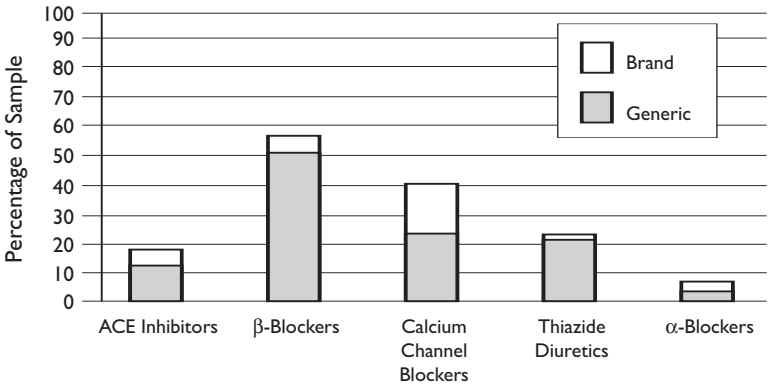
taking thiazides (92.8%) and β-blockers (88.5%).

Overall, 80% of respondents used at least 1 generic cardiovascular drug from 1 or more of the 5 drug classes (Table 2). In unadjusted analysis, the proportion of individuals using 1 or more generic medications did not differ significantly across the 5 income levels. In the adjusted analysis, when compared with individuals who had household incomes at or above 300% of the federal poverty level, seniors with household incomes below 200% of the federal poverty level were modestly more likely to use generics, associations that were statistically significant or near significant (Table 2).

Generic medication use differed significantly across the 7 prescription drug coverage groups, owing principally to the high proportion of VA patients using generics (97.3%). In the adjusted analysis, VA users were more than twice as likely to use 1 or more generic drugs compared with those who had employer-sponsored drug coverage (ARR = 2.84, 95% confidence interval = 1.83, 3.27). HMO coverage also had a positive and statistically significant association with generic use in the adjusted analysis, although the magnitude of this association was less than that for VA patients. Finally, those who lacked prescription coverage were also more likely to use generics, but the association was of borderline statistical significance. Among the other variables included in this analysis, the numbers of cardiovascular and other drugs used was significantly and positively associated with use of 1 or more generic medications (Table 2). Hispanic ethnicity and asthma or chronic obstructive pulmonary disease were associated with lower likelihood of generic use.

We tested the interaction of any prescription coverage (a dichotomous variable) and income (stratified as less than 100% of the federal poverty level, 100% to 199%, and 200% or more to preserve adequate cell sizes for the analysis). No level of the interaction had a significant association with generic use.

Figure. Percentage of Hypertensive Adults Using Brand Name and Generic Cardiovascular Drugs, by Drug Class



The bars indicate the fraction of the medication use in each class that was represented by generic medications (shaded) and brand name medications (white). ACE indicates angiotensin-converting enzyme.

Analyses Within Drug Classes

In separate analyses of generic medication use within each of the 5 individual drug classes, no significant associations were observed between income and generic medication use, although individuals with incomes below the federal poverty level had a greater likelihood of using generic ACE inhibitors and calcium channel blockers, which approached statistical significance (**Table 3**). The associations of prescription coverage and generic drug use largely mirrored those in the aggregate analysis. Moreover, VA users were more likely to use generics in all drug classes except thiazide diuretics. Generic α-blockers were used significantly more often by individuals with HMO, VA, and other sources of drug coverage compared with those with employer-sponsored drug coverage.

DISCUSSION

In this nationally representative sample of elderly Medicare beneficiaries with hypertension, we studied the use of multisource cardiovascular drugs—chemically equivalent brand name and generic drugs—and found that most individuals used at least 1 generic agent. Yet brand name agents were commonly used when their generic equivalents were available. Indeed, among the individuals in our study using multisource ACE inhibitors, calcium channel blockers, and α-blockers, only one half to two thirds used generic agents, a finding consistent with prior research.[11] Because physicians express concern about the cost of medications for their patients,[24,25] one might expect a greater tendency toward use of cost-effective drugs for low-income patients, for whom out-of-pocket costs are more burdensome. We did observe such a pattern of generic medication use, although the magnitude of the association between income and generic use was surprisingly small. For example, after adjusting for confounding variables, we found that individuals with incomes below the federal poverty level were only 40% more likely to receive

Table 3. Multivariate Analyses of Generic Drug Use, by Drug Class*

Characteristic	Adjusted Relative Risk (95% CI)				
	ACE Inhibitors (n = 428)	β-Adrenergic Receptor Antagonists (n = 1656)	Calcium Channel Blockers (n = 1026)	Thiazide Diuretics (n = 1256)	α_1-Adrenergic Receptor Antagonists (n = 414)
Household income (% of federal poverty level)					
≥300	Reference	Reference	Reference	Reference	Reference
200-299	1.29 (0.76, 1.93)	0.96 (0.65, 1.35)	1.04 (0.76, 1.37)	1.09 (0.63, 1.69)	0.95 (0.60, 1.41)
150-199	1.20 (0.68, 1.85)	1.10 (0.68, 1.62)	0.07 (0.79, 1.40)	0.81 (0.46, 1.31)	0.93 (0.50, 1.54)
100-149	1.24 (0.77, 1.81)	1.03 (0.69, 1.44)	1.21 (0.89, 1.57)	1.25 (0.69, 1.94)	0.89 (0.46, 1.51)
<100	1.55 (0.98, 2.12)	1.21 (0.78, 1.70)	1.37 (0.97, 1.79)	1.38 (0.81, 2.00)	0.92 (0.48, 1.53)
Source of drug coverage					
Employer	Reference	Reference	Reference	Reference	Reference
Medicaid	1.08 (0.49, 1.91)	0.67 (0.35, 1.16)	0.82 (0.46, 1.34)	1.35 (0.61, 2.24)	1.09 (0.40, 2.11)
Medigap	1.57 (0.99, 2.17)	1.38 (0.90, 1.91)	0.89 (0.58, 1.29)	2.21 (1.30, 2.88)†	1.64 (0.98, 2.32)
HMO	1.60 (0.94, 2.32)	1.43 (0.95, 1.98)	1.15 (0.85, 1.49)	1.24 (0.72, 1.90)	1.71 (1.10, 2.33)‡
Veterans Administration	2.71 (1.52, 3.24)†	2.40 (1.29, 3.08)‡	2.18 (1.40, 2.80)†	0.91 (0.36, 1.81)	2.91 (2.33, 3.21)§
Other	0.94 (0.41, 1.75)	0.85 (0.55, 1.26)	1.16 (0.79, 1.60)	0.92 (0.39, 1.76)	1.98 (1.21, 2.64)‡
None	1.24 (0.77, 1.80)	1.42 (1.03, 1.83)‡	0.86 (0.60, 1.19)	1.33 (0.90, 1.80)	1.51 (1.00, 2.06)

*Weighted logistic regression. The outcome is use of 1 or more generic medication within each drug class. All medications included in these analyses were available as generics. Analyses are adjusted for age, sex, race, ethnicity, education level, urban residence, census region, self-reported general health, number of cardiovascular drugs, number of additional drugs, number of chronic diseases, and specific chronic diseases (asthma or chronic obstructive pulmonary disease, diabetes mellitus, coronary artery disease, congestive heart failure, and chronic renal insufficiency).
†$P < .01$.
‡$P < .05$.
§$P < .001$.
CI indicates confidence interval; ACE, angiotensin-converting enzyme.

generics than those with incomes 3 times above the poverty level. In addition, individuals who lacked prescription drug coverage also had a modestly greater probability of generic medication use (29%) compared with those who had prescription coverage from current or former employers. The smaller-than-expected differences in generic use between those with employer-sponsored coverage and those without prescription coverage may be due in part to the widespread use of drug formularies in retiree benefits packages.[26] Nonetheless, the absolute rates of generic use among multisource cardiovascular medications was high for individuals with employer-sponsored coverage, ranging from 30% for β-blockers to 42% for calcium channel blockers.

Taken together, our findings suggest that opportunities exist to increase use of generic cardiovascular drugs among elderly patients and potentially reduce these patients' out-of-pocket drug spending. This observation is supported by recent studies that examined the potential savings from generic substitution. Using data from the Medical Expenditure Panel Survey, Haas and colleagues found that only 35% of multisource cardiac drugs were dispensed to adults as generic drugs, and estimated that $1.93 billion could be saved through generic substitution of these agents.[11] Fischer and Avorn reported savings of up to 30% with generic substitution of multisource cardiovascular drugs in state Medicaid programs[12] and more in one state's pharmaceutical assistance program.[17] We note, however, that the potential for increasing rates of generic substitution may vary under different circumstances, such as by type of insurer or region. Using data from a single pharmacy benefits manager (1999-2000) for private retiree plans, Ritter et al found that 91% of multisource drugs were dispensed as generics.[27] Pharmacy data from a single Midwestern state similarly found that 84% of multisource drugs were dispensed as generics.[13] The basis for variation in generic substitution is not entirely clear, but the variation should make physicians and policy makers alert to the

possibility that when a prescription is written for a brand name multisource drug, a generic drug will not necessarily be substituted.

Our findings also imply that those with low incomes and no prescription coverage stand to benefit the most from generic substitution because low-income seniors have the highest rates of skipping medication because of costs.[1,28,29] As estimated by Haas and colleagues, substituting generic drugs for brand name equivalents could result in savings on medications for older patients (up to $241 annually),[11] savings that are likely to have a considerable impact on use of medications by financially vulnerable seniors.[3,7,30,31] The impact on savings through expanded use of generic medications may be especially large for Medicare Part D enrollees because selecting plans that cover brand name agents could inadvertently lead Medicare beneficiaries to enroll in higher-cost PDPs (higher premiums, deductibles, and copayments).[32]

Two additional observations based on these data deserve mention. First, we found that individuals with VA coverage had the highest rates of generic use among users of multisource drugs and were the only individuals with consistently high rates of generic use across the 5 drug classes studied. The VA is able to achieve this high level of generic use through its National Drug Formulary, which emphasizes use of generic medications and uses a combination of open, closed, and preferred formulary structures to guide prescribing and to obtain discounts from manufacturers.[33,34] A study conducted by the Institute of Medicine found that the VA National Drug Formulary did not result in compromised quality of care for veterans.[34] Second, higher levels of medication use were associated with a greater likelihood of using generics. Using more medications may present a greater number of opportunities for introducing generics into a medication regimen, or it may increase the need to minimize medication costs, thereby promoting use of generics.

Policy issues, like formularies and state laws that mandate use of generics for Medicaid beneficiaries, are probably the most influential factors determining use of generic medications among the elderly. Also, pharmacists are required by the Medicare Modernization Act to discuss generic substitution with Medicare Part D enrollees when such opportunities arise. Yet even with strong generic policies in place, physician and patient attitudes toward generic drugs may remain an important factor. Some physicians may prefer using brand name drugs, perhaps due to the effect of pharmaceutical marketing[35] or to perceptions about safety and efficacy.[22,24] Indeed, a 1989 study of a nationally representative sample of outpatient visits found that 30% of the residual variability in generic versus brand name medications use was attributable to physicians.[36] Selection of generic medications also may be influenced by physician specialty, as specialists are more likely than generalists to adopt the use of novel agents.[37] It should be noted, however, that physicians may at times have no preference for a brand name or generic drug, but may be in the habit of referring to a commonly used drug by its brand name. Negative attitudes toward or misperceptions of generic drugs by patients also may play a role, as prior studies have shown that patients often regard generics as riskier to use than brand name drugs.[38,39] For the most part, these studies address attitudes about generics among nonelderly adults in Europe and in a single metropolitan area in the United States. Additional research is needed in the United States to determine older patients' and physicians' roles in the uptake of generic medications.

Limitations

To our knowledge, this is the first nationally representative study of multisource medication use among elderly Medicare beneficiaries, and the first to specifically examine the associations of income and coverage with generic or brand name multisource drugs. The study has some limitations, however, that warrant discussion. First, we relied on verbatim reports of medication names to determine whether each drug was generic or brand. This approach might result in underreporting of generic drug use,[40] but such underreporting should not necessarily differ across strata of income and prescription drug coverage, nor should it result in different rates of generic medication use across the 5 classes of drugs we studied. Second, the MCBS does not provide data on the number of prescriptions filled, so we were unable to determine the proportion of prescription fills that were generic. Third, the MCBS has no data on the cost-sharing structure of prescription plans, so we can only report the aggregate effect among plan types and may have missed details of insurance plans that successfully promote use of generic medications. Fourth, adverse selection could have biased our results if individuals without prescription coverage and those with HMO coverage had less need for medications and therefore did not acquire any or more generous prescription benefits. However, the average number of cardiovascular drugs used by individuals in these groups (1.6 and 1.7, respectively) did not differ substantially from the number used by individuals in other coverage groups (range of means, 1.6 to 2.0; overall mean, 1.7). Thus, it is unlikely that adverse selection greatly biased our estimates of generic use or expenditures. Last, the study was underpowered to detect statistically significant differences of 10% in use of generic medications by income and prescription drug coverage in many of the

subgroup analyses of individual classes of cardiovascular drugs.

CONCLUSION

Our findings indicate that Medicare beneficiaries with hypertension, including those who are most financially vulnerable, underuse generic medications in 3 of 5 classes of cardiovascular medications and are therefore missing opportunities to reduce out-of-pocket spending. Because elderly Medicare beneficiaries burdened by medication costs infrequently tell their doctors about problems paying for medications,[41-43] physicians should be ever vigilant about cost-effective prescribing. Moreover, because prescription drug plan medication formularies present a significant burden to many physicians,[8] and because Medicare Part D might add to this burden by increasing the number of different formularies in local markets, the surest way for patients to receive the least expensive medications covered by their plans is to prescribe generic agents whenever possible.

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REFERENCES

1. Safran DG, Neuman P, Schoen C, et al. Prescription drug coverage and seniors: how well are states closing the gap? *Health Aff (Millwood).* 2002 (Suppl; Web Exclusives):W253-W268.

2. Steinman MA, Sands LP, Covinsky KE. Self-restriction of medications due to cost in seniors without prescription coverage. *J Gen Intern Med.* 2001;16:793-799.

3. Mojtabai R, Olfson M. Medication costs, adherence, and health outcomes among Medicare beneficiaries. *Health Aff (Millwood).* 2003;22:220-229.

4. Piette JD, Wagner TH, Potter MB, Schillinger D. Health insurance status, cost-related medication underuse, and outcomes among diabetes patients in three systems of care. *Med Care.* 2004;42:102-109.

5. Heisler M, Langa KM, Eby EL, Fendrick AM, Kabeto MU, Piette JD. The health effects of restricting prescription medication use because of cost. *Med Care.* 2004;42:626-634.

6. Kravitz RL, Chang S. Promise and perils for patients and physicians. *N Engl J Med.* 2005;353:2735-2739.

7. Stuart B, Zacker C. Who bears the burden of Medicaid drug copayment policies? *Health Aff (Millwood).* 1999;18:201-212.

8. Shrank WH, Ettner SL, Glassman P, Asch SM. A bitter pill: formulary variability and the challenge to prescribing physicians. *J Am Board Fam Pract.* 2004;17:401-407.

9. Shrank WH, Young HN, Ettner SL, Glassman P, Asch SM, Kravitz RL. Do the incentives in 3-tier pharmaceutical benefit plans operate as intended? Results from a physician leadership survey. *Am J Manag Care.* 2005;11:16-22.

10. Murphy JE. Generic substitution and optimal patient care. *Arch Intern Med.* 1999;159:429-433.

11. Haas JS, Phillips KA, Gerstenberger EP, Seger AC. Potential savings from substituting generic drugs for brand-name drugs: medical expenditure panel survey, 1997-2000. *Ann Intern Med.* 2005;142:891-897.

12. Fischer MA, Avorn J. Economic consequences of underuse of generic drugs: evidence from Medicaid and implications for prescription drug benefit plans. *Health Serv Res.* 2003;38:1051-1063.

13. Mott DA, Cline RR. Exploring generic drug use behavior: the role of prescribers and pharmacists in the opportunity for generic drug use and generic substitution. *Med Care.* 2002;40:662-674.

14. Alexander GC, Tseng CW. Six strategies to identify and assist patients burdened by out-of-pocket prescription costs. *Cleve Clin J Med.* 2004;71:433-437.

15. Malkin JD, Goldman DP, Joyce GF. The changing face of pharmacy benefit design. *Health Aff (Millwood).* 2004;23:194-199.

16. National Pharmaceutical Council. Pharmaceutical benefits under state medical assistance programs. Available at: http://www.npcnow.org/resources/PharmBenefitsMedicaid.asp. Accessed April 11, 2005.

17. Fischer MA, Avorn J. Potential savings from increased use of generic drugs in the elderly: what the experience of Medicaid and other insurance programs means for a Medicare drug benefit. *Pharmacoepidemiol Drug Saf.* 2004;13:207-214.

18. Phelps CE. *Health Economics.* New York, NY: Harper Collins; 1992.

19. Hodgson TA, Cai L. Medical care expenditures for hypertension, its complications, and its comorbidities. *Med Care.* 2001;39:599-615.

20. Adler GS. A profile of the Medicare Current Beneficiary Survey. *Health Care Financ Rev.* 1994;15:153-163.

21. U.S. Food and Drug Administration. *Orange Book.* Available at: http://www.fda.gov/cder/ob/docs/queryai.htm. Accessed July 23, 2003.

22. Banahan BF 3rd, Kolassa EM. A physician survey on generic drugs and substitution of critical dose medications. *Arch Intern Med.* 1997;157:2080-2088.

23. Zhang J, Yu KF. What's the relative risk? A method of correcting the odds ratio in cohort studies of common outcomes. *JAMA.* 1998;280:1690-1691.

24. Glickman L, Bruce EA, Caro FG, Avorn J. Physicians' knowledge of drug costs for the elderly. *J Am Geriatr Soc.* 1994;42:992-996.

25. Reichert S, Simon T, Halm EA. Physicians' attitudes about prescribing and knowledge of the costs of common medications. *Arch Intern Med.* 2000;160:2799-2803.

26. Kaiser Family Foundation. Prospects for retiree health benefits as Medicare drug coverage begins: findings from the Kaiser/Hewitt 2005 Survey on Retiree Health Benefits. Available at: http://www.kff.org/medicare/7439.cfm. Accessed March 9, 2006.

27. Ritter G, Thomas C, Wallack SS. Greater use of generics: a prescription for drug cost savings. Waltham, Mass: Schneider Institute for Health Policy, Brandeis University; February 2002. Available at: http://bcbshealthissues.com/relatives/19385.pdf. Accessed July 17, 2006.

28. Safran DG, Neuman P, Schoen C, et al. Prescription drug coverage and seniors: findings from a 2003 national survey. *Health Aff (Millwood).* 2005 (Suppl; Web Exclusives):W152-W166.

29. Rector TS, Venus PJ. Do drug benefits help Medicare beneficiaries afford prescribed drugs? *Health Aff (Millwood).* 2004;23:213-222.

30. Piette JD, Heisler M, Wagner TH. Cost-related medication underuse among chronically ill adults: the treatments people forgo, how often, and who is at risk. *Am J Public Health.* 2004;94:1782-1787.

31. Piette JD, Heisler M. Problems due to medication costs among VA and non-VA patients with chronic illnesses. *Am J Manag Care.* 2004;10:861-868.

32. Doggett L. Attention, Medicare shoppers... *New York Times.* January 10, 2006.

33. Sales MM, Cunningham FE, Glassman PA, Valentino MA, Good CB. Pharmacy benefits management in the Veterans Health Administration: 1995 to 2003. *Am J Manag Care.* 2005;11:104-112.

34. Veterans Administration Pharmacy Formulary Analysis Committee, Division of Health Care Services, Institute of Medicine. *Description and Analysis of the VA National Formulary.* Washington, DC: National Academy Press; January 2000.

35. Kravitz RL, Epstein RM, Feldman MD, et al. Influence of patients' requests for direct-to-consumer advertised antidepressants: a randomized controlled trial. *JAMA.* 2005;293:1995-2002.

36. Hellerstein JK. The importance of the physician in the generic versus trade-name prescription decision. *Rand J Econ.* 1998;29:108-136.

37. Tamblyn R, McLeod P, Hanley JA, Girard N, Hurley J. Physician and practice characteristics associated with the early utilization of new prescription drugs. *Med Care.* 2003;41:895-908.

38. Ganther JM, Kreling DH. Consumer perceptions of risk and required cost savings for generic prescription drugs. *J Am Pharm Assoc (Wash DC).* 2000;40:378-383.

39. Himmel W, Simmenroth-Nayda A, Niebling W, et al. What do primary care patients think about generic drugs? *Int J Clin Pharmacol Ther.* 2005;43:472-479.

40. Poisal JA. Reporting of drug expenditures in the MCBS. *Health Care Financ Rev.* 2004;25:1-4.

41. Alexander GC, Casalino LP, Meltzer DO. Patient-physician communication about out-of-pocket costs. *JAMA.* 2003;290:953-958.

42. Federman AD. Don't ask, don't tell: the status of doctor-patient communication about health care costs. *Arch Intern Med.* 2004;164:1723-1724.

43. Piette JD, Heisler M, Wagner TH. Cost-related medication under-use: do patients with chronic illnesses tell their doctors? *Arch Intern Med.* 2004;164:1749-1755.