Employer Drug Benefit Plans and Spending on Prescription Drugs

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Context With drug spending rising rapidly for working-aged adults, many employers and health insurance providers have changed benefits packages to encourage use of fewer or less expensive drugs. It is unknown how these initiatives affect drug costs.

Objective To examine how innovations in benefits packages, such as those that include multitier formularies and mandatory generic substitution, affect total cost to insurance providers for generic and brand drugs and out-of-pocket payments to beneficiaries.

Design and Participants Retrospective study from 1997 to 1999 linking claims data of 420,786 primary beneficiaries aged 18 through 64 years who worked at large firms (n = 25) with health insurance benefits that included outpatient drugs.

Main Outcome Measures Overall drug costs; generic, single-source brand, and multisource brand costs; and drug expenditures by health insurance providers and out-of-pocket costs for beneficiaries.

Results For a 1-tier plan with a $5 co-payment for all drugs, the average annual spending was $725 per member. Doubling co-payments to $10 for all drugs reduced the annual average drug cost from $725 to $563 per member (22.3%, P < .001). Doubling co-payments in a 2-tier plan from $5 for generics and $10 for brand drugs to $10 for generics and $20 for brand drugs reduced costs from $678 to $455 (32.9%, P < .001). Adding an additional co-payment of $30 for nonpreferred brand drugs to a 2-tier plan ($10 generics; $20 brand) lowered overall drug spending by 4% (P < .001). Requiring mandatory generic substitution in a 2-tier plan reduced drug spending by 8% (P < .001). Doubling co-payments in a 2-tier plan increased the fraction beneficiaries’ paid out-of-pocket from 17.6% to 25.6%.

Conclusions Adding an additional level of co-payment, increasing existing copayments or coinsurance rates, and requiring mandatory generic substitution all reduced plan payments and overall drug spending among working-age enrollees with employer-provided drug coverage. The reduction in drug spending largely benefited health insurance plans because the percentage of drug expenses beneficiaries paid out-of-pocket rose significantly.

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PRESCRIPTION DRUG BENEFITS

Table 1. Description of Benefit Packages and Most Common Coinsurance and Co-payments*

<table>
<thead>
<tr>
<th>Description</th>
<th>Co-payment, Mean $</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-Tier 2-Tier 3-Tier</td>
</tr>
<tr>
<td></td>
<td>Single co-payment</td>
</tr>
<tr>
<td></td>
<td>for all drugs</td>
</tr>
<tr>
<td>Type of drug</td>
<td>Single coinsurance</td>
</tr>
<tr>
<td>Generic</td>
<td>30</td>
</tr>
<tr>
<td>Preferred brand</td>
<td>30</td>
</tr>
<tr>
<td>Nonpreferred brand</td>
<td>30</td>
</tr>
</tbody>
</table>

*Co-payments and coinsurance rates reported reflect the modal benefit in each type of plan in the study sample. Coinsurance rate is the percentage paid by the beneficiary.
†Plan descriptions reflect common benefit designs, yet other definitions exist (some 2-tier plans place low-cost brand medications in the 1-tier and high-cost generics in the 2-tier).

In this study, we use data for a wide array of employers and benefit designs to assess how multitier formulations, increased co-payments, and MGS requirements affect spending for generic and brand drugs and patients’ out-of-pocket costs.

With incentive-based formulations, members pay differential co-payments or coinsurance rates based on the status of a drug (TABLE 1). In some plans, members pay a single co-payment for all drugs, a so-called 1-tier plan. To provide a financial incentive to purchase generic drugs, some plans charge different co-payments for brand and generics, with lower co-payments for the generics (2-tier plans). To encourage use of lower-cost brand medications, some plans further differentiate by adding a third co-payment for more expensive brand medications. In these 3-tier plans, generic drugs typically have the lowest co-payment, formulary or preferred brands have a mid-range co-payment, and nonformulary brands have the highest co-payment. Other variants of the 3-tier plan distinguish brand drugs without generic substitutes (single-source brands) and brand drugs with generic substitutes (multisource brands). Savings result from shifting members’ drug use to generics or preferred brands, for which the health plans have negotiated favorable rates, and by increasing patients’ cost-sharing for nonpreferred brands.5

Many health plans have adopted other tools to control drug spending such as MGS and coinsurance rates rather than fixed dollar co-payments per prescription. Under MGS, members electing brand drugs over their generic equivalent generally must pay the generic co-payment plus the full difference in cost between the brand and generic drugs. Coinsurance rates, or percentage co-payments, are attractive to plans because they keep pace with rising drug costs. However, they are more difficult for patients to understand and lead to greater variation and uncertainty in out-of-pocket expenses.22

METHODS

We assembled a unique data set linking health care claims to health plan benefits. Through a health benefits consulting firm, we obtained claims data from 1997 to 1999 for 35 private employers. The analysis excluded 10 employers with fewer than 1000 employees per health plan or with incomplete information on drug claims (eg, missing national drug codes). Of the 25 firms included in the study sample, most offered employees a choice of medical plans, and some plans changed benefits at the beginning of a calendar year. As a result, there were 55 unique medical or pharmacy benefit packages (ie, plans) and 75 plan-years of data since several plans have data for multiple years. Although employees typically had a choice of medical plans, only 2 firms had a choice of drug plans, thereby minimizing potential bias from selection of drug plans based on anticipated use. The study sample consisted of 702 782 person-years of data on 420 786 beneficiaries aged 18 to 64 years who were continuously enrolled in a plan for 1, 2, or 3 years. We excluded dependents and employees aged 65 years or older because we could not be sure that their drug utilization was not covered by other insurance.

Enrollment files included each person’s age, sex, ZIP code of residence, and relationship to employee. Claims files captured all health care claims and encounters, including prescription drugs, inpatient, emergency, and ambulatory services. Drug claims included information on the type of drug (drug name, national drug codes, dosage, supply), place of purchase (retail or mail-order), and expenditures, including billed charges, negotiated discounts, excluded expenses, deductibles, co-payments and payments made by the employer, employee, and other third-party coverage. Data were also available on prescriptions costing less than the minimum drug co-payment. The medical claims included the same financial information, as well as the date of service, diagnosis and procedure codes, type of facility, and provider.

Plan Benefits

The claims data were linked with information about plan benefits. For each plan, we obtained photocopies of the summary of benefits provided by the firms to their employees and abstracted the benefit information. Because some benefit packages contained more detail than others, we coded information only when the plan specifically stated that a benefit was covered or excluded. The few discrepan-
cies were resolved by consensus. The drug benefit design features we coded included co-payments or coinsurance rates for both retail and mail-order pharmacies, generic substitution rules, and a list of drugs or drug classes excluded from coverage. Drugs not covered by the plans consisted primarily of lifestyle or cosmetic drugs such as sildenafil citrate and other discretionary medications for hair loss, weight reduction, and smoking cessation. The medical plan characteristics that we coded included individual plan deductibles, co-payments or coinsurance rates for physician office visits, and a binary indicator for enrollment in a managed care plan. No plans had a separate deductible for prescription drugs.

Statistical Analysis
We estimated 2 sets of regression models: costs by type of drug (generic, single-source brand, or multisource brand) and drug costs paid by the health insurance plan and by the patient. Costs reflected total annual payments made by the enrollee (co-payments, deductibles, excluded expenses) and by all third-party payers (primary and secondary coverage, net of negotiated discounts) for outpatient prescription drug claims.

The main independent variables in both models were the drug benefit design features, including the plan’s lowest co-payment at retail pharmacies and incremental co-payments for second- and third-tier drugs, if applicable. The model also included binary indicators for coinsurance plans and use of MGS rules. We did not include cost-sharing arrangements at mail-order pharmacies because they were highly correlated with retail co-payments and coinsurance rates. In addition, we did not include indicators for excluded drugs because there was little variation across plans and the excluded medications comprised only a small fraction of covered drugs.

The covariates included a set of variables to describe the medical benefits, including individual plan deductibles, co-payments or coinsurance rates for physician office visits, and a binary indicator for enrollment in a managed care plan. Other covariates were age categories, sex, work status (active or retired), urban residence, and median household income in the ZIP code of residence. We controlled for observed differences in comorbid conditions based on International Classification of Diseases, Ninth Revision (ICD-9) diagnostic codes from the medical claims files. We identified individuals who were treated for any of 26 chronic conditions, such as hypertension, diabetes, congestive heart failure, asthma, and depression, and included a binary indicator for each condition. Last, the model also included binary indicators for the calendar year to control for time trends in prescription drug spending and prices.

Our statistical analyses used a 2-part model.23 The first part of the model, including the entire study sample, used probit regression to estimate the probability that a member had at least 1 pharmacy claim. The second part of the model used a generalized linear model with a logarithmic link function to estimate the level of drug spending among members with at least 1 claim, for the outcome of interest. For example, we analyzed use of generic, multisource, and single-source drugs separately. We chose the generalized linear model because it predicted component drug expenditures better than the standard 2-part model that uses linear regression in the second part, but our conclusions were insensitive to this choice.24,25

Simulations
We combined the 2 parts of the model to predict average annual drug spending by drug type and payer status under different plan/co-payment combinations. Specifically, we used estimates from the first part of the model to predict the probability of nonzero expenditures for each person under alternative benefit designs and co-payments. Simultaneously, we used the second part of the model to predict expenditures, conditional upon having at least 1 claim for each person under each plan/co-payment combination. We calculated total expenditures as the product of the 2 parts of the model and averaged them over all individuals in the sample for each plan/co-payment combination.23

The simulations used a predetermined set of co-payments that occurred frequently in our data and were representative of cost-sharing arrangements in private health insurance plans. Because the coinsurance plans in our sample lacked sufficient variation in coinsurance rates, we included a binary indicator for coinsurance in predicting drug expenditures for these plans. We assumed that 1-tier co-payment plans required MGS, but that other plans did not. We also compared drug spending with and without MGS in 2-tier co-payment plans. We adjusted the SEs for clustering of patients within plans. We also used the bootstrap to derive the SEs of the predictions and compute 95% confidence intervals (CIs).26 STATA version 7 (STATA Corp, College Station, Tex) was used for statistical analyses and the 95% CI reflects .025 in each tail or $P\leq.05$.

RESULTS
Descriptive Data
The characteristics of the patients in the study were consistent with a working-age population (Table 2). About half (46.6%) were aged 45 years or younger, 63.9% were men, and more than 4 out of 10 were treated for 1 or more chronic health conditions.

We categorized benefits packages into coinsurance plans and 1-, 2- and 3-tier co-payment plans as described in Table 1. The 15 coinsurance plans in our sample had a single coinsurance rate for prescription drugs of 20% or 30%, with a mean of 27.3% (Table 3). Ten of these plans required MGS. Among plans with co-payments, the 15 1-tier plans had an average co-payment of $6.67 (range, $2-$10). Two-tier plans ($n=36$) were the most prevalent benefit design in our sample; the average difference in co-payment between generic and brand drugs was about $7. Two- and 3-tier plans had
similar co-payments in the first 2 tiers. However, the average co-payment for nonpreferred brands was $23.56, nearly $12 more than what members would typically pay for preferred brands. All plans with a single co-payment had MGS programs. In contrast, only 6 of the 45 multitier plans required MGS.

Unadjusted total drug spending was highest in single co-payment plans (Table 4). Annual mean spending was approximately $150 higher per member in 1-tier plans than in coinsurance or 3-tier plans. The average number of prescriptions dispensed followed a similar pattern. The fraction of enrollees who filled 1 or more prescriptions was highest in 1-tier plans and lowest in coinsurance plans. The fraction of drugs dispensed as generic ranged from 33.2% in 2-tier plans to 38.7% in 1-tier plans.

### Spending by Drug Type

Table 5 presents predicted annual drug spending per member within each type of drug plan and co-payment level. Increasing co-payments within a particular benefit design reduced spending significantly, controlling for other factors known to affect utilization. For example, increasing single fixed co-payments for all drugs from $5 to $10 reduced annual average drug spending from $725 to $563 per member (22.3% reduction, P<.001). Similarly, doubling co-payments in multitier plans reduced annual average drug spending by about one third (32.9% in 2-tier plans, 34.5% in 3-tier plans; P<.001).

Higher patient cost-sharing led to less spending on both generic and brand name drugs.

Adding co-payments also significantly reduced average drug spending. Changing from a single co-payment of $5 to a 2-tier plan with co-payments of $5 for generic and $10 for brand drugs reduced average drug spending from $725 to $678 (6% reduction, P<.001). Similarly, changing from a single co-payment of $10 to a 2-tier plan with co-payments of $10 for generic and $20 for brand drugs reduced average drug costs from $563 to $455 (19% reduction, P<.001). Adding another co-payment for nonpreferred brands reduced spending further, albeit more modestly. For example, adding a co-payment of $5 or $10 for nonpreferred brand drugs lowered overall drug spending an additional 2% to 4%, respectively (P=.004 and P<.001). Spending on brand drugs declined, while spending on generic drugs increased with the addition of a third tier. For instance, annual expenditures on generic drugs increased from $571 to $81 per member with the addition of an incremental co-payment of $5 for nonpreferred brand drugs.

Higher co-payments for physician office visits had no effect on drug spending (data not shown). Also, total drug spending was similar in managed care and nonmanaged care plans, although use of brand drugs was modestly lower in managed care settings.

### Spending by Payer

We also examined the share of drug spending borne by patients and all third-party payers under different cost-sharing arrangements (Table 6). Patient out-of-pocket spending did not change substantially within a specific benefit design, because the reduction in overall drug use due to higher patient cost-sharing largely offset the effects of higher co-payments per prescription. However, the fraction of drug costs borne by patients rose considerably. Doubling co-payments in 2- and 3-tier plans increased the fraction of drug expenses beneficiaries paid out-
of-pocket from 17.6% to 25.6% and 20.1% to 32.3%, respectively. Overall, patient out-of-pocket payments were highest in coinsurance plans and 3-tier plans with higher co-payments.

**Impact of MGS**

Mandatory generic substitution also lowered drug costs significantly (Table 7). Specifically, adding MGS in 2-tier plans reduced drug spending by $36 to $52 per person (8% reduction, \( P<.001 \)), depending on the level of co-payments. Requiring MGS reduced expenditures on multisource and single-source brands, but had no appreciable effect on generic drug spending. However, separate analyses examining the number of prescriptions dispensed rather than drug spending found a modest increase in generic prescriptions and little change in total prescriptions with the addition of MGS.

**COMMENT**

The desire to control health care costs has led to considerable variation in how employers and health insurance providers structure formularies, design benefits, and provide incentives to both physicians and patients. We found that many of the tools used to influence pharmaceutical use were effective in reducing drug expenditures for working-age enrollees with employer-provided drug coverage. Adding an additional level of co-payment, increasing existing co-payments or coinsurance rates, and requiring MGS all reduced health insurance plan payments significantly. Doubling patient co-payments lowered average drug spending by as much as one third (Table 5), reducing both the likelihood of having a claim and the level of spending conditional upon use. The reduction in drug spending largely benefited employers, as the fraction of drug costs borne by pa-

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**Table 7.** Average Annual Prescription Drug Spending and Use by Plan Benefit for 1997-1999

<table>
<thead>
<tr>
<th>Type of Prescription Plan</th>
<th>1-Tier Co-payment</th>
<th>2-Tier Co-payment</th>
<th>3-Tier Co-payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total drug spending per member, $</td>
<td>505</td>
<td>650</td>
<td>598</td>
</tr>
<tr>
<td>No. of prescriptions per member</td>
<td>9.8</td>
<td>12.3</td>
<td>11.1</td>
</tr>
<tr>
<td>Users, %</td>
<td>70.7</td>
<td>78.0</td>
<td>77.7</td>
</tr>
<tr>
<td>Generic prescriptions per member, %</td>
<td>35.1</td>
<td>38.7</td>
<td>33.2</td>
</tr>
</tbody>
</table>

*All means are unadjusted and computed at the individual level.

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**Table 6.** Share of Annual Prescription Drug Spending per Member by Payer Status and Type of Prescription Plan

<table>
<thead>
<tr>
<th>Payer Expenses</th>
<th>1-Tier Co-payment†</th>
<th>2-Tier Co-payment</th>
<th>3-Tier Co-payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out-of-pocket, %</td>
<td>25.6</td>
<td>16.9</td>
<td>22.3</td>
</tr>
</tbody>
</table>

*Total expenditures reflect the sum of generic, single-source (brand drug without generic substitute), and multisource (brand drug with generic substitute) prescription drug spending. All estimates are in 1999 dollars and exclude 3.2% of prescriptions and 5.6% of drug expenditures with missing national drug codes.
†See dagger footnote of Table 5.
 Debate over the effects of cost-containment strategies often fail to distinguish between the level of drug spending and growth in spending. The rapid increase in pharmaceutical spending from 1987 to 1993 was due both to rising drug prices and to higher per capita utilization. However, since 1994, the growth in spending has been largely due to increased utilization. If this trend continues, increased patient cost-sharing will play a larger role in reducing the level of drug spending than slowing the growth in expenditures.

Our analysis has several limitations. First, we examined a working-age population with employer-provided drug coverage. Thus, our findings may not generalize to lower-income groups or the elderly population. However, our findings reflect behavioral responses of more than 400,000 enrollees to a wide range of drug and medical benefits.

Second, some plans imposed higher co-payments or coinsurance rates for drugs dispensed at out-of-network pharmacies. We did not control for this feature in our analysis because this information was not consistently reported in the benefits package. In addition, we had no information on use of over-the-counter medications, which could potentially mitigate the effects of increased patient cost-sharing.

Third, we could not assess the full impact of extremely high co-payments. In our sample, the mean difference in co-payments was $6.50 between generic and brand drugs and $12 between preferred and nonpreferred brands, with a maximum of $15. Therefore, we could not reliably predict the effect of a plan with co-payments in excess of $30. Although such high co-payments were unusual in our data, they are increasingly becoming more common as costly new drugs and biotech agents enter the market.  

Finally, we could not control for selection of health insurance plans because we did not know the full range of choices offered to employees. Most of the firms in our sample offered employees a choice of medical plans, which typically included a managed care and indemnity option. However, in all but 2 firms there was no choice of drug plan, which minimizes any potential bias from employees selecting benefit package designs that suit their particular needs or preferences. Furthermore, reestimating the models without these plans did not change our results.

A large fraction of the increase in drug spending in 2000 was due to higher expenditures on a small number of drugs and drug categories. Where drugs are placed in the formulary will substantially affect utilization patterns and costs. Currently, drug classification is often a function of ingredient cost and manufacturer rebates rather than clinical outcomes. As a result, pharmacy benefit managers and their sponsors may be designing prescription benefit packages that reduce the costs of pharmaceuticals but increase overall medical costs.

There is little evidence about whether lower pharmaceutical use resulting from higher patient cost-sharing adversely affects clinical outcomes. Several studies have found that spending caps and formulary restrictions reduced use of both essential and nonessential medications among low-income and elderly populations. However, few studies have found a consistent link between higher co-payments and patients' health, particularly among persons with employer-provided coverage whose drug spending comprises a much smaller percentage of their income. A recent study of reference pricing for angiotensin-converting enzyme inhibitors, in which insurance covers the cost up to the refer-

### Table 7. Impact of Mandatory Generic Substitution on Annual Prescription Drug Spending per Member in 2-Tier Plans*

<table>
<thead>
<tr>
<th>Drug Type</th>
<th>Mean $ (95% Confidence Interval)</th>
<th>2-Tier ($5 for Generic, $10 for Brand)</th>
<th>2-Tier ($10 for Generic, $20 for Brand)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without MGS</td>
<td>With MGS</td>
<td>Without MGS</td>
</tr>
<tr>
<td>All drugs</td>
<td>678 (666-689)</td>
<td>626 (613-639)</td>
<td>655 (648-662)</td>
</tr>
<tr>
<td>Generic</td>
<td>71 (68-74)</td>
<td>71 (68-74)</td>
<td>41 (38-44)</td>
</tr>
<tr>
<td>Single-source brand</td>
<td>534 (524-544)</td>
<td>500 (488-512)</td>
<td>367 (353-381)</td>
</tr>
<tr>
<td>Multisource brand</td>
<td>73 (71-75)</td>
<td>55 (54-57)</td>
<td>47 (45-48)</td>
</tr>
</tbody>
</table>

*MGS indicates mandatory generic substitution. See asterisk footnote of Table 5.
whether changes in drug spending affect health care costs of different patient populations.

Author Contributions: Study concept and design: Joyce, Escarce, Goldman. Acquisition of data: Joyce, Goldman. Analysis and interpretation of data: Joyce, Escarce, Solomon, Goldman. Drafting of the manuscript: Joyce, Goldman. Critical revision of the manuscript for important intellectual content: Escarce, Solomon, Goldman. Statistical expertise: Joyce, Escarce, Goldman. Obtained funding: Joyce, Goldman.

Administrative, technical, or material support: Joyce, Solomon.

Study supervision: Joyce, Escarce, Goldman.

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REFERENCES

or have no relationship with it in other cases. Furthermore, even among experts, allocation concealment, as well as other quality measures, are subject to diverse interpretations.

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CORRECTIONS

Incorrect Number: In Appendix IA, Table 2 published in the September 4, 2002, issue of THE JOURNAL (2002;288:1143-1145), on page 1145 Baylor College of Medicine’s total enrollment should be 667 students.

Incorrect Affiliation: In the Medical News & Perspectives article entitled “Sewage Yields Clues to SV40 Transmission” published in the September 18, 2002, issue of THE JOURNAL (2002;288:1337-1338), Michael Carbone, MD, PhD, is erroneously referred to as “a University of Chicago pathologist.” Carbone is now associate professor in the Department of Pathology at Loyola University Chicago Stritch School of Medicine, Cardinal Bernardin Cancer Center, in Maywood, Ill. He was previously at the University of Chicago.

Incorrect Data: In the article entitled “Employer Drug Benefit Plans and Spending on Prescription Drugs” published in the October 9, 2002, issue of THE JOURNAL (2002;288:1733-1739), there was incorrect data in a table. On page 1736, in Table 2, the number (percentage) for patient characteristic aged 35 to 44 years stated “207473 (29.5)” but should have read “185025 (26.3).”

CME ANNOUNCEMENT
Online CME to Begin in Mid-2003

In mid-2003, online CME will be available for JAMA/Archives Journals and will offer many enhancements:

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- Hypertext links from questions to the relevant content
- Online CME questionnaire
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