

## Effects of Benefit Design Change Across 5 Disease States

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**Objective:** To assess the effects of benefit design change (BDC) on medication adherence and persistence (including switch in therapy), drug costs, and total healthcare costs.

**Study Design:** A retrospective study was performed using administrative claims data from an integrated healthcare system between January 2001 and December 2002.

**Methods:** Continuously enrolled patients in 2001 and 2002 with allergic rhinitis, asthma, diabetes mellitus, hypertension, or osteoarthritis belonged to employer groups with or without a pharmacy BDC as of January 1, 2002. Prescription status (same, switch, or discontinue), adherence among patients receiving therapy, and differences in drug costs and total healthcare costs for each disease state were measured between groups. Bivariate and multivariate statistics were used to test differences in outcomes between groups.

**Results:** Compared with the group without BDC, the proportion of patients who discontinued drug therapy was significantly greater in the BDC group among those with allergic rhinitis (67% vs 54%), asthma (66% vs 50%), osteoarthritis (61% vs 36%), and hypertension (39% vs 18%) ( $P < .05$  for all). Medication compliance was not affected by BDC. The year-to-year pharmacy costs per patient in the BDC group decreased \$305 for patients with osteoarthritis ( $P < .001$ ) and \$95 for patients with allergic rhinitis ( $P = .03$ ). There was no significant effect on overall healthcare costs in any disease state during the year following the BDC.

**Conclusion:** A pharmacy BDC may result in decreased pharmacy costs, with no effect on overall healthcare costs within 1 year for patients with allergic rhinitis, asthma, hypertension, or osteoarthritis.

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For author information and disclosures, see end of text.

Since 1996, employers and other payers of prescription drug benefits have seen growth in annual spending expand to double digits.<sup>1</sup> Strategies to counter this growth in drug benefit costs have included shifting more of the financial responsibility for prescription drugs to employees and to drug benefit plan members. One of the major pharmacy benefit managers in the United States reported that mean copayments for nonpreferred medications recently increased by more than 70%, from \$17 in 2000 to \$33 in 2004.<sup>2</sup>

During the past 20 years, researchers have examined different populations to try to determine how well patients comply with their medication regimens.<sup>3,6</sup> The effects on compliance and on total healthcare costs of increasing patient contributions toward prescription medication payments must be considered.

With Americans paying higher copayments for their prescriptions, there has been significant interest in the effects of these increases on compliance, persistence, health status, and overall healthcare expenditures. Motheral and Fairman<sup>7</sup> examined copayments and their effects on compliance and on overall medical use. Although the conclusions of this study showed that drug expenditures decreased and that compliance and medical use were not affected, the study considered chronic therapies, without close inspection of specific diseases or medications.

A study performed by Huskamp et al<sup>8</sup> concluded that there was a decrease in the use of proton pump inhibitors for treatment of gastroesophageal reflux disease and other gastrointestinal disorders, as well as in the use of angiotensin-converting enzyme inhibitors in the treatment of hypertension, when substantial changes in copayments were implemented. Goldman et al<sup>9</sup> in 2004 examined medication use associated with specific disease states. The researchers found that antihistamine and nonsteroidal anti-inflammatory drug utilization was significantly reduced when copayments were doubled. Despite a \$10 increase in prescription copayment, Meissner et al<sup>10</sup> found no significant effects on drug utilization (low-sedating antihistamines and nasal corticosteroids) among patients with allergic rhinitis; however, health plan costs decreased significantly. Most recently, a study by Taira and colleagues<sup>11</sup> reported the effects of increased tiers on patient compliance in hypertension. In this study, the adjusted odds ratios for patients with \$20 and \$20 to \$165 copayments were 0.76 and 0.48,

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respectively, versus patients with a \$5 copayment. These studies highlight how difficult it is to conclusively determine what effect higher copayments have on patient outcomes and expenditures. The concern is that if benefit design change (BDC) in general becomes a barrier to patient medication use, accessibility to necessary medications may be compromised.

The objectives of the present study were to evaluate the effects of pharmacy BDC on prescription utilization as measured by discontinuation and by switching across select disease conditions and to assess the effects of BDC on medication compliance and on drug costs and total healthcare costs among beneficiaries in an integrated healthcare system. Five diseases (asthma, diabetes mellitus, hypertension, osteoarthritis, and allergic rhinitis) were selected for inclusion to provide a mix of chronic and episodic conditions.

## METHODS

### Study Setting

Intermountain Healthcare (IHC) is an integrated not-for-profit healthcare system based in Salt Lake City, Utah. Intermountain Healthcare has been ranked number 1 in *Modern Healthcare's* top 100 integrated healthcare networks and is recognized for its pursuit of continuous quality improvement.<sup>12-14</sup> The IHC system consists of a health maintenance organization health plan, 21 hospitals, 150 medical facilities and physician offices, 450 physician employees (including 350 primary care physicians), 2500 affiliated physicians, and approximately 425 000 members in the health plans. Pharmacy benefit management services are provided internally by SelectHealth, Salt Lake City.

### Study Design

An administrative claims database was used to examine the effects of prescription BDC on patient drug utilization behaviors. The decision to adopt a particular pharmacy BDC was made for each employer health plan during negotiation between the individual plan sponsor and IHC. Beneficiaries who had no BDC on January 1, 2002 were compared with beneficiaries with BDC on January 1, 2002.

The scope of the study was limited to 5 diseases. Hypertension was selected to represent a disease condition that was chronic but asymptomatic and perhaps more sensitive to BDC. Osteoarthritis was included to represent a chronic disease with acute exacerbations and significant symptoms in which medication treatment decisions may be less sensitive to copayment increases. Osteoarthritis also has drug treatment options that may present significant cost-saving opportunities

between the 2 classes studied (ie, cyclooxygenase-2 inhibitors and nonsteroidal anti-inflammatory drugs); in addition, patients may simply switch to over-the-counter medications if prescription drug prices are too high. Allergic rhinitis was included because of the seasonality of the disease and the potential effect of increased copayments to swing patients between an over-the-counter product or a prescription option. Diabetes mellitus is a chronic disease but is more symptomatic in nature; thus, prescription utilization could be less sensitive to copayment changes. Asthma was the fifth disease condition studied, specifically because of the immediate effect of the onset of asthma attacks and the presumed low sensitivity to cost.

*No formulary changes* occurred in these classes during the study period. While several medications became available in generic form (eg, metformin and lisinopril) and 1 medication became available over the counter (loratadine), the tier-copayment status for the branded prescription form did not change.

### Inclusion and Exclusion Criteria

Beneficiaries were included if they had been enrolled in an IHC plan for 2 full calendar years beginning January 2001 through December 2002. Those meeting the continuous enrollment criteria were included if they had evidence of at least 1 of 5 targeted disease conditions based on the presence of claims for drugs normally used to treat the disease condition of interest. Drug groups were defined by 4-digit or 6-digit Medispan Generic Product Identifier codes to assure that all drug claims were captured.

Only patients receiving drug monotherapy were included in the analysis in an attempt to reduce the potential confounding of compliance and cost results. Therefore, patients who had pharmacy claims for multiple medications to treat a given disease were excluded from the analysis. For example, a patient taking both an angiotensin-converting enzyme inhibitor and a calcium channel blocker for treatment of hypertension were excluded. However, patients with claims for different medications to treat 2 separate diseases were included in each disease category analyzed.

Members who had no pharmacy copayment increase for 2 full calendar years from January 2001 through December 2002 served as study control subjects, compared with members who had a pharmacy copayment increase in year 2 (January 2002 through December 2002). For the purposes of this study, we defined BDC as a copayment increase in the second or third tier of \$5 or greater or as a change from a flat copayment to a percentage coinsurance. The general strategy for employer groups was to raise the incentive to use generic medications

and formulary brands by increasing the copayment differential between generics and tier 1, between formulary brands and tier 2, and between nonformulary brands and tier 3 by increasing the tier 2 copayment or tier 3 copayment or both.

### Study Variables

*Persistence*, as defined by the International Society of Pharmacoeconomics and Outcomes Research,<sup>15</sup> is the time from initiation to discontinuation of therapy. The objective of this study was to measure whether a patient consistently taking a drug in year 1 remained on therapy during year 2. Changes in prescription utilization behavior may occur at any time during the year for clinical reasons that are unrelated to BDC. To isolate BDC-related behavior, analysis criteria were developed that looked at therapy for the last 100 days of the pre- and post-years. The last prescription within a 100-day window before the end of each year was identified and was used as the comparator medication. One hundred days was chosen to assure inclusion of retail and mail-order fills (typical mail-order fills for this population are 90 days). Within the study population, mail-order pharmacy accounted for 4.16% of total pharmacy claims in 2001 and 3.74% of total pharmacy claims in 2002. Meanwhile, looking at the last 100 days of the benefit year allowed enough time to pass in the second year to settle into a behavior after pharmacy BDC. In addition, looking at 100 days at the same time of the year helps to control for seasonality differences in the utilization of medications to treat allergic rhinitis.

The effects of pharmacy BDC were evaluated for the following outcomes: switching to another drug within or across therapeutic classes to treat a given disease, persistence with original therapy, prescription compliance, and direct medical healthcare costs, including a subanalysis of pharmacy costs.

Patients were defined as being persistent with therapy if they were receiving the same chemical entity (eg, a patient taking Capoten was still taking Capoten or the generic captopril) in the last 100 days of 2001 and the last 100 days of 2002. Patients who discontinued had a pharmacy claim for the drug in the last 100 days of 2001 but had no pharmacy claim for the same drug or any other in the last 100 days of 2002. Patients who switched drugs were taking a different agent to treat the disease under study in the last 100 days of 2002 than in the last 100 days of 2001.

Prescription compliance was measured using a medication possession ratio (MPR) method, which is the ratio of days supplied divided by a defined study period.<sup>16</sup> For this analysis, the MPR was calculated for 2001 as the baseline year and for 2002 as the study year. The MPR numerator was sum of the days' supply dispensed during the entire year, including days' supply

that extended into the following year. The MPR denominator was the number of days in the year (ie, 365) and not the number of days between the first and last fills. The MPR was calculated for those who continued therapy, switched therapy within the same therapeutic class, or switched to another therapeutic class but was not calculated for patients who discontinued therapy.

All direct medical care costs in this study were from the perspective of the health plan. These included emergency department, inpatient, outpatient, and pharmacy costs. These costs were obtained from medical and pharmacy claims databases and represented the amount that IHC paid to its providers in 2001 and 2002 (ie, the allowed charge minus the member cost share). A total healthcare cost variable was computed as the sum of the direct medical cost variables already mentioned.

### Statistical Analysis

Data were analyzed using Intercooled STATA 8.0 for Windows (StataCorp LP, College Station, Tex). All statistical tests were conducted at  $\alpha = .05$ . Descriptive statistics were computed where appropriate. Effects of pharmacy BDC on prescription switching and discontinuation behavior, compliance, and total healthcare costs were analyzed. An overall  $\chi^2$  test was conducted, followed by post hoc tests to determine which stratum was significantly different between the copayment increase group and the control group.

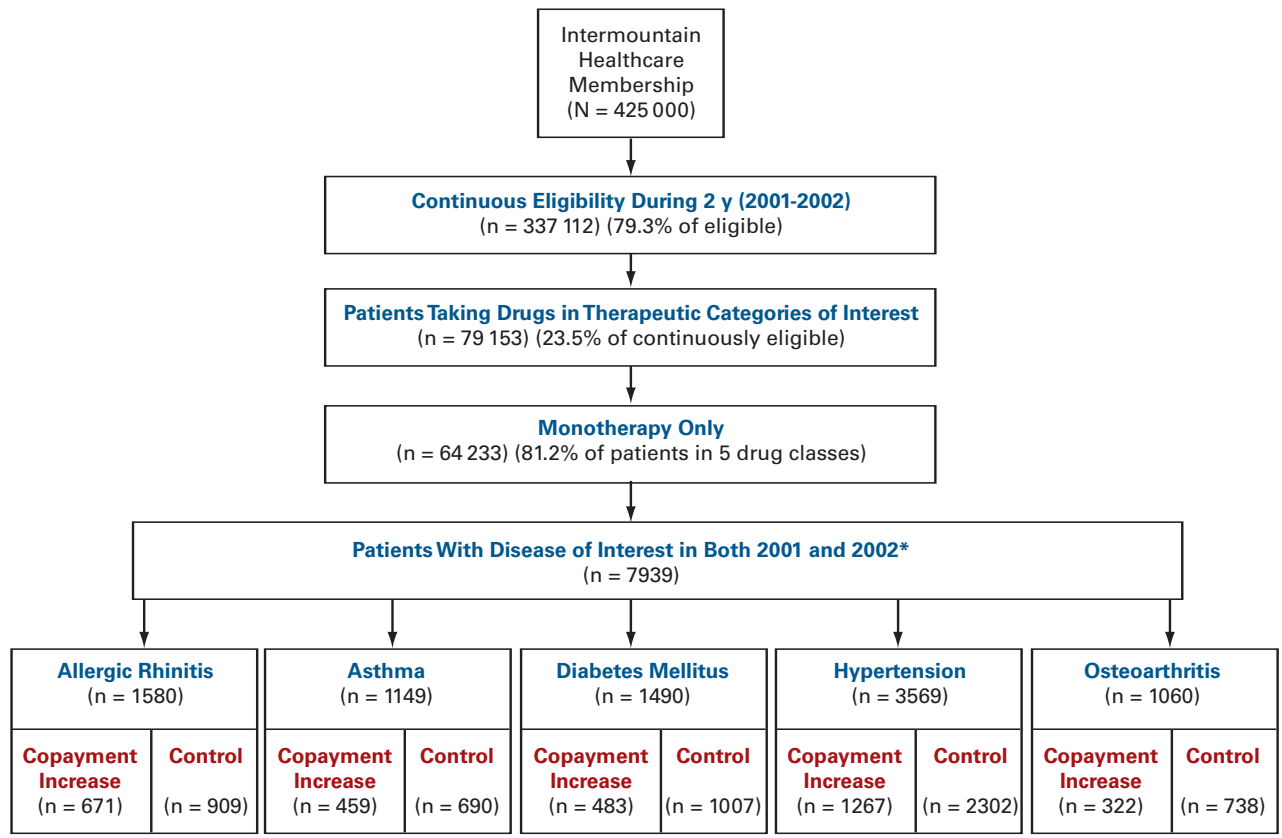
Because of the skewed nature of medical care costs and MPRs, the differences between 2001 and 2002 medical care costs and MPRs were used as dependent variables. The differences in costs and MPRs demonstrated a gaussianlike distribution. Analysis of covariance was used to determine the effect of BDC on the differences in costs and MPRs after adjusting for age and sex. The main effect was the study group.

## RESULTS

The health plans for 672 IHC employer groups were analyzed. Of those, 228 plans representing 56 690 continuously enrolled members (71.6%) had no change in pharmacy benefit structure between 2001 and 2002, and 444 plans representing 22 463 continuously enrolled members (28.4%) had a change in pharmacy benefit structure between 2001 and 2002. Patients with hypertension, allergic rhinitis, and osteoarthritis were identified by *International Classification of Diseases, Ninth Revision* codes in addition to drugs by therapeutic class. For patients with use of medications to treat allergic rhinitis, 26% had an *International Classification of Diseases, Ninth Revision* code; the percentages with codes were 8% for hypertension

## Benefit Design Change

■ **Figure.** Study Population Selection



\*Patients identified by *International Classification of Diseases, Ninth Revision* codes and by Medispan Generic Product Indicator codes for hypertension, allergic rhinitis, and osteoarthritis and by drugs filled for asthma and diabetes mellitus. Subjects who were treated for 2 or more diseases of interest (n = 909) were categorized into more than 1 disease condition for analysis.

and 14% for osteoarthritis. The study sample that met the inclusion criteria totaled 7939. Of this study population, 1580 were classified as having allergic rhinitis, 1149 had asthma, 1490 had diabetes mellitus, 3569 had hypertension, and 1060 had osteoarthritis (Figure). Subjects who were treated for 2 or more diseases of interest (n = 909) were categorized into more than 1 disease condition for analysis.

Age, sex, and distribution of BDC are given in Table 1 for the study sample. Table 2 summarizes persistence and switching behavior across the disease groups as categorized by copayment change status. For patients with allergic rhinitis, there was a 9.6% decrease in the number of patients who stayed on the same therapy with a BDC; for patients with asthma, hypertension, and osteoarthritis, the decreases were 12.8%, 18.0%, and 22.1%, respectively ( $P < .001$  for all).

There was also a statistically significant increase in the rates of discontinuation for patients experiencing BDC versus the controls in all disease conditions except diabetes mellitus. For patients with allergic rhinitis, there was a 12.9% increase, and for asthma, hypertension, and osteoarthritis, the rates of

discontinuation increased 17.0%, 21.2%, and 25.3% ( $P < .001$  for all) (Table 2). For patients with diabetes mellitus, 19.7% of controls discontinued therapy versus 20.1% with a copayment increase, and this was the only group with a nonsignificant difference ( $P = .85$ ).

After adjusting for potential covariates, the associations of BDC with MPR and with variation in pharmacy and total healthcare costs within each disease group are summarized in Table 3. Overall, pharmacy BDC had no effect on medication compliance except in the case of allergic rhinitis, in which compliance increased in the intervention group ( $P < .05$ ). The osteoarthritis group experienced the largest difference in pharmacy cost change versus the control group, and unlike the other diseases, the changes in total costs were higher for the intervention group than for the control group (\$971 vs -\$14).

In the allergic rhinitis and asthma groups from 2001 to 2002, there were statistically significant decreases in pharmacy costs in the BDC group of \$95 ( $P = .03$ ) and \$269 ( $P < .001$ ) per patient per year, respectively (Table 3). In the hyper-

## ■ FORMULARY MANAGEMENT ■

■ **Table 1.** Demographic Characteristics of the Study Sample

Disease Group	Patients, No.		Age, mean ± SD, y			Female Sex		
	No BDC (n = 5017) (%)	BDC (n = 2922) (%)	No BDC (n = 5017)	BDC (n = 2922)	P	No BDC (n = 5017) (%)	BDC (n = 2922) (%)	P
Allergic rhinitis	909 (57.5)	671 (42.5)	34 ± 0.63	32 ± 0.67	.02	517 (56.9)	366 (54.5)	.36
Asthma	690 (60.1)	459 (39.9)	30 ± 0.79	27 ± 0.88	.03	369 (53.5)	237 (51.6)	.54
Diabetes mellitus	1007 (67.6)	483 (32.4)	47 ± 0.58	44 ± 0.70	<.001	561 (55.7)	231 (47.8)	.004
Hypertension	2302 (64.5)	1267 (35.5)	57 ± 0.27	52 ± 0.26	<.001	1315 (57.1)	594 (46.9)	<.001
Osteoarthritis	738 (69.6)	322 (30.4)	59 ± 0.49	54 ± 0.56	<.001	518 (70)	192 (59.6)	.001

Medispan Generic Product Indicator codes are as follows: allergic rhinitis (411000, 412000, 414000, 415000, 415500, 419910, 422000, 422510, 423000, and 424010), asthma (441000, 441500, 442010, 442020, 442099, 443000, 444000, 445040, and 445050), diabetes mellitus (271010, 271030, 271040, 272000, 272500, and 276070), hypertension (340000, 361000, 361500, 369910, 369915, 369918, 369920, 369940, 369950, and 369990), and osteoarthritis (661000, 661005, 661099, 662000, 662500, and 662800).  
BDC indicates benefit design change.

■ **Table 2.** Effect of Benefit Design Change (BDC) on Drug Utilization Behavior\*

Disease Group	No BDC (n = 5017) (%)	BDC (n = 2922) (%)	$\chi^2$ (P)
Allergic rhinitis			
Nonswitchers	312 (34.3)	166 (24.7) <sup>†</sup>	$\chi^2 = 26.6, P < .001$
Switched drug	106 (11.7)	56 (8.3) <sup>‡</sup>	
Switched therapeutic class	0	0	
Discontinued therapy	491 (54.0)	449 (66.9) <sup>†</sup>	
<b>Total</b>	<b>909</b>	<b>671</b>	<b>1580</b>
Asthma			
Nonswitchers	308 (44.6)	146 (31.8) <sup>†</sup>	$\chi^2 = 37.1, P < .001$
Switched drug	24 (3.5)	5 (1.1) <sup>‡</sup>	
Switched therapeutic class	17 (2.5)	3 (0.7) <sup>‡</sup>	
Discontinued therapy	341 (49.4)	305 (66.4) <sup>†</sup>	
<b>Total</b>	<b>690</b>	<b>459</b>	<b>1149</b>
Diabetes mellitus			
Nonswitchers	551 (54.7)	260 (53.8)	$\chi^2 = 4.2, P = .24$
Switched drug	238 (23.6)	108 (22.4)	
Switched therapeutic class	20 (2.0)	18 (3.7) <sup>‡</sup>	
Discontinued therapy	198 (19.7)	97 (20.1)	
<b>Total</b>	<b>1007</b>	<b>483</b>	<b>1490</b>
Hypertension			
Nonswitchers	1412 (61.3)	548 (43.3) <sup>†</sup>	$\chi^2 = 197.8, P < .001$
Switched drug	472 (20.5)	222 (17.5) <sup>‡</sup>	
Switched therapeutic class	3 (0.1)	0	
Discontinued therapy	415 (18.0)	497 (39.2) <sup>†</sup>	
<b>Total</b>	<b>2302</b>	<b>1267</b>	<b>3569</b>
Osteoarthritis			
Nonswitchers	390 (52.8)	99 (30.7) <sup>†</sup>	$\chi^2 = 58.8, P < .001$
Switched drug	81 (11.0)	25 (7.8)	
Switched therapeutic class	0	0	
Discontinued therapy	267 (36.2)	198 (61.5) <sup>†</sup>	
<b>Total</b>	<b>738</b>	<b>322</b>	<b>1060</b>

\*Data are given as number (percentage) unless otherwise indicated.

<sup>†</sup>Statistically significant difference ( $P < .001$ ) between proportions of subjects with no BDC vs BDC.

<sup>‡</sup>Statistically significant difference ( $P < .05$ ) between proportions of subjects with no BDC vs BDC.

tension and osteoarthritis groups, the decreases were \$180 and \$305, respectively ( $P < .001$  for both). Pharmacy costs in patients with diabetes mellitus also decreased (\$92); however, the change was not statistically significant. There were no statistically significant differences in total healthcare costs from 2001 to 2002 between the BDC group and the control group in the 5 disease states.

## DISCUSSION

This study analyzed the effects of BDC on prescription utilization behaviors, compliance, and costs across 5 disease conditions and related therapeutic drug classes. For patients who remained on therapy with the initial drug or with switched therapy, BDC generally did not result in any difference in compliance for the 5 disease conditions. Except for those with diabetes mellitus, subjects in the intervention group had significantly lower pharmacy costs per patient per year the year after the

## Benefit Design Change

**Table 3.** 2002 vs 2001 Mean Change in Medication Compliance and Health Plan Expenditures for 2922 Patients in the Benefit Design Change (BDC) Group vs 5017 Patients in the Control Group\*

Disease Group	Dependent Variables, Per Member Per Year					
	Medication Possession Ratio		Pharmacy Costs, \$		Total Costs, \$	
	No BDC	BDC	No BDC	BDC	No BDC	BDC
Allergic rhinitis	-0.02 ± 0.013 <sup>†</sup>	0.04 ± 0.013 <sup>†</sup>	87 ± 60.7 <sup>†</sup>	-8 ± 56.3 <sup>†</sup>	568 ± 194.3	132 ± 188.1
Asthma	-0.09 ± 0.009	-0.02 ± 0.008	261 ± 91.5 <sup>†</sup>	-8 ± 83.1 <sup>†</sup>	382 ± 393.5	27 ± 357.4
Diabetes mellitus	0.05 ± 0.059	0.05 ± 0.051	301 ± 91.4	209 ± 78.5	1061 ± 74.1	-632 ± 63.5
Hypertension	0.02 ± 0.015	0.02 ± 0.011	328 ± 30.8 <sup>†</sup>	148 ± 30.7 <sup>†</sup>	427 ± 198.1	-135 ± 145.8
Osteoarthritis	-0.02 ± 0.013	-0.01 ± 0.011	307 ± 36.1 <sup>†</sup>	2 ± 29.5 <sup>†</sup>	-14 ± 674.7	971 ± 644.7

\*Data are given as mean ± SE. Levene statistic and Brown and Forsythe extended Levene test of equal variance suggested nonparametric distribution ( $P \leq .05$ ) only for total costs in the asthma group; therefore, a stricter  $\alpha$  value ( $P < .01$ ) was set when testing the outcome.  
<sup>†</sup> $P < .05$  and probability greater than F critical for the main effect (ie, categorical study group variable) derived from analysis of covariance.

BDC. These findings are consistent with studies<sup>9,17</sup> that have shown that BDC can lower cost to plans through greater cost sharing and lower utilization.

However, the present study demonstrated between patients with and without prescription copayment increases. Other recent studies of commercially insured populations have reached similar conclusions, including studies by Motheral and Fairman<sup>7</sup> and Fairman et al,<sup>17</sup> although neither of these studies saw the same degree of therapy discontinuation as that observed in our study. Furthermore, the effects of sustained drug compliance versus discontinuation on overall healthcare costs may play out in a time frame greater than the 1-year period considered in this study.

The prescription copayment increase had the least effect on diabetes treatment. Because diabetes mellitus is a complicated metabolic disease with few treatment options within classes, one would expect prescription change decisions to be driven more by clinical considerations than by potential cost savings due to BDC. The opposite effect was seen in osteoarthritis, in which efficacy is the same among drugs but with different costs per day of therapy between drugs and which can be treated with over-the-counter medications.

There was a large increase in the numbers of patients discontinuing therapy in the symptomatic diseases of allergic rhinitis (12.9%), asthma (17.0%), and osteoarthritis (25.3%). However, patients with hypertension, a nonsymptomatic disease, also had a 21.2% increase in rate of discontinuation of therapy. Similar findings were reported in a study by Landsman et al<sup>18</sup> in which discontinuation rates were higher for symptomatic diseases. Switching behavior across therapeutic classes was low in all groups, perhaps driven by selection of patients receiving monotherapy (ie, with mild disease).

Age and sex were controlled for in the analysis, as patients in plans undergoing a copayment increase were younger, and more were female. If severity of illness was greater in the control group, the effect would have been less. Socioeconomic effect was also not specifically addressed, as the income level of members was unavailable. However, the demographics of the member population were homogenous, in contrast to those of managed care populations representing multiple states and varied employer types.

A relevant question regarding the effects of BDC on utilization behavior, compliance, and overall healthcare costs is whether the effects varied depending on the incremental copayment BDC differences from year 1 to year 2 within our study. This is a topic of future research within this study population.

There were several limitations of our study. First was the absence of disease severity in these analyses. However, because of the monotherapy criteria, the severity of patients within the study disease states was generally mild to moderate.

Second, drug utilization and cost were measured at the disease-treatment level. There was no attempt to assess drug therapy changes for patients with multiple drug therapies (ie, polypharmacy) or to assess the effects of copayment changes for patients taking multiple medications to treat a single disease. Studies<sup>4,19,20</sup> have found that total prescription drug out-of-pocket costs and number of prescriptions affect compliance. There was no adjustment for changes in drug formulary or in the tier-copayment status of individual drugs. For example, over-the-counter Claritin<sup>®</sup> became available in mid December 2002, but this change most likely did not affect our results, as IHC continued to cover prescription Claritin until the end of 2002. Similarly, no adjustments were made for stan-

### Take-away Points

Patients exposed to benefit design change were compared with those not exposed to benefit design change across 5 disease states, including allergic rhinitis, asthma, diabetes mellitus, hypertension, and osteoarthritis.

■ Except for diabetes mellitus, benefit design change led to more changes in utilization and to a decrease in pharmacy costs; however, it did not affect adherence or total costs during a 1-year time frame.

■ This information may assist managed care decision makers in making benefit design change choices that lower pharmacy costs without jeopardizing quality of care.

dard errors between or across employer groups within each comparison group. In general, employer groups insured by IHC are more similar than different, although the groups that underwent change were significantly younger. This may have represented a more aggressive approach toward BDC. The lack of control for potential differences may have allowed for unobserved specific factors to cause correlations among groups.

Third, this study patient population may not be representative because it was derived from an integrated healthcare system recognized as a leader in progressive approaches to wellness and disease management. The influences of IHC disease management programs on patient behaviors within and across classes could not be controlled for and were not assessed.

### Conclusions

A pharmacy BDC resulted in decreased pharmacy costs without negative effects on outcomes as measured by compliance for patients who remained on therapy. There was no change in total healthcare costs within 1 year of the increase in drug copayments.

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