For employers, the underlying premise of benefit design is to provide quality healthcare services to their employees. Although the cost of providing healthcare benefits is a key consideration, employers balance this consideration against employee satisfaction and retention as well as productivity.¹ The concept of a value-based benefit design (VBBD) has emerged over the past decade as a strategy to meet this objective.

**Value-Based Benefit Design**

VBBD allows employers to adopt innovative approaches to health benefits that are designed to lower costs and encourage employees to engage in better health-promoting behaviors.

The National Business Coalition on Health has defined VBBD as a “set of benefits and activities that apply information and incentives to promote a change in patient or provider behavior”⁴ and “use plan design features to maximize the value of a high-quality benefit design.”⁵ Academics have further focused the definition of VBBD to a “clinically sensitive approach that is explicitly designed to mitigate the adverse health consequences of high out-of-pocket expenditures.”⁶

VBBD health plan strategies are gaining in popularity among employers. A nationwide survey of US employers conducted by the Midwest Business Group on Health (a nonprofit coalition of more than 90 employers) in May 2008 found that 62% of employers will waive copays or reduce the costs of certain drugs to provide financial incentives for employees to participate in disease management programs.⁴ Another survey of 117 employers revealed that 45% of employers are currently considering modifying their current prescription copay structure, and 16% had already reduced prescription copays for select chronic conditions.⁵

VBBDs in pharmacy benefits have received the most attention from employers. The most popular approach

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**Objective:** To examine the impact of a value-based benefit design on utilization and expenditures.

**Methods:** This benefit design involved all diabetes-related drugs and testing supplies placed on the lowest copay tier for 1 employer group. The sample of diabetic members were enrolled from a 9-month preperiod and for 2 years after the benefit design was implemented. Measured outcomes included prescription drug utilization for diabetes and medical utilization. Generalized measures were used to estimate differences between years 1 and 2 and the preperiod adjusting for age, gender, and comorbidity risk.

**Results:** Diabetes prescription drug use increased by 9.5% in year 1 and by 5.5% in year 2, and mean adherence increased by 7% to 8% in year 1 and fell slightly in year 2 compared with the preperiod. Pharmacy expenditures increased by 47% and 53% and expenditures for diabetes services increased by 16% and 32% in years 1 and 2, respectively.

**Conclusion:** Increases in adherence and use of diabetes medications were observed. There were no compensatory cost-savings for the employer through lower utilization of medical expenditures in the first 2 years. Adherent patients had fewer emergency department visits than nonadherent patients after the implementation of this benefit design. [AHDB. 2009;2(1):14-24.]

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Dr Nair is Associate Professor, School of Pharmacy, University of Colorado at Denver, Aurora, CO; Dr Miller is Vice President of Pharmacy Services, Great West Healthcare (now Cigna), Denver, CO; Dr Saseen is Associate Professor, University of Colorado, Denver, CO; Ms Wolfe and Mr Allen are Statisticians, University of Colorado, Denver, CO; Ms Park is Pharmacy Manager, GlaxoSmithKline, Research Triangle Park, NC.
has been to target select chronic diseases and lower copays for drugs used to treat those diseases. The impetus for this VBBD stemmed from evidence that increasing cost-sharing for prescription medications can reduce the use of necessary medications and increase adverse events and associated medical utilization, such as hospital or emergency department visits.

With this evidence, Asheville, North Carolina, launched one of the earlier forms of a prescription-centered VBBD in 1997. In this program, copays for diabetes medications and supplies were waived for employees of Asheville if they agreed to be counseled by trained pharmacists every 1 to 3 months about diet, exercise, medication use, blood glucose testing, and foot and eye examinations. Although prescription costs increased for the employer, mean medical costs per member decreased between $2705 and $6502 annually in all 5 years after program implementation, 53% to 75% of employees had improved hemoglobin (Hb) A1c levels, and the city saved an estimated $18,000 annually through reduced sick day use.

The efforts of Pitney Bowes, a national organization providing various postal services, in implementing VBBDs have been widely publicized. Pitney Bowes lowered prescription copays for brand-name medications for diabetes, asthma, and hypertension to a co-insurance rate of 10% compared with previous rates of 30% and 50%. For patients with diabetes, nonadherence to insulin therapy decreased by two thirds, strip use increased by 27%, and the use of fixed combination oral drugs for diabetes increased by 13%.

Most recently, Chernew and colleagues examined the impact on medication adherence of lower copays for angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), beta-blockers, diabetes medications (oral and insulin based), HMG-CoA reductase inhibitors (statins), and steroids. Copays for generic medications were reduced from $5 to $0, for preferred brand-name medications from $25 to $12.50, and for nonpreferred medications from $45 to $22.50. The authors saw a 3.8% to 6.3% increase in medication adherence for all drug classes examined, with the smallest increase for ACE inhibitors and ARBs (3.8%) and the largest increase for statins (6.3%).

Despite the complexities of a pharmacy benefit, prescription-centered VBBDs are popular because employers believe that benefit structures should be based on a system of financial incentives that encourage the use of high-value services and discourage low-value services. The consensus among employers is that adherence to medications is integral to the management of chronic diseases. Interventions that are very effective (eg, the use of prescription medications to treat chronic conditions) and moderate the growth of healthcare costs should be covered at lower or at no cost-sharing, whereas low-value interventions (eg, bariatric surgery) should have higher cost-sharing associated with it. Finally, the “ease” of implementing a pharmacy benefit change is also appealing to an employer. At its simplest form, employers merely have to change a pharmacy benefit rider to reflect the lower copays and communicate this change to employees.

The 3 studies outlined above illustrate the emerging research in evaluating a prescription-centered VBBD. In a review of more than 100 articles, the national consulting company PricewaterhouseCoopers concluded that despite these efforts, there is a paucity of objective academic research demonstrating the true impact of a prescription-centered VBBD for employers. The firm called for more academic research.

The goal of our research was to examine the impact of reducing prescription copays for brand-name diabetes medications and testing supplies from a 3-tier plan with $10, $20, and $40 upper-tier copays to a generic-tier copay of $10 for diabetic employees and their dependents in 1 employer group.

The employer group implemented this program starting on October 1, 2005, and ending in December 2008. Our primary goal was to examine the impact of reducing prescription copays for medications for diabetes on pharmacy utilization patterns, medication adherence for diabetes medication, and medical utilization and expenditures during a 2-year period (October 1, 2005, to September 30, 2007) and to compare these results to a 9-month baseline period for 1 employer group. Our

**KEY POINTS**

- Healthcare cost is a key consideration in benefit design, but employers have to balance cost against quality of care to ensure employee satisfaction, retention, and productivity.
- Value-based benefit design is a relatively new strategy that attempts to meet employers' objectives.
- This study examined the impact of lower copays for diabetes medications on pharmacy and medical utilization, medication adherence, and healthcare expenditures.
- The number of adherent patients increased during the study compared with the period before study initiation. Diabetes-specific office visits and laboratory/diagnostic visits were reduced.
- The flip side of increased adherence was an increase in pharmacy expenditures for diabetes medications.
secondary goal was to compare prescription and medical utilization behavior between adherent and nonadherent patients in a similar manner.

Methods

The study design involved a pre/post period comparison of a cohort of continuously enrolled members in the baseline and after years 1 and 2.

The employer group was from the healthcare industry and represented a nationwide group. At the time of the study, there were 5,427 employees, 3,146 of whom had dependent coverage as well (an average of 2.23 dependents per employee), for a total of 12,443 employees and dependents. A majority of the employees (68%) were women. The mean age was 42 years, and the average length of job tenure was 7.4 years. A majority of the employees (45%) were located in Colorado, 13% were in Missouri, 6% were in California and Texas, and small percentages lived in other states.

Two preferred provider organization (PPO)-based plans were offered to employees between 2005 and 2007. Plan features remained the same in all years and most features of both plans were similar. The plans differed with respect to out-of-network benefits. For PPO plan 1, in-network benefits were:

1. $500 individual and $1,500 family annual deductible
2. $20 copay for office visits and preventive care
3. 20% cost-sharing for hospital services, nursing facilities, home healthcare, and hospice care
4. 20% cost-sharing for laboratory and x-ray services for inpatient services
5. 40% cost-sharing for outpatient surgery, laboratory, and x-ray services for outpatient facilities, physical therapy, and outpatient mental health visits
6. 40% cost-sharing for emergency department visits.

For PPO plan 2, in-network benefits were similar to plan 1 except that:

1. Emergency department visits were at 20% cost-sharing
2. Outpatient mental health visits were 50% for 20 visits per calendar year.

Pharmacy benefits were similar for both plans and consisted of an annual $100 deductible per individual or a $300 deductible per family, with copays of $10 for tier-1 drugs or generics, $20 for tier-2 drugs or preferred brands, and $30 for tier-3 preferred brands. Prescription copays for mail-order drugs were $20 for tier 1, $40 for tier 2, and $80 for tier 3.

The program consisted of placing all diabetes drugs and testing supplies at tier 1, so members would have access to these drugs and testing supplies for a $10 retail copay or a $20 mail-order copay. A letter was sent to all participants before the start of year 1 informing them of their reduced copays for brand-name diabetes medications or testing supplies. No further communication about the program was made to employees following the initial letter in year 1.

The sample consisted of members who were continuously enrolled with the health plan for the 3 observation periods:

- Preperiod or baseline period (January 1, 2005, to September 30, 2005)
- Postperiod year 1 (October 1, 2005, to September 30, 2006) referred to as “year 1”
- Postperiod year 2 (October 1, 2006, to September 30, 2007) referred to as “year 2.”

Patients with diabetes were identified in the preperiod as those who met 1 of the following conditions:

- 2 outpatient visits with diabetes as the primary or secondary International Classification of Diseases, Ninth Revision (ICD-9) code of 250.xx
- 1 emergency department visit with diabetes as the primary or secondary ICD-9 code
- Hospitalization with diabetes as the primary or secondary ICD-9 code
- 2 consecutive prescriptions for any diabetes drugs.

Patients with gestational diabetes, polycystic ovarian syndrome, or chronic renal failure and on dialysis as well as transplant patients and individuals with high-cost conditions (such as cancer, HIV) in the baseline period were excluded.

Outcome Measures

The pharmacy-based measures consisted of annual or annualized measurements per member per year (PMPY) in 3 observation periods for (1) the number of diabetes medications (any, brand, generic, single, combination, mail order); (2) number of diabetes-testing supplies; and (3) medication adherence defined as the proportion of days covered (PDC) for diabetes medications (any medications for diabetes, oral medications for diabetes, or insulin use). Individuals were classified as adherent if the PDC was greater than 80% for any diabetes medications, including oral diabetes medications and insulin. Individuals were classified as adherent or nonadherent in each period separately. Percent differences between year 1 and the preperiod, year 2 and the preperiod, and year 2 and year 1 were also determined for all measures. Differences in utilization of diabetes medications between adherent and nonadherent patients in each time period were examined as well.

Medical outcome measures consisted of the number of diabetes-related emergency department visits, hospi-
Co-pay Reduction Program

Table 1: Adjusted Differences in PMPY Pharmacy Utilization: Diabetes Medications and Testing Supplies

<table>
<thead>
<tr>
<th>Member characteristics (N = 225)</th>
<th>Preperiod</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Preperiod vs Year 1</th>
<th>Difference, % Preperiod vs Year 2</th>
<th>Year 2 vs Year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any diabetes prescriptions *</td>
<td>11.62</td>
<td>12.72</td>
<td>12.22</td>
<td>9 (P &lt; .05)</td>
<td>5</td>
<td>-4</td>
</tr>
<tr>
<td>Brand-name diabetes prescriptions †</td>
<td>4.36</td>
<td>4.99</td>
<td>4.92</td>
<td>14 (P &lt; .05)</td>
<td>13 (P &lt; .05)</td>
<td>-1</td>
</tr>
<tr>
<td>Generic diabetes prescriptions †</td>
<td>4.70</td>
<td>5.19</td>
<td>4.90</td>
<td>10</td>
<td>4</td>
<td>-6</td>
</tr>
<tr>
<td>Mail-order diabetes prescriptions †</td>
<td>2.00</td>
<td>2.20</td>
<td>2.02</td>
<td>10 (P &lt; .05)</td>
<td>1</td>
<td>-8</td>
</tr>
<tr>
<td>Single-entity diabetes prescriptions</td>
<td>9.66</td>
<td>10.68</td>
<td>10.40</td>
<td>11 (P &lt; .05)</td>
<td>8</td>
<td>-3</td>
</tr>
<tr>
<td>Combination-based diabetes prescriptions †</td>
<td>0.23</td>
<td>0.26</td>
<td>0.37</td>
<td>13 (P &lt; .05)</td>
<td>61 (P &lt; .05)</td>
<td>42 (P &lt; .05)</td>
</tr>
<tr>
<td>Diabetes-testing supplies †</td>
<td>1.83</td>
<td>1.82</td>
<td>1.63</td>
<td>-1</td>
<td>-11 (P &lt; .05)</td>
<td>-10</td>
</tr>
</tbody>
</table>

*Estimates based on a Poisson model.
†Estimates based on a zero-inflated Poisson model.
PMPY indicates per member, per year.

Table 1 Adjusted Differences in PMPY Pharmacy Utilization: Diabetes Medications and Testing Supplies

Analysis

Generalized estimating equations for repeated measures were used to estimate pairwise differences between the observation periods. For count-based variables with <25% of values equal to zero, we assumed a Poisson distribution (numbers of prescriptions, emergency department visits, and hospitalizations). For count-based variables with >25% zero values, we used a zero-inflated Poisson model (brand or generic prescription use, testing supply use, and mail-order prescription use). Medication adherence was coded as a binary variable—“yes” was “adherence of ≥80%” and “no” otherwise—and this outcome measure was evaluated using logistic regression. Expenditure data were evaluated by computing the period-to-period differences within a subject; the differences were approximately normally distributed. All analysis was conducted in SAS version 9.1.3.

Results

A total of 225 patients who were continuously enrolled for all 3 observation periods met all the inclusion criteria. Their mean age was 49 years, slightly more than half the sample were women (53.4%), and the mean risk score was 1.08. More than 50% of the patient sample had dyslipidemia (52%) and hypertension (68%); one fifth (21%) had depression.

Pharmacy Utilization

Pharmacy utilization of diabetes medications and testing supplies is shown in Table 1. There was a mean increase of 9% for any prescription for diabetes in year 1 and a smaller increase (95%) in year 2 compared with the preperiod. There was a 14% increase in brand-name
prescription drug use for diabetes in year 1 and a 13% increase in year 2 compared with the preperiod. Smaller increases of 10% and 4% were seen for generic diabetes prescription drugs in years 1 and 2, respectively, compared with the preperiod. There was a 10% increase in year 1, with a negligible change in year 2, in mail-order prescriptions. There was a dramatic increase in the number of combination diabetes prescriptions in year 1 and year 2 compared with the preperiod, but the mean number of combination prescriptions was less than 1.0 PMPY. The number of single-entity prescriptions for diabetes increased by 11% in year 1 and 8% in year 2 relative to the preperiod. There was a decrease in the mean number of diabetes-testing supplies in both years after the preperiod. A majority of these differences were significant \( (P < .05) \).

**Medication Adherence**

Mean medication adherence increased by 7.74% for any medication for diabetes in year 1 but dropped by 2.31% in year 2 compared with year 1 (Table 2). Mean medication adherence increased from 67% to 75% in year 1 and dropped to 73% in year 2 for any diabetes medications. Similar increases in mean levels of medication adherence were seen for users of oral diabetes medications. However, adherence was lower for insulin users in all years (56% in the preperiod, 63% in years 1 and 2) compared with those taking oral medications, with an increase of 7.7% in year 1 but with virtually no change in year 2. All differences in year 1 compared with the preperiod were significant.

The number of adherent patients increased for all diabetes medications and for oral diabetes medications in both years compared with the preperiod. Members were 1.67 times more likely to use any medication for diabetes in year 1 compared with the preperiod and 1.32 times more likely in year 2 compared with the preperiod. These differences were significant in year 1 compared with the preperiod. Similar increases were observed for members using oral diabetes medications. There was little change in the number of adherent members using insulin in all 3 years.

**Medical Utilization**

Mean medical utilization showed a decrease in diabetes-specific office visits and laboratory/diagnostic visits in both years compared with the preperiod (Table 3). There was a 25% decrease in diabetes-specific emergency department visits and a 20% decrease in hospitalizations in year 2 compared with year 1. Differences comparing year 1 and year 2 with the preperiod were not significant.

**Expenditures**

There was a 47% increase in health plan-paid pharmacy expenditures for diabetes medications in year 1 and a 53% increase in year 2 compared with the preperiod (Table 4). These increases were highest for brand-
name medication use (53% increase in year 1 and 68% in year 2 compared with the preperiod). The increase in expenditures for generic diabetes medications was much smaller compared with brand-name agents (28% in year 1 and no change in year 2 compared with the preperiod). Member out-of-pocket expenditures (including deductible amounts) decreased by 28% for all diabetes medications in year 1 and by 33% in year 2 compared with the preperiod. Large decreases were seen in member out-of-pocket costs for brand-name diabetes medications (41% in year 1 and 37% in year 2 compared with the preperiod). There was a 13% increase in member out-of-pocket expenditures for generic medications in year 1 and no change in year 2 compared with the preperiod. A majority of these differences in years 1 and 2 compared with the preperiod were significant.

Despite some decreases in diabetes-related medical utilization in year 2 compared with year 1, there was a 16% increase in total medical expenditures for diabetes services in year 1 and a 32% increase in year 2 compared with the preperiod, none of which was significant.

**Adherent and Nonadherent Patients**

Table 5 shows percent difference in the PMPY prescription utilization for diabetes medication and testing supplies in all 3 observation periods between adherent and nonadherent patients. Adherent patients used 81% more prescriptions in the preperiod, 93% more in year 1, and 126% more in year 2 compared with nonadherent patients. Similarly, they used 87% more brand-name prescriptions in the preperiod and 122% more brand-name prescriptions in years 1 and 2 compared with nonadherent patients. Generic prescription use was 113% higher in the preperiod for adherent patients, 122% higher in year 1, and 190% higher in year 2 compared with nonadherent patients. Mail-order prescription use for adherent patients was

<table>
<thead>
<tr>
<th>Sample (N = 225)</th>
<th>Preperiod</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Preperiod vs year 1, %</th>
<th>Preperiod vs year 2, %</th>
<th>Year 2 vs year 1, %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Office visits</strong></td>
<td>2.88</td>
<td>2.39</td>
<td>2.45</td>
<td>17</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td><strong>Emergency department visits</strong></td>
<td>0.08</td>
<td>0.12</td>
<td>0.09</td>
<td>50</td>
<td>13</td>
<td>-25</td>
</tr>
<tr>
<td><strong>Hospitalizations</strong></td>
<td>0.04</td>
<td>0.05</td>
<td>0.04</td>
<td>25</td>
<td>0</td>
<td>-20</td>
</tr>
<tr>
<td><strong>Laboratory/ diagnostic visits</strong></td>
<td>4.01</td>
<td>3.69</td>
<td>3.57</td>
<td>-8</td>
<td>-11</td>
<td>-3</td>
</tr>
</tbody>
</table>

*Estimates based on a Poisson model.
†Estimates based on a zero-inflated Poisson model.
No comparisons were significant at the 0.05 level.
PMPY indicates per member, per year.

**Table 4 Adjusted Differences in Mean PMPY Pharmacy, Medical Expenditures, and Member Out-of-Pocket Prescription Costs**

<table>
<thead>
<tr>
<th>Sample (N = 225)</th>
<th>Preperiod, $</th>
<th>Year 1, $</th>
<th>Year 2, $</th>
<th>Preperiod vs year 1, %</th>
<th>Preperiod vs year 2, %</th>
<th>Year 2 vs year 1, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>All diabetes medications</td>
<td>888</td>
<td>1305</td>
<td>1361</td>
<td>47 (P &lt; .05)</td>
<td>53 (P &lt; .05)</td>
<td>4</td>
</tr>
<tr>
<td>Brand-name diabetes drugs</td>
<td>611</td>
<td>936</td>
<td>1030</td>
<td>53 (P &lt; .05)</td>
<td>68 (P &lt; .05)</td>
<td>10</td>
</tr>
<tr>
<td>All generic medications</td>
<td>121</td>
<td>156</td>
<td>121</td>
<td>28 (P &lt; .05)</td>
<td>0</td>
<td>-22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Health plan pharmacy expenditures</th>
<th>Health plan diabetes-specific medical expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>All diabetes medications</td>
<td>Office visits</td>
</tr>
<tr>
<td>267</td>
<td>192</td>
</tr>
<tr>
<td>Brand-name diabetes drugs</td>
<td>Hospitalizations</td>
</tr>
<tr>
<td>142</td>
<td>83</td>
</tr>
<tr>
<td>Generic diabetes drugs</td>
<td>Total</td>
</tr>
<tr>
<td>67</td>
<td>76</td>
</tr>
</tbody>
</table>

Statistical tests are based on the analysis of differences between periods for each patient.
PMPY indicates per member, per year.
121% higher in the preperiod, 104% higher in year 1, and 110% higher in year 2 compared with nonadherent patients. Diabetes-testing supply use for adherent patients was higher by 8% in the preperiod, lower by 5% in year 1, and higher by 32% in year 2 compared with the nonadherent patients.

Figure 1 shows that the mean number of emergency department visits was much lower for adherent patients compared with nonadherent patients in all 3 years and disparity was greater in each year (50% in the preperiod, 55% in year 1, and 83% in year 2). Hospitalizations for adherent patients (Figure 2) were fewer in all 3 years, but fewest in the preperiod compared with the other years (75% in the preperiod, 43% in year 1, and 67% in year 2). The number of office visits was 30% lower for adherent patients in the preperiod compared with nonadherent patients but 6.3% and 3.5% higher in year 1 and 2, respectively (Figure 3). Laboratory/diagnostic visits showed similar trends: lower by 9.1% for adherent patients in the preperiod compared with nonadherent patients but higher by 2.5% and 17.1% in years 1 and 2, respectively (Figure 4). No statistical tests were done on these measures due to small sample and low event rate.

In a comparison of medical expenditures for diabetes-related services in all 3 years (results not shown), there was a 70% difference for adherent patients compared with nonadherent patients in the preperiod, a 75% difference in year 1, and no difference in year 2.

**Discussion**

Following the work of Chernew et al.,
10 we expanded the examination of a prescription-centered VBBD for a more comprehensive set of outcomes than previously included. Our results show that prescription utilization for diabetes medications increased in years 1 and 2, although the rates of increase were lower in year 2 compared with year 1. The 9.5% increase in diabetes medications in year 1 was higher than the national average of 6.2% for 2006, and the 5.5% increase in year 2 was higher than the national average of 2.2% for diabetes prescriptions.17,18 The increase in brand-name medications was greater in both years compared with generics. It is possible that members had some moral hazard behavior with the use of brand-name medications after copays were reduced as member out-of-pocket costs for brand-name diabetes medications decreased by 22% and 17% in years 1 and 2, respectively.

However, there were some decreases in the use of diabetes-testing supplies, particularly in year 2 (11%) compared with the preperiod. We believe we did not capture all use of diabetes-testing supplies through the paid pharmacy claims because it is likely that members were purchasing glucometers and testing supplies on their own before the reduction in copays and continued to use the same testing supplies. While more than 90% of members purchased prescription medications, fewer than 50% purchased any diabetes-testing supplies in all 3 observation periods.

| Table 5 Adjusted Differences in PMPY Pharmacy Utilization for Diabetes Drugs and Testing Supplies: Nonadherent vs Adherent Patients |
|---------------------------------|-------------------|-------------------|
|                                | Nonadherent | Adherent | Adherent/non-adherent as % of nonadherent |
| Preperiod                       |              |          |                                           |
| Any diabetes prescription      | 7.15        | 12.93    | 81 (P < .05)                              |
| Any brand-name diabetes        | 2.89        | 5.41     | 87 (P < .05)                              |
| prescription                   |              |          |                                           |
| Any generic diabetes           | 2.81        | 6.00     | 113 (P < .05)                             |
| prescription                   |              |          |                                           |
| Any mail-order diabetes        | 1.17        | 2.59     | 121 (P < .05)                             |
| prescription                   |              |          |                                           |
| Any diabetes-testing supply    | 1.44        | 1.55     | 7                                          |
| Year 1                          |              |          |                                           |
| Any diabetes prescription      | 9.47        | 18.26    | 93 (P < .05)                              |
| Any brand-name diabetes        | 3.61        | 8.03     | 122 (P < .05)                             |
| prescription                   |              |          |                                           |
| Any generic diabetes           | 3.70        | 8.23     | 122 (P < .05)                             |
| prescription                   |              |          |                                           |
| Any mail-order diabetes        | 1.61        | 3.29     | 104 (P < .05)                             |
| prescription                   |              |          |                                           |
| Any diabetes-testing supply    | 2.16        | 2.05     | -5                                         |
| Year 2                          |              |          |                                           |
| Any diabetes prescription      | 8.68        | 19.65    | 126 (P < .05)                             |
| Any brand-name diabetes        | 3.80        | 8.44     | 122 (P < .05)                             |
| prescription                   |              |          |                                           |
| Any generic diabetes           | 3.13        | 9.07     | 190 (P < .05)                             |
| prescription                   |              |          |                                           |
| Any mail-order diabetes        | 1.58        | 3.32     | 110 (P < .05)                             |
| prescription                   |              |          |                                           |
| Any diabetes-testing supply    | 1.71        | 2.25     | 32 (P < .05)                              |
| PMPY indicates per member, per year. |          |          |                                           |

PMPY indicates per member, per year.
Medication adherence increased 7.7% in year 1 and dropped between 0.2% and 3% in year 2 compared with the preperiod. In years 1 and 2, mean levels of adherence ranged from 65% to 73% (less than the 80% cutoff for an individual to be classified as adherent). But there was an increase in the number of adherent patients in both years compared with the preperiod for patients taking any oral diabetes medications (13% to 14%). However, even with these increases, the number of adherent patients remained below 55% of the population in all time periods. In particular, only 20% of insulin users were adherent in all time periods.

Medical utilization for diabetes services showed some decrease in use, notably for emergency department visits and hospitalizations in year 2 compared with the preperiod, but the trends showed increases in total medical costs for both years (16% in year 1 and 14% in year 2). There were some decreases in medical utilization caused by complications from diabetes, but the low prevalence in a sample of 225 members makes these results difficult to interpret.

As expected, pharmacy expenditures for all diabetes prescriptions increased considerably: 47% and 53% in years 1 and 2, respectively. Increases in expenditures for brand-name medications were more than 100% in both years. Because pharmacy and medical expenditures increased, a return on investment was not achieved during the study period.

The impact of a prescription-centered VBBD program on adherent versus nonadherent patients supports the impact of improving medication adherence on health outcomes. Adherent patients were less likely to have emergency department visits than nonadherent patients, a discrepancy that widened following the reduction in copays (50% fewer in the preperiod, 55% fewer in year 1, and 83% fewer in year 2). Adherent patients were also more likely to have an increase in the number of office visits and laboratory/diagnostic visits after the reduction in copays compared with nonadherent patients.

There are several lessons learned from this endeavor. First, the prescription-centered VBBD may improve medication behaviors. The VBBD we measured was a “no-frills” approach to changing medication adherence. Over a 3-year period, the only change to diabetes management was the copay reduction. With only a change in financial incentives, there were noticeable increases in medication adherence, use of diabetes medications, and the number of adherent patients. It has been well established that medication adherence is influenced by several factors, only one of which is reducing financial barriers for medications. Therefore, additional attempts may be needed to reinforce these behaviors through other means, such as education about adherence to medications, methods to remind patients about taking their medication, or other efforts to help patients better manage their disease (excluding the existing disease management program that was available throughout the 3-year period). Further reinforcement of adherence through additional value-based efforts could enhance the increases in medication adherence.

Second, employers need to be encouraged to think in different ways about a return on investment for a prescription-centered VBBD. Employers may expect to offset the increased pharmacy costs they incur due to lower copays with savings on medical costs. However, our results show that such saving may not be realized even 2 years after the implementation of a VBBD.
ings show that patients who were adherent had fewer emergency department visits, continued to increase their adherence, and had more office visits and laboratory/diagnostic services after a copay reduction was introduced. Therefore, employers need to be encouraged to think of a return on investment in alternative terms and expect to notice long-term improvements in disease management by their members. Employers also should find ways to encourage members to improve their adherence with medications for chronic conditions. By getting more members to achieve adherence levels of 80% or greater, employers may realize savings in medical costs over time.

**Limitations**

Our study had several limitations. First, different forms of reduced prescription copay VBBD models exist and could include: (1) eliminating all copays for disease-specific medications, (2) reducing the copay levels at all tiers or reducing the differential between the tiers for disease-specific medications, (3) reducing copays for disease-specific brand-name medications, and (4) reducing copays for certain chronic condition medications. The employer group participating in this study chose to eliminate copays for brand-name medications and testing supplies for diabetes. Their rationale for doing so was to (1) create an even “playing field” so that their members could have access to all diabetes medications at a singular and uniform copay, and (2) to maintain some level of cost-sharing and thereby responsibility for purchasing their diabetes medications albeit at a lower copay. However, the very nature of the prescription-based reduction of copays for only brand-name medications could result in the unintended consequence of overutilization of brand-name diabetes medications, which could negatively impact any cost-savings in medical utilization.

Second, the $4 prescription program by Wal-Mart was initiated in September 2006\(^\text{[18,19]}\) and may have affected the adherence levels we observed in this population as it included many generic oral diabetes medications. We did not have data on whether members in our sample chose to purchase diabetes medications from Wal-Mart directly for $4 rather than through their health plan, thereby resulting in lower observed adherence levels in the health plan data we utilized for this study. As the popularity of Wal-Mart’s $4 prescription program continues to grow, the impact of this source of prescription medications needs to be considered in making any assessments of a prescription-centered VBBD.

Third, we did not have a control group. This would have allowed us to tease apart the effects of the copay reduction from any underlying trends in prescription utilization. We tried to identify a comparison group from the health plan’s other employer groups with a similar 3-tier pharmacy benefit, type of industry, age, gender, and risk score distribution. However, our efforts did not yield an appropriate comparison group. Although we used national benchmarks to compare the overall change in diabetes medications, a more accurate comparison would involve a control group or benchmark data from a matched group of patients with diabetes across health plans. We are currently in the process of creating such a benchmark using an external dataset.

Fourth, our small sample size due to the inclusion criteria limits the interpretation of some of our findings, specifically the utilization of emergency department visits and hospitalizations, which are not common medical events (ie, most members do not incur such events). Changes in emergency department visits and hospitalizations should be interpreted with caution because the mean number of annual visits per member was small (<0.1) in all years. In addition, insulin adherence may have been overestimated using the PDC, because the amount of insulin a patient consumes is based on the dosage and directions for use, none of which are available in pharmacy claims data.

Fifth, we were not able to compare changes in prescription use for diabetes by tier status in the pharmacy claims. The identifiers for tier status (tiers 1-3) were not available in the claims and cross references using the formulary, and brand/generic indicator was not conclusive. Thus we were unable to examine whether members purchased more expensive brand-name medications that were placed in the highest or third tier before the copay reduction was introduced, which could imply the possibility of moral hazard behavior after the program was implemented. Similarly, because 30% of our sample had diagnosis codes for both type 1 and type 2 diabetes, the resulting sample sizes after all the inclusion criteria were met did not permit a comparison of these 2 forms of diabetes.

Sixth, the ultimate impact of a prescription-centered VBBD for diabetes is on clinical outcomes. Although we
were not able to collect data on clinical markers such as HbA1c levels, examining these outcomes for improvements in the mean levels of HbA1c markers and the number of patients whose HbA1c levels improved after the copay reductions for medications could provide greater evidence of the positive impact of a VBBD.

Our approach took an overall assessment of each measure within a time period. Another approach examines quarterly changes in adherence over the observed time period. Because of our limited sample size we chose to examine the PMPY levels of each outcome in each observation period.10

Finally, we are not certain that we captured data on all testing supplies. Fewer than 50% of the patients in our sample purchased diabetes-testing supplies in the preperiod, and after the copay reduction there were decreases in the purchase of glucometers and testing supplies. It is possible that members were purchasing testing supplies from alternative sources.

Conclusions

A prescription-centered VBBD can have an impact on medication adherence which is influenced by many factors, and reducing financial barriers through VBBD should be coupled with other behavior modification. Because adherent patients have lower healthcare costs, employers should think about a return on investment as a long-term goal that can result in savings when more employees become adherent with their medications.

Disclosure Statement

Dr Nair is a consultant to Centocor, Inc. Dr Saseen is a consultant to Daichii Sankyo, Inc. Ms Park is an employee of GlaxoSmithKline.

References


Stakeholder Perspective

Improved Clinical Outcomes the True Value of Copay Reductions for Diabetic Employees, Despite Increased Overall Costs

EMPLOYERS: This is a case report of an employer group’s almost 3-year study to institute a copay reduction program for their diabetic employees and their dependents. The article also reviews the implications of value-based benefit design for health plans and employers.

In this study, copays were reduced from a 3-tiered plan to a single-level copay for all diabetes medications and diabetes-testing supplies. Two outcomes were measured. The pharmacy outcome measured adherence versus nonadherence. The medical utilization outcome measured diabetes-related emerg-
gency department (ED) visits, hospitalizations, outpatient visits, and diagnostic visits in adherent and nonadherent members.

Members could obtain any diabetic prescription medication at a $10 copay; therefore, for insured members the higher-cost brand-name drugs were free of any marginally increased copay amount.

Results show that members utilized the “free” benefit and obtained the more expensive drugs. What did the employer group get for this added expense? Claims expenditure data appear to be the only measurement evaluated in this study, showing that the expenses were higher for pharmacy costs and diabetes supplies. Overall medical utilization expenses also increased, while medical utilization of diabetes-specific ED visits and diabetes-specific hospitalizations decreased from year 1 to year 2.

Patients selected higher-priced brand-name diabetes medications and supplies, remained on the medications at a higher rate, and had fewer visits to the ED as the study progressed. During the study period, the employer group did not achieve cost-savings from this copay design, based on pharmacy and medical utilization expenditures.

MEDICAL/PHARMACY DIRECTORS: One lesson for medical directors and others responsible for pharmacy benefit design in the treatment of diabetic members is that copay reduction alone will likely not generate cost-savings.

However, another lesson is that to determine whether quality improvements occur in the management of diabetic members, more than just claims data must be analyzed: In a diabetic population, measuring clinical outcomes—such as the rates or progression of renal disease, retinopathy, and peripheral neuropathies—may reveal the true value associated with these types of benefit-design changes.

Geoffrey P. Cole, MD, MBA
Chief Medical Officer
Health Plan Select
Athens, Georgia