Predicting Adherence to Prescription Medication Purchase Among HMO Enrollees With Diabetes

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OBJECTIVE: To identify variables that determine the likelihood that enrollees with diabetes in a health maintenance organization (HMO) will adhere to purchasing prescription medications.

METHODOLOGY: A survey was mailed to 200 diabetic patients aged 18–64 who were enrolled in a metropolitan HMO during 1995.

RESULTS: Psychosocial barriers, susceptibility to complications, and patients' experiences in hospitalization or emergency room visits were found to be the most significant predictors of adherence. Lower adherence to medication purchase was found among patients who perceived significant barriers to obtaining and using medication, and among patients who had been hospitalized or treated in an emergency room for diabetic complications. Patients who perceived themselves at greater risk for complications related to diabetes were more likely to adhere to prescription medication purchases. Drug cost sharing also demonstrated significant influence on patient behavior.

CONCLUSIONS: Overall findings suggest that managed care organizations can contain their diabetic medical expenses through proper policy formulation and increased patient education.

KEYWORDS: Adherence, Health beliefs, Diabetes, Drug Costsharing

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Diabetes mellitus is the seventh leading cause of death in the United States, affecting 16 million Americans, half of whom are undiagnosed. More than 70% of patients diagnosed with diabetes must rely on insulin and/or hypoglycemic agents to control their blood glucose adequately. Hence, drug therapy is an essential element in diabetes management, requiring a life-long commitment and many behavior changes.

Bloom, Cerkoney, and Hart2 wrote that a key to success for long-term diabetes management is patient adherence to clinical prescriptions. The Workshop/Symposium on Compliance with Therapeutic Regimens of 1974 defines adherence (or compliance) as the extent to which the patient's behavior coincides with the clinical prescription. Sackett’s review of adherence literature suggests that 75% of patients adhere to short-term medication regimens and about 50% adhere to long-term medication therapy. The rate of adherence to lifestyle regimens is usually lower than that for medication regimens.

A review of the literature indicates that overall adherence levels among patients with diabetes appear to be unsatisfactory, ranging widely from as low as 19% to as high as 91%. Less than 10% of diabetics adhered to all behaviors deemed essential for good control. Simply, most diabetics are under poor control, a problem that consistently plagues managed care outcomes. Evidence shows that patients’ health beliefs about benefits of therapy, barriers to obtaining and using medication, severity of disease, and susceptibility to complications,
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as well as some sociodemographic variables (e.g., age, sex, duration of diabetes, race, insurance coverage) play important roles in levels of adherence to diabetes medication regimens. More than 50% of diabetes-related amputations and 20% of emergency room visits may, some studies suggest, be avoidable through better patient education, screening, and improved access to primary care.

Although drug therapy accounts for less than 3% of annual medical costs for diabetes, and is necessary for most diabetics, adherence to drug therapy among diabetics is suboptimal. With the growing prevalence of diabetes and its escalating annual costs, improving diabetics' adherence to medication therapy has become a more vital goal than ever for practitioners and policymakers alike.

This study used a mailed survey to examine the extent to which the health beliefs and personal profiles of diabetics enrolled in a health maintenance organization (HMO) affected these patients' first-order adherence to purchasing prescription medications. The study also identified the most influential factors that predict a diabetic's adherence to medication purchase. In this study, medication purchase is a proxy, though not a guarantee, for the consumption of those medications. Obviously, if a patient does not adhere to the first order for medication, there is a lapse in necessary therapy.

METHODS

Patients

This study surveyed diabetic patients enrolled in an HMO in a large Midwestern city. Diabetes type and age were used to identify qualified subjects from a database of pharmacy claims submitted January 1, 1995, through December 31, 1995. Because long-term drug therapy is commonly prescribed for patients with either Type I or Type II diabetes, both types of patients were included. Enrollees younger than 18 or older than 64 years of age were excluded due to concerns about their capacity for independent care-seeking, literacy levels, and health plan coverage.

After selecting for these factors, 1,672 subjects were identified and invited to participate in this study. A reminder letter and second survey were sent to each subject before the patient was considered a nonrespondent. A total of 264 diabetic enrollees responded to the HMO's invitation. Of the questionnaires returned, 200 proved useful for final data analysis, for a response rate of 12%.

Measurements

A single-item statement with a yes/no scale addressed adherence to purchasing prescription medications. Four diabetes-specific health beliefs were either adopted or adapted from the work of other researchers. All multitem scales were measured on a five-point Likert scale:

- Severity of diabetes: 1=not at all to 5=extremely;
- Susceptibility: 1=very unlikely to 5=very likely;

▲ Perceived benefits: 1=strongly disagree to 5=strongly agree;
▲ Perceived barriers: 1=strongly disagree to 5=strongly agree.

The seriousness measure was adopted from Hampson et al's Personal Modes of Diabetes Interview (PMDI). Six items inquired about the perceived severity of the patient's diabetes. The susceptibility measure of eight items was drawn from a 16-item instrument developed by Lewis et al, focusing on the patient's perceived vulnerability to the likelihood of developing diabetes-related complications, diseases, and symptoms.

The five items that measured perceived benefits and the four items relating to psychosocial barriers were adopted from Given et al's inventory of diabetics' health beliefs, with an emphasis on items relating to taking medications (e.g., "I believe that my medication will control my diabetes."). In addition to psychosocial barriers (defined as "interruptions") this study also included a set of barriers considered important in influencing adherence to purchasing prescription medications, such as drug-cost sharing, time spent on obtaining medications, and perceived difficulty in accessing medications.

The overall reliability assessments (Cronbach's alpha) of all scales achieved a satisfactory level of 0.7 as Nunnally suggested, ranging from 0.74 for perceived benefits to 0.87 for severity. Through principal component factor analysis, most scales other than susceptibility were unidimensional. This factor explains 49.2% of the benefit variance to 61.6% of the severity variance. A partition of the susceptibility scale was determined in response to the statistical evaluation. Five items were retained to represent the scale of susceptibility to rare complications. In the final analysis, due to the potential of multicollinearity, both subscales were kept in a multiple regression equation.

Statistical Analysis

Both analysis of variance and chi-square tests were used to compare respondents, nonrespondents, and nonparticipants in terms of age, sex, and drug cost sharing. Multiple regression analysis was performed to investigate the association between adherence to purchasing prescription medications and each health belief, as well as demographic variables, while other factors were held constant. A simultaneous multiple regression analysis sought to select significant independent variables among a set of candidates. Health beliefs and demographic variables were used as independent variables in the models. Possible associations with the adherence measures were assumed to be linear.

RESULTS

Description of Sample

Table 1 summarizes the results of comparing respondents (n=200), nonrespondents (n=64), and nonparticipants (n=1,408) on the available information of age, sex, and drug cost-sharing policy. Results show that no significant difference was found in the average age and sex distribution among the
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Table 1. Nonparticipants vs. Nonrespondents vs. Respondents: Age, Sex, & Copay

<table>
<thead>
<tr>
<th>Variables</th>
<th>Nonparticipants N=1,408</th>
<th>Nonrespondents N=64</th>
<th>Respondents N=200</th>
<th>Statistics*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>Mean</td>
<td>45.6</td>
<td>46.3</td>
<td>46.8</td>
<td>1.25</td>
</tr>
<tr>
<td>SD</td>
<td>11.8</td>
<td>10.2</td>
<td>10.6</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (%)</td>
<td>523 (37.1)</td>
<td>25 (39.1)</td>
<td>75 (37.5)</td>
<td>.10</td>
</tr>
<tr>
<td>Female (%)</td>
<td>885 (62.9)</td>
<td>39 (60.9)</td>
<td>125 (62.5)</td>
<td>.05</td>
</tr>
<tr>
<td>Copay* S (%)</td>
<td></td>
<td></td>
<td></td>
<td>4.8</td>
</tr>
<tr>
<td>0</td>
<td>650 (46.2)</td>
<td>33 (51.6)</td>
<td>42 (21.0)</td>
<td></td>
</tr>
<tr>
<td>0&lt;s&lt;3</td>
<td>199 (14.1)</td>
<td>7 (10.9)</td>
<td>25 (12.5)</td>
<td></td>
</tr>
<tr>
<td>3&lt;s&lt;5</td>
<td>205 (14.6)</td>
<td>10 (15.6)</td>
<td>87 (43.5)</td>
<td></td>
</tr>
<tr>
<td>5&lt;s&lt;7</td>
<td>53 (3.8)</td>
<td>2 (3.1)</td>
<td>4 (2.0)</td>
<td></td>
</tr>
<tr>
<td>7&lt;s&lt;10</td>
<td>79 (5.6)</td>
<td>1 (1.6)</td>
<td>6 (3.0)</td>
<td></td>
</tr>
<tr>
<td>&gt;10</td>
<td>50 (3.6)</td>
<td>0 (0.0)</td>
<td>3 (1.5)</td>
<td></td>
</tr>
<tr>
<td>Differential</td>
<td>100 (7.1)</td>
<td>9 (14.1)</td>
<td>4 (2.0)</td>
<td></td>
</tr>
<tr>
<td>No benefit</td>
<td>72 (5.1)</td>
<td>2 (3.1)</td>
<td>16 (8.0)</td>
<td></td>
</tr>
</tbody>
</table>

*Analysis of variance was used to compare the average scores of age among three groups, and chi-square test for sex and drug copay; T1 refers to a comparison between nonparticipants and nonrespondents, T2 for nonparticipants and respondents, and T3 for nonrespondents and respondents.

**Level of significance i.e., *p≤.05; **p≤.01; ***p≤.001)

*Reclassify "copay" to four categories for the purpose of chi-square test to meet the requirement of each cell with five or more subjects: $0, 0<s<3, 3<s<5,$ and $>5$. In this case, the categories of differential, no benefit, and unknown/missing were eliminated because there were too few subjects within the cell or the result was useless for statistical purposes.

*Included those with no prescription benefits or benefits that cannot be identified among nonparticipants.

Three groups. The demographic characteristics of the respondents are shown in Table 2.

However, the distribution of drug cost-sharing levels among respondents significantly differed from that of nonrespondents and nonparticipants. Only 21% of the 200 respondents received prescription medications at no out-of-pocket fee, compared to 51.6% of nonrespondents and 46.2% of nonparticipants.

Relationship Between Adherence and Predictor Variables

As shown in Table 3, interruption (psychosocial barriers), susceptibility, and bad experiences with hospitalization or emergency room treatment were found to be the most significant predictors of adherence to purchasing prescription medications, explaining 36.5% of the variance.

Patients who perceive that taking diabetes medications causes greater interruption in their lives were less likely to adhere to purchasing those medications. Adherence levels were higher among patients who perceived themselves as being more susceptible to developing rare complications. Patients who had bad experiences when hospitalized or had been treated in emergency rooms for diabetes-related complications tended to purchase medications less frequently than their doctors recommended.

After removing demographic variables, interruption and susceptibility, plus perceived benefits, became the best predictors of adherence. The likelihood of adhering to medication purchases rose with a patient's score on perceived benefits. Among barriers, drug cost sharing was influential in impeding adherence to drug purchasing. Those who had to pay more for their prescription drugs were less likely to adhere to purchasing those medications.

LIMITATIONS

One of this study's major limitations is the low response rate. Despite efforts made to improve the response rate, only 12% of qualified subjects were willing to participate in the study and return usable questionnaires. Several factors may help explain this low response rate. Some patients with serious and chronic illnesses, including diabetes, maintain a degree of denial about their condition. Their unwillingness to see themselves or be labeled as diabetic would make them unlikely to participate in a study of patients with this illness. Further, patients who pay no out-of-pocket fee for their medications are underrepresented in this study compared to those who must pay a portion of their medication expense. These patients may simply have had less interest or concern in the study's examination of cost sharing as a barrier, because this issue has no application to them.

Measuring adherence to purchasing prescription medication presents another limitation. Such adherence is a dichotomy
variable on a yes/no scale. Only nine of 199 persons reported nonadherence in purchasing all prescription medications during the last six months of the survey period. This limitation in measurement may explain why only 36% of the variance in adherence was attributed to 18 predictors, and only three independent variables showed significant association with adherence. The single-item measure also limited the representativeness of purchasing adherence. Because this study population was selected from the population of a mixed-model HMO, its results may not be generalizable to other types of health insurers without modifications.

Future research using multiple items of adherence to purchasing prescription medications on a multipoint scale should improve the measure of purchasing adherence. Further studies on the construct validity of the concept of purchasing adherence, using claims databases, also are warranted.

**DISCUSSION**

Interruption, susceptibility, and bad experience were found to significantly relate to adherence in purchasing prescription medications. Patients who perceived that taking diabetes medications caused interruption were less likely to purchase those medications. The perception of interruption and its impact on taking medications has been demonstrated in other studies.28

Among the examined barriers, drug cost sharing was predicted to be the second most powerful factor affecting patients’ adherence to medication purchase. Several studies have demonstrated the negative effects of drug cost-sharing policies on drug utilization in a variety of settings.29-31 Such a negative impact was not clearly observed in this study, for reasons that may include the following:

- **Research method.** Most existing research used claims databases to collect data, which likely provide accurate estimates of drug use. This study used a survey that relies on patient reports of their own behavior, which may be considered an inherent weakness.32

- **Sample size.** The low response rate combined with the self-reported survey may have made detection of the association between cost sharing and drug purchasing adherence difficult.

- **Statistical method.** This study controlled other competitive variables while measuring the impact of drug cost sharing, unlike other studies in which a stronger association between cost sharing and purchase adherence has been demonstrated.

- **Study population.** This study focused on a specific population of diabetic patients. Previous research has shown that drug cost sharing has a lesser effect on the purchase of essential drugs than on discretionary medications.30, 33-36

Although the impact of drug cost sharing demonstrated in this study is not significant (p=0.05), cost sharing did appear to have a substantial influence on drug purchasing adherence worthy of note.

The significant correlation demonstrated between susceptibility and adherence suggests that patients’ perception of their vulnerability to complications has a determinant impact on their drug-purchasing behavior, a result consistent with the findings of Janz and Becker’s review of literature on the health belief model, which showed that health belief barriers and susceptibility were the top predictors of adherence behaviors. It may be fair to conclude that perceived susceptibility may positively affect not only purchasing, but also taking medications.

The negative association between drug purchasing adherence and bad experience in hospitalization and emergency room treatment may seem surprising. We might expect patients who have had such bad experiences to make every attempt to

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**Table 2. Demographic Background (n=200)**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Male</th>
<th>Female</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>124</td>
<td>73</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>95</td>
<td>101</td>
<td>62.5</td>
<td></td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>92</td>
<td>101</td>
<td>48.5</td>
<td></td>
</tr>
<tr>
<td>Nonmarried</td>
<td>113</td>
<td>95</td>
<td>51.5</td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No college</td>
<td>82</td>
<td>113</td>
<td>57.9</td>
<td></td>
</tr>
<tr>
<td>College or above</td>
<td>68</td>
<td>111</td>
<td>422.1</td>
<td></td>
</tr>
<tr>
<td><strong>Medication type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin</td>
<td>68</td>
<td>111</td>
<td>63.2</td>
<td></td>
</tr>
<tr>
<td>Noninsulin</td>
<td>85</td>
<td>117</td>
<td>36.8</td>
<td></td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whites</td>
<td>111</td>
<td>117</td>
<td>56.6</td>
<td></td>
</tr>
<tr>
<td>Nonwhites</td>
<td>85</td>
<td>117</td>
<td>43.4</td>
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<tr>
<td><strong>Bad experience</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>16</td>
<td>182</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>182</td>
<td>16</td>
<td>91.9</td>
<td></td>
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<tr>
<td><strong>Purchase adherence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>190</td>
<td>62.5</td>
<td>95.5</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>9</td>
<td>37.5</td>
<td>4.5</td>
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</table>

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean ± SD</th>
<th>N</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>46.8 ± 10.6</td>
<td>198</td>
<td>65</td>
<td>22</td>
</tr>
<tr>
<td>Duration (years)</td>
<td>10.8 ± 9.7</td>
<td>192</td>
<td>43</td>
<td>0</td>
</tr>
<tr>
<td>Family income</td>
<td>4.9 ± 2.7</td>
<td>146</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Drug cost sharing</td>
<td>3.9 ± 3.1</td>
<td>171</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>#, complications</td>
<td>2.1 ± 1.7</td>
<td>194</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>#, household</td>
<td>2.9 ± 1.5</td>
<td>195</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

1Missing data accounts for less than a total of 200 summed by all categories in a variable.
2Family income was constructed on a 12-point scale ranging from $1= ≤$10,000/year to $12= ≥$100,000
3The items of drug cost sharing is an open-ended question with the $ unit.
Table 3. Multiple Regression Analysis: Purchasing Adherence Behavior

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 Beta</th>
<th>Model 2 Beta</th>
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</thead>
<tbody>
<tr>
<td>Benefit</td>
<td>.2271**</td>
<td>.0506</td>
</tr>
<tr>
<td>Interruption</td>
<td>-.3447***</td>
<td>-.2915</td>
</tr>
<tr>
<td>Difficulty</td>
<td>-.0066</td>
<td>-.0560</td>
</tr>
<tr>
<td>Time</td>
<td>-.0177</td>
<td>.0315</td>
</tr>
<tr>
<td>Drug cost sharing</td>
<td>-.1508</td>
<td>-.2119</td>
</tr>
<tr>
<td>Severity</td>
<td>-.1037</td>
<td>-.0331</td>
</tr>
<tr>
<td>Susceptibility</td>
<td>.2869**</td>
<td>.3274**</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>.1075</td>
</tr>
<tr>
<td>Bad experience</td>
<td></td>
<td>-.2740*</td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td>-.1244</td>
</tr>
<tr>
<td>Duration</td>
<td></td>
<td>.1095</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td>.0340</td>
</tr>
<tr>
<td>Family income</td>
<td>-.2386</td>
<td></td>
</tr>
<tr>
<td>Household</td>
<td>-.0028</td>
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</tr>
<tr>
<td>Marital status</td>
<td>-.0148</td>
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</tr>
<tr>
<td>Medication type</td>
<td>-.0362</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>-.0807</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-.0045</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>.2214</td>
<td>.3646</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.1760</td>
<td>.1859</td>
</tr>
<tr>
<td>F value</td>
<td>4.8743***</td>
<td>2.0403*</td>
</tr>
<tr>
<td>DF for F</td>
<td>(7.120)</td>
<td>(18, 64)</td>
</tr>
</tbody>
</table>

*a Consisted of the variables in model 1 plus health threats and/or family income if willingness to pay was included; *Composed of all variables.

*Level of significance (i.e., *p≤.05; **p≤.01; ***p≤.001)

However, some patients may use emergency room facilities intentionally, as a means of obtaining care and prescription medications at little or no direct cost to themselves. The relationship between emergency room use and socioeconomic status remains controversial, however, and the information gathered through this survey does not allow for a clear correlation of adherence, bad experience, and economic barriers.

When demographic variables were removed from the results, perceived benefits became prominent in explaining variances in adherence. The predictive power of perceived benefits is not conclusively found in the literature. Brownlee-Duffeck, et al. found that perceived benefits significantly predicted adherence among older diabetics, but not among younger patients. In the present study, when age was controlled, the impact of perceived benefits on adherence became less significant. Overall, the results suggest that perceived barriers were more powerful predictors of adherence behavior than perceived benefits, consistent with the findings of previous research.

CONCLUSIONS

The findings of this study have implications for policy formulation and patient education. The data suggest that even low drug cost-sharing provisions may build an economic barrier to access to diabetes medications for some patients, more than 75% of the respondents in this study paid $5 or less per prescription. Several studies have found that drug cost sharing appears to have a disproportionate effect on the health status of certain patient populations, including the poor, polypharmacy patients, and those with chronic diseases. Hurley and Johnson emphasize that user charges (patient cost sharing) should combat expenditure problems for health plans, but should be used within the broader context of assuring access to and quality of care. In the interests of both controlling pharmacy costs and encouraging the use of essential drugs, MCOs should consider the option of allowing exemptions from drug cost sharing for some patients due to medical and economic factors. Differential cost sharing could allow MCOs to contain costs without diminishing access to essential care for certain subpopulations.

This study's results imply that patient education emphasizing patients' perceptions of interruption and susceptibility could enhance adherence. Evidence shows that patient education may make substantial contributions in reducing the frequency of amputations and of emergency room visits. Patient education delivered through personal interventions, mailed materials, and workshops could improve purchasing adherence behavior, strengthening patients' incentives to seek effective care, and thus reducing expenditures while improving patients' health.

Diabetes disease state management programs likely will yield more positive results if the interventions not only educate patients about the benefits of adherence to medication regimens and lifestyle modifications, but also identify and
remove barriers to care and medication purchase. Low-cost or zero-cost sharing may be the key to improving adherence.

Managed care pharmacists have a clear role in these efforts, not only in educating patients, but also in helping other health care professionals work with at-risk and noncompliant patients to enhance adherence to medication purchase and use, and to break the pattern of delay in medication purchasing.

References
