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Impact of Compliance to Oral Hypoglycemic Agents on Short-Term Disability Costs in an Employer Population

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Abstract

This study evaluated the relationships between compliance with oral hypoglycemic agents and health care/short-term disability costs in a large manufacturing company. The retrospective analysis used an observational cohort drawn from active employees of Ford Motor Company. The study population consisted of 4978 individuals who were continuously eligible for 3 years (between 2001–2007) and who received a prescription for an oral hypoglycemic agent during that time. Medical, pharmacy, and short-term disability claims data were obtained from the University of Michigan Health Management Research Center data warehouse. Pharmacy claims/refill data were used to calculate the proportion of days covered (PDC); an individual was classified as compliant if his/her PDC was $\geq 80\%$. Model covariates included age, sex, work type, and Charlson comorbidity scores. The impact of compliance on disability and health care costs was measured by comparing the costs of the compliant with those of the noncompliant during a 1-year follow-up. Among these employees, compliant patients had lower medical, higher pharmacy, and lower short-term disability costs than did the noncompliant. After adjusting for demographics and comorbidity, noncompliance was associated with statistically higher short-term disability costs ($1840 vs. $1161, $P < 0.0001$), longer short-term disability duration, and an increase in short-term disability incidence (21.5% of the noncompliant had a claim compared to 16.0% of the compliant, $P < 0.0001$). These results suggest that medication compliance may be important in curtailing the rise of health care/disability costs in the workplace. Employers concerned with the total costs associated with diabetes should not overlook the impact of compliance on short-term disability. (*Population Health Management* 2014;17:35-41)

Introduction

Diabetes represents a significant financial burden to American society in general and to US employers in particular. Estimates from 2007 suggested that direct and indirect costs associated with diabetes exceeded $174 billion annually.[1] Numerous researchers have examined and quantified the high medical and pharmacy costs associated with diabetes[1–3]; similarly, studies on the productivity costs related to the disease have shown that, on average, employees with diabetes are more likely to be disabled,[4] have more disability claims,[5] experience longer duration of disability,[5] and report lower productivity while at work[6] than individuals without diabetes. Although the data are contradictory, many researchers also report that employees with diabetes miss more days from work.[4,7–11]

The magnitude of this financial impact is especially sobering to employers who provide benefits such as medical insurance, paid sick time, and disability to their employees.[5] To date, efforts to mitigate the costs associated with diabetes through disease management programs and/or interventions targeted toward prevention of diabetes have produced mixed results.[3,12] Strategies specifically targeted to increase compliance with hypoglycemic medications may be useful in controlling or reducing costs associated with diabetes, although noncompliance with such medication regimens is high.[13]

For those patients with diabetes, compliance with hypoglycemic medications is often critical to achieve clinical goals and to avoid serious medical complications of the disease.[14–17] Not only is compliance with hypoglycemic medications related to health outcomes, but studies have

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shown a relationship between medication compliance and total health care costs. In most examples, increased compliance was associated with decreased medical expenditures with an attendant increase in pharmacy spend, which often results in modest savings in total health care costs.[18–20] However, less is known about the impact of such compliance on indirect costs such as short-term disability. Recent reports have indicated that high adherence to oral hypoglycemic agents is associated with fewer short-term disability days,[17] as well as fewer absent days,[21] in an employer population. Another study found that increased adherence to insulin or to oral hypoglycemic agents was a significant predictor of improved job performance in the workplace.[22]

Employers interested in containing disability and health care costs need more guidance on the relationships between medication compliance and indirect costs, such as those related to short-term disability. Toward this end, the present study examines the impact of compliance with oral hypoglycemic agents on the medical, pharmacy, and short-term disability costs among active employees of Ford Motor Company. Given the composition and characteristics of this employee population, the study results should be particularly relevant to those concerned with the impact of medication compliance on the direct and indirect costs associated with diabetes in the labor force.

Methods

This study was a retrospective analysis using an observational cohort comprised of employees of Ford Motor Company. Ford is a multinational automaker primarily involved with the production of cars, trucks, and commercial vehicles. The data source for this analysis was the University of Michigan Health Management Research Center (UM-HMRC) database of medical and pharmacy claims and disability records. The study sample was restricted to active full-time employees who were continuously eligible for medical and pharmacy benefits for a 3-year time span from January 1, 2001 through December 31, 2007; in those cases in which an individual's eligibility spanned a longer time period, the most recent 3-year period was used in the analysis. Other inclusion requirements were a prescription for an oral hypoglycemic agent within the 3-year time span and a minimum 30-day supply of that hypoglycemic agent. Oral hypoglycemic agents were defined as those from the following drug classes: metformin, sulfonylureas, thiazolidinones, meglitinides, and combinations thereof. Those individuals with a prescription for insulin and/or any injectable antidiabetic medications were excluded from the study population because it is difficult to measure compliance with injectable antidiabetic drugs using claims data alone; furthermore, the outcomes and costs associated with those individuals taking insulin plus an oral agent could confound the results arising from those taking oral agents alone. After application of these criteria, 4978 individuals were chosen for the analysis.

Pharmacy claims were used to identify active employees within a large manufacturing company who met the inclusion criteria. Medical claims data were not used to identify or verify participants with a diabetes diagnosis. The resulting study sample included treatment-naïve and treatment-experienced patients, a population that is reflective of real-world employer experience. Corresponding demographic data such as sex, age, and job type (hourly vs. salaried) were collected from the UM-HMRC database, but ethnicity data were not available. Charlson comorbidity scores also were calculated for individuals involved in the study using the *International Classification of Diseases, Ninth Revision* codes in their medical claims data. The Charlson comorbidity score/index is an indicator that estimates the risk of death for an individual based on the presence of diagnoses of specific illnesses or chronic conditions in that individual's medical records.

For the purposes of this study, compliance was defined as the proportion of days covered (PDC). Prescription drug claims and refill data were used to determine the PDC; the PDC was calculated as the number of days with drugs on hand divided by 365.[23,24] An individual was classified as compliant if his or her PDC was ≥ 0.80.

The primary outcomes for this study were medical, pharmacy, and short-term disability costs, all of which were calculated for a 1-year follow-up. The 1-year follow-up (or "Year 1" in Tables 1–3) refers to the year immediately following the first occurrence of a drug fill for the oral hypoglycemic agent and does not refer to a calendar year; in other words: Y1 = (date of first fill) + 365 days. Medical costs included expenses related to outpatient services, emergency room visits, and hospitalizations. Pharmacy costs were those paid amounts for all drugs (not just those for the oral hypoglycemic agent(s) in question). Both the pharmacy paid amounts and the medical paid amounts were those costs paid by the employer, exclusive of co-pays and deductibles paid by the employee. Medical costs and pharmacy costs were summed to provide the total health care costs. Short-term disability costs were obtained from Ford Motor Company records and were based on employee salary, employee job type (hourly or salaried), and, if salaried, employee job classification (general salaried or management). In general, Ford hourly employees on short-term disability received approximately 60% of base pay, and general salaried employees received 100% for 3 months and then 63% for up to 9 additional months; in comparison, management received 100% of base salary for 6 months and then approximately 63% for up to 6 additional months. In order to assess the impact of compliance on short-term disability further (and to help mitigate the effects of benefit design on related disability costs), the duration of short-term disability absence also was calculated as weeks per follow-up year (Year 1).

Multiple linear regression (general linear model in SAS) was used to examine the association between medication compliance and medical, pharmacy, and short-term disability costs. The appropriate statistical tests (Pearson chi-square for categorical variables and *t* test for continuous variables) were used to compare baseline demographic factors and outcome relationships between compliant and noncompliant populations. Cost estimates were adjusted for the effects of sex (male or female), job type (hourly or salaried), age (continuous), and Charlson comorbidity score (continuous). Least squares means were computed and compared using the PDIFF option. All statistical procedures were performed using SAS version 9.2 (SAS Institute Inc., Cary, NC).

Results

Table 1 summarizes the demographic and compliance characteristics of the study population. The participants were largely male and predominantly hourly waged, reflective of the manufacturing nature of Ford's general work environment. Fifty-seven percent of the study population had a PDC ≥0.80.

Initial comparisons of demographics and costs between the compliant and the noncompliant are shown in Table 2; note that the means reported in Table 2 are unadjusted. When compared to those individuals who are noncompliant with their treatment regimen, compliant employees were older and more likely to be male. The compliant also had higher Charlson scores than the noncompliant. In the year immediately following the first recorded pharmacy fill, the compliant had lower mean medical costs than the noncompliant. However, compliant individuals had higher mean pharmacy costs in Year 1 than the noncompliant and higher mean pharmacy costs for diabetes drugs alone. When mean pharmacy and medical costs were combined to provide mean annual total health care costs, the compliant individuals were more costly overall than were the noncompliant because of the much higher drug costs associated with the compliant population. Short-term disability costs for those compliant with their medications were much lower than for those who were not compliant. The mean duration of short-term disability absence also was shorter for the compliant as compared to the noncompliant.

After controlling for age, sex, Charlson score, and job type, compliance was significantly associated with medical costs, pharmacy costs, and short-term disability costs (Table 3). Individuals who were compliant with their oral hypoglycemic agents had lower mean medical costs and higher mean total pharmacy costs than the noncompliant. Not surprisingly, the compliant also had higher mean pharmacy costs for hypoglycemic agents alone. The combination of lower mean medical costs and much higher mean pharmacy costs meant that the average total health care cost for the compliant group was slightly higher than that for the noncompliant group. Finally, short-term disability costs were negatively associated with increasing treatment compliance: compliant individuals had much lower mean annual short-term disability costs than did the noncompliant. When only those individuals with a short-term disability claim were included in the model, the compliant still had lower mean annual disability costs than did the noncompliant.

Differences in short-term disability between the compliant and the noncompliant were not restricted to cost alone. As might be predicted, the mean duration of short-term disability absence was significantly shorter for the compliant than for the noncompliant (Table 3). Table 4 compares the percentage of those individuals in the compliant group with a short-term disability claim to the analogous percentage of those in the noncompliant group with a claim. During the year in question, fewer individuals in the compliant group filed a short-term disability claim than did the individuals in the noncompliant group. The difference was statistically significant.

Table 1. Demographic and Compliance Characteristics of the Study Population

	Number	*Percentage*
n	4978	
Age categories		
18–34	136	2.7
35–44	473	9.5
45–54	1911	38.4
55–64	2442	49.1
65+	16	0.32
Mean age in years (±S.D.)	53.0 (±7.47)	
Male sex	4242	85.2
Job categories		
Hourly	3934	79.0
Salaried	1044	21.0
Mean Charlson score (±S.D.)	2.11 (±1.86)	
Mean adherence (±S.D.)	0.727 (±0.308)	

S.D., standard deviation.

Discussion

Claims data from Ford Motor Company revealed that those patients with diabetes who were compliant with oral hypoglemic agents had lower mean medical costs, higher mean pharmacy costs, lower short-term disability costs, and fewer weeks of short-term disability absence than did the noncompliant, after controlling for demographics and comorbidities. The differences in short-term disability were statistically significant and striking: not only did the compliant have lower mean disability costs ($1161 vs. $1840 for the noncompliant), they also reported a lower number of disability claims, percentage-wise, than did the noncompliant (16% of the compliant group filed a short-term disability claim vs. 21.5% of the noncompliant).

All too often, medication compliance studies focus primarily on health care costs and may not adequately address indirect costs such as absence and short-term disability. As a result, analyses that do not include the impact of compliance on indirect costs may underestimate the severity and scope of the noncompliance problem. Employers in particular need more information on the complicated relationships between patient compliance with antidiabetic regimens and outcomes such as medical and disability costs, especially as the overall impact of diabetes on the workforce continues to increase. This study adds to the growing literature on diabetes costs from the perspective of the employer[5] by analyzing the financial liability of diabetes on an employee population and evaluating the effect of medication compliance on those costs. These results are particularly relevant to US employers, given that the study population consisted of active employees; it is also noteworthy that these employees were a mixture of treatment-naïve and treatment-experienced patients, representative of the diverse disease states and treatment regimens present in a typical US workforce.

Although rates of short-term disability in the US workforce are fairly low (generally 5–10 claims per 100 employees per year), their workplace consequences are not.[25] The burden on employers is significant; in addition to the monetary costs associated with employees' short-term disability claims, other costs (including those associated with replacement wages and reduced productivity) may be equally important. Contrary to popular perception, most short-term disability is not related to injury but rather to disease;

Table 2. Characteristics of the Compliant and the Noncompliant

Characteristic	*Compliant*	*Noncompliant*
n	2820	2158
Mean age, years (±S.D)	54.2 (±6.4)	51.5 (±8.4)
% Male	89.8	79.2
% Hourly job type	80.9	76.6
Mean Charlson Comorbidity score (±S.D)	2.25 (±1.81)	1.93 (±1.91)
Mean (paid) medical costs in Year 1 (±S.D)	$4313 (±$10,782)	$5192 (±$17,723)
Mean (paid) pharmacy costs in Year 1 (±S.D)	$3347 (±$3546)	$1727 (±$2372)
Mean (paid) pharmacy costs for hypoglycemic agents (±S.D)	$2412 (±$2404)	$785 (±$1262)
Mean health care costs for Year 1 (±S.D)	$7660 (±$11,704)	$6919 (±$18,301)
Mean STD costs for Year 1 (±S.D)	$985 (±$3705)	$1717 (±$5360)
Mean STD duration for Year 1 (±S.D)	1.7 weeks (±6.5)	2.7 weeks (±8.3)

S.D., standard deviation; STD, short-term disability.

according to recent data from Unum, injury accounts for only 11% of short-term disability claims.[26] Employers interested in the total costs of employee health must be aware of the nuances and importance of short-term disability on overall health care expenditures.

In general, the results of the present study are consistent with the findings of other research on the relationship between compliance with hypoglycemic medications and health care expenditures. For example, in a study of adherence among insured working-aged individuals diagnosed with diabetes, Hepke reported that the adherent had higher pharmacy costs, lower medical costs, and fewer emergency room visits and inpatient admissions than did the nonadherent.[27] Using employer insurance data, Encinosa observed a similar cost and utilization pattern among patients adherent to an oral hypoglycemic regimen, where the higher drug spend by the adherent group was associated with lower rates of health care utilization.[20] Sokol analyzed the medical/pharmacy claims of a large manufacturing employer and determined that the lower medical cost incurred by patients adherent to their hypoglycemic medications more than compensated for their higher pharmacy costs, resulting in a net reduction in health care costs for the adherent group.[19]

The present study builds on these observations and extends the analysis to include the impact of compliance on short-term disability. Gibson found that adherence to oral hypoglycemic agents correlated with lower rates of emergency room admissions and hospitalizations, and also with fewer days of short-term disability absence.[17] In a conceptually similar analysis, Carls used a large commercial claims database to show that length of short-term disability was significantly lower among those employees who were adherent to their oral and injectable diabetes medications, with 2.1 fewer days of short-term disability for compliant individuals as compared to the noncompliant.[21] The present study confirms this association between compliance and duration of short-term disability; furthermore, the current work monetizes the differences in short-term disability costs between the compliant and the noncompliant and emphasizes the impact of compliance on the incidence of short-term disability.

Recent trends in health care costs and changes in benefit design suggest that the potential impact of compliance on costs may be even greater than that observed in this study. The health care and disability cost data used in this analysis are from 2001 to 2007. Although the rate of growth in health care spending is not as rapid now as it was in the early 2000s, health care costs continue to climb as medical inflation rates outpace the overall US inflation rate; indeed, there is evidence that the slow rate of growth in health care spending observed during the 2007–2009 recession has begun to accelerate.[28] The steady rise of medical, pharmacy, and disability costs since 2007 further underscores the importance of compliance as a cost-containment strategy. Benefit plan designs also have evolved since 2007, with more emphasis on consumerism and higher deductibles for employees. In this environment, increasing medication compliance may be

Table 3. General Linear Regression Results: Relationship Between Compliance and Costs

Characteristic	*Compliant*	*Noncompliant*	P
Mean (paid) medical costs in Year 1	$4627	$5974	0.0008
Mean (paid) pharmacy costs in Year 1	$3155	$1668	<0.0001
Mean (paid) pharmacy costs for hypoglycemic agents	$2168	$614	<0.0001
Mean health care costs for Year 1	$7782	$7642	0.7370
Mean STD costs for Year 1	$1161	$1840	<0.0001
Mean STD duration for Year 1	1.9 weeks	2.8 weeks	<0.0001
Mean STD costs for Year 1, for only those with STD claims	$7667 (*N*=451)	$9113 (*N*=465)	0.0101
Mean STD duration for Year 1, for only those with STD claims	10.5 weeks	11.9 weeks	0.1207

STD, short-term disability.

Table 4. General Linear Regression Results: Relationship Between Compliance and Incidence of Short-Term Disability Claims

Compliant		*Noncompliant*		
# with disability claim	*% of compliant population with claim*	*# with disability claim*	*% of noncompliant population with claim*	*P value*
N = 451	16.0%	N = 465	21.5%	< 0.0001

instrumental in saving money for both the employer and the employee. A relatively new approach to employee benefits, value-based insurance design (VBID), may help redefine the relationship between medication compliance and health care savings, especially given that preliminary research indicates that VBID has a broad, positive impact on medication compliance among employees with chronic conditions.[29]

If better medication compliance can cut employer costs and improve employee health, then what interventions can successfully increase patient compliance? In the words of a recent review, the current methods of improving adherence for long-term chronic health conditions are complex and often ineffective.[30] In general, simplifying dosing regimens and increasing interactions between patients and health care professionals can produce improvements in compliance, although concomitant improvements in clinical outcomes are not always observed.[30,31] Interventions to improve compliance with antidiabetic drug regimens were reviewed recently by the Agency for Healthcare Research and Quality, which found that only 1 program—care coordination and collaborative care—had a beneficial impact on medication adherence; all other approaches did not produce consistent improvements in compliance and therefore were deemed insufficient for lack of consistency or precision in the results.[32] Newer approaches based on VBID[33] and novel health technologies[34] offer promise, as do patient-centered medical homes and accountable care organizations that emphasize compliance metrics.[35] However, results from these models still must be widely validated and quantified. More research on the psychosocial determinants of compliance and the development of interventions targeted toward these determinants also are needed.[36]

Limitations

This study has several limitations that should be considered when interpreting the results. Participants were identified solely on the basis of pharmacy records with no verification of diagnosis or disease state from the corresponding medical records. Given that compliance was calculated based on drug refill data from pharmacy claims, the measure of drug compliance was more accurately a measure of drug possession. Claims information may designate when a prescription is filled, but it cannot indicate whether the patient actually takes the medication appropriately. Patients may also obtain medications from other sources (such as physician samples, self-pay opportunities, or drug sharing) that claims records cannot capture. Even for those patients who received and took their prescriptions as recommended, this study could not determine if those patients were prescribed the optimal therapies for their disease state or if their conditions were managed correctly. Obviously, claims-based methods of measuring compliance are not perfect, although these methods are popular in the compliance and adherence literature,[37] and although previous studies have shown an association between claims-generated measures of compliance and clinical outcomes for patients with diabetes.[38]

Some lifestyle-associated variables—such as diet, exercise, and self-management skills—could not be included in the model even though their impact on diabetes progression and associated costs could be significant. Other potentially important variables (such as race) were not available from data sources. As mentioned previously, the study population was not treatment- or disease-state homogenous because it consisted of a mix of patients, ranging from those newly diagnosed with diabetes to those with advanced disease. Although this heterogeneity does realistically mirror the nature of diabetes in the workplace, it also may complicate the analysis and its interpretation. Individuals taking insulin were excluded from this study, even though a significant percentage of diabetes patients do inject insulin to control their disease; the most recent statistics from the Centers for Disease Control and Prevention indicate that 12% of patients with diabetes use insulin alone, and 14% use insulin in combination with oral hypoglycemic agents to manage their conditions.[39] The economics of this particular segment of the population with diabetes may warrant additional attention because the relationships between compliance and direct/indirect costs are even less well understood for the insulin dependent and because almost all of those diagnosed with diabetes will eventually require insulin to maintain good glycemic control.[40,41] Finally, this study followed individuals with a progressive chronic disease for a relatively short amount of time; the compliance-cost relationships discussed in this analysis could shift if a longer follow-up time period was used.

Conclusion

In conclusion, this study demonstrated that patients who were compliant with their oral hypoglycemic medications had lower mean medical costs, higher mean pharmacy costs, lower short-term disability costs, and fewer weeks of short-term disability absence than did the noncompliant. These results have real-world applications because compliance with oral hypoglycemic medications positively affects both the employee with diabetes and the employer who pays for that care. From the patient perspective, research has shown that individuals who are compliant with their hypoglycemic therapies have fewer complications and lower mortality[16,17] than do the noncompliant; for the employer, increased patient compliance holds promise for helping decrease the direct and indirect costs associated with diabetes in the workforce. In particular, better compliance with hypoglycemic medications could reduce the incidence, cost, and duration of short-term disability, an important driver of employer health care costs. Multiple policies and interventions designed to increase patient compliance may produce substantial downstream benefits to employer and employees alike, even though compliance is a notoriously complex metric to improve. Health care reform and the Affordable Care Act also will impact (and be

impacted by) these issues of compliance and costs as the health care exchange system is implemented and any concomitant shifts in employer-defined benefits occur. Despite the challenges associated with improving compliance, it is a problem worth addressing, especially because the cost and productivity burdens associated with diabetes will continue to grow as the disease becomes even more prevalent in working-aged populations.

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