

The Effect of Cost Sharing on Employees With Diabetes

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Most employers are responding to rapidly growing healthcare costs by asking workers to pay more of the premium and by increasing prices (eg, deductibles and copayments) workers face at the point of care. In 1999, for example, 84% of people covered by employer-sponsored health insurance had a physician copayment of \$10 or less, whereas 72% had physician copayments of \$15 or more in 2005.¹ Likewise, copayments for prescription drugs on the second (preferred branded) and third (nonpreferred branded) tiers have almost doubled between 2000 and 2005, rising from \$13 to \$25 and from \$17 to \$33, respectively. The objective of these changes is to encourage employees and their dependents to compare the benefits of medical care with the cost, to discourage the use of low-value medical services, and thereby to slow down the growth rate of health insurance premiums.

It is clear that increasing employee cost sharing achieves its primary objective of reducing costs.^{2,3} For people with certain health conditions, however, increasing employee cost sharing may have unintended consequences. Several recent studies show that patients with high blood pressure, elevated cholesterol levels, or diabetes mellitus (DM) are less likely to adhere to medical therapy when drug copayments rise.⁴⁻⁹ If the health of nonadherent patients worsens such that they require additional medical services, then reducing drug copayments may actually increase total medical expenditures. Furthermore, if one defines health costs broadly to include health-related absenteeism and reduced on-the-job productivity (often referred to as presenteeism) due to a health condition, direct medical costs may actually represent a small proportion of total health-related costs.^{10,11}

At least 20 employers, including Pitney Bowes Inc and the University of Michigan, are adopting a contrarian approach.¹²⁻¹⁴ Rather than increasing copayments for all drug classes, these employers are selectively reducing copayments for conditions such as diabetes, asthma, and hypertension in which the clinical evidence suggests there is a strong connection between adherence to drug therapy and health. Unfortunately, there is no

single study that performs a complete analysis of the financial effect of changing DM drug copayments on adherence, medical expenditures, absenteeism, and on-the-job productivity from the perspective of an employer, to my knowledge. The objective of this article is to perform such an analysis for DM by constructing a financial model that links together results from several different published studies. The Diabetes Outcomes Analyzer model, which is a disease-specific application of a general model proposed recently by Nicholson et al,^{15,16} focuses on DM because there are more studies examining the key links required for the financial model than for other diseases and because it is a fairly common and expensive condition.

Although this financial model can help employers design health benefits, one must be careful when interpreting the results. The model uses mean values (eg, the percentage change in pharmaceutical expenditures associated with a \$1 change in the drug copayment) across several different studies and then links these values together to estimate the financial effect of drug copayments on total health-related costs. For pragmatic reasons, I assume that the employee populations and the examined interventions are similar to one another and are representative of employers nationally.

BASELINE SITUATION FOR AN EMPLOYER

The baseline situation for an employer with 5000 workers is given in **Table 1**.^{2,7,10,11,14,17-24} The analysis focuses on workers only. Dependents and retirees could be incorporated, although the employer would not benefit from any changes in absenteeism or presenteeism. Each data element is described in column 1, the mean

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Table 1. Baseline Estimated Total Diabetes Mellitus (DM) Health-related Costs for 5000 Employees

Data Element	Estimated Value	Source or Assumption
Workers who have DM based on age- and sex-specific rates (6.6% of workers)	332	Cowie et al, ¹⁷ 2006
Workers with DM who are adhering to the recommended medication regimen	56.5%	Mean of Dor and Encinosa, ⁷ 2004, and Sokol et al, ¹⁸ 2005
Medical costs per worker with DM, mean 2006 dollars		Mean of Sokol et al, ¹⁸ 2005, and Garrett and Bluml, ¹⁴ 2005
Pharmaceutical	\$3922	
Nonpharmaceutical	\$10 776	
Total	\$14 698	
Annual health-related absences per worker with DM	4.4 days	Mean of 8 studies ^{2,10,11,19-24*}
Annual absenteeism costs per worker with DM	\$980	Mean daily wage per worker (with benefits) times no. of annual absences
Reduction in on-the-job productivity per worker with DM due to health reasons	11.4%	Mean of 3 studies ^{10,11*}
Annual presenteeism costs per worker with DM	\$6071	Self-reported decrement in productivity times annual salary (with benefits)
Total annual direct and indirect medical costs per worker with DM	\$21 749	—
Total annual direct and indirect medical costs for all workers with DM	\$7 219 600	—

*The studies are described in the “Baseline Situation for an Employer” section.

value based on the literature is given in column 2, and the sources or assumptions are reported in column 3. Using the National Health and Nutrition Examination Survey, Cowie et al¹⁷ reported the percentages of US employees between 1999 and 2002 by sex and by age category (20-39 years vs 40-64 years), as well as the percentages of employees (men and women combined) in these age categories who were diagnosed as having DM. Based on these data, an estimated 6.6% of the employed population has DM, or 332 workers for a typical employer with 5000 workers.

The patient populations, interventions, and results from several key studies are summarized in **Table 2**.^{1,7,14,18,25} Two studies examined the medication adherence rates for patients with DM. Among a population of 137 300 nonelderly employees and dependents insured by a manufacturing firm, Sokol et al¹⁸ found that 55% of the patients with DM adhered to their medication regimen. A patient was considered adherent if he or she received a supply of drugs for at least 80% of the year. Dor and Encinosa⁷ reported that 58% of patients with DM adhered to their physicians’ recommended drug treatment among a population of 27 100 workers and retirees who received employer-based health insurance

from 9 large firms. In the latter study, a patient was considered adherent if he or she had a full 3-month supply of drugs following the expiration of his or her first DM prescription, among patients who filled at least 1 DM prescription between June 1999 and September 2000. I averaged these 2 results and assumed that, before any drug copayments were changed, 56.5% of employees with DM adhered to their physicians’ recommended drug therapy. For an employed population of 5000, this implies that 144 workers are not adherent among 332 workers with DM.

The model assumes that an employer’s pharmaceutical and nonpharmaceutical expenses per employee with DM are \$3922 and \$10 776, respectively. These are the mean amounts reported by Sokol et al¹⁸ and by Garrett and Bluml.¹⁴ Garrett and Bluml studied a population of 256 patients with DM in Asheville, NC, who were covered by employer-sponsored health insurance (Table 2). The spending amounts reported in these 2 studies were adjusted from the period examined (1999 for Sokol et al¹⁸ and 2004 for Garrett and Bluml¹⁴) to 2006 values by using the overall US growth rate of pharmaceutical and nonpharmaceutical expenses. Specifically, I applied a 12.5% annual growth rate for pharmaceutical

Table 2. Overview of Key Studies*

Source	Diseases	Patient Population	Intervention	Results
Goldman et al ²⁵	8 Drug classes examined separately, including DM drugs	530 000 Persons aged 18-64 years insured by 30 large US employers between 1997 and 2000	Relationship between changes in drug copayments and changes in drug days supplied and drug spending	Doubling the drug copayment is predicted to increase drug spending by 23% for patients with DM
Dor and Encinosa, ⁷ 2004	DM	27 100 Persons in Medstat MarketScan Health and Productivity Management database comprising employees with employer-based health insurance and retirees at 9 large firms	Association between spending between June 1999 and December 2000 and patient's mean copayment	\$4 Increase in copayment is predicted to: <ul style="list-style-type: none"> • Reduce adherence by 3.4 percentage points (9%) • Reduce drug spending by 4.9% • Increase other medical spending by 6.4%
Garrett and Bluml, ¹⁴ 2005	DM	256 Patients with DM covered by employer-sponsored health plan in Asheville, NC	(1) \$14.40 Reduction, on average, in DM drug copayments (2) Pharmacy care services program	<ul style="list-style-type: none"> • 48% Reduction in health-related absenteeism in first year • 27.3% Increase in drug spending • 14.4% Reduction in nondrug spending
Sokol et al, ¹⁸ 2005	DM, hypertension, hypercholesterolemia, congestive heart failure	137 300 Nonelderly employees and dependents insured by a large manufacturer between June 1997 and May 1999	Association between adherence to medical treatment and medical costs	For DM and hypercholesterolemia, higher levels of adherence were associated with lower medical costs

*DM indicates diabetes mellitus.

expenses between 1999 (the date of the study by Sokol et al¹⁸) and 2004; I applied a 9.1% annual growth rate for nonpharmaceutical expenses during the same period. The growth rates from 2004 (the date of the study by Garrett and Bluml¹⁴) to 2006 (8.2% for pharmaceutical expenses and 7.9% for nonpharmaceutical expenses) are the actual growth rates in the United States between 2003 and 2004.

Eight studies examined how often workers with DM were absent because of their health condition. Although the questions differed somewhat across the studies, the data were self-reported by surveyed employees, and employees were usually asked to distinguish health-related absences from overall absences. The numbers of annual self-reported absence days ranged from 1.2 days to 12.6 days across the 8 studies, with a mean of 4.4 days. Goetzel et al^{10,11} summarized 4 of these studies: the Medstat MarketScan Health and Productivity Management database that contained absenteeism information on 375 000 employees between 1997 and 1999 at 6 large corporations, the Employers Health Coalition, Inc,⁹ that surveyed 10 000 employees at 8 large employers in 1998 and 1999, the Work Productivity Short Inventory

(Ozminkowski et al¹⁹) that evaluated 619 employees at a large telecommunications company, and the Bank One Worker Productivity Index (Burton et al²⁰) that collected data from 1000 Bank One customer service operators in Illinois in 1995. To arrive at the overall mean of 4.4 days per year, the data from these 4 studies were combined with the data from 4 other studies on how frequently employees with DM were absent: Collins et al²¹ surveyed 6000 employees at Dow Chemical Company in 2004, Cranor et al²² and Cranor and Christiansen²³ examined 164 patients with DM covered by employer-sponsored health insurance in Asheville, Wang et al²⁴ examined an employer-based population, and Egéde et al²⁶ examined patients with DM in the general population.

To estimate the annual cost associated with DM-related absences, I multiplied the mean daily wage of an employee in the United States by 4.4 days. This is a reasonable assumption if workers are paid according to the mean value they provide a firm and if an absence results in 1 day's worth of output not being produced. Pauly et al²⁷ showed that the minimum cost of an absence is an employee's daily wage if labor markets are competitive, so this assumption is conservative. Pauly et al argue that

if it is difficult to substitute for an absent worker if the worker operates as part of a team or if the worker's output cannot be postponed without some penalty (eg, lost sales), the true cost of an absence will exceed the worker's daily wage. With a mean annual salary of \$41 414, fringe benefits that represent 28.6% of the salary, and 240 work days per year, the estimated annual cost to an employer of 4.4 absences is \$980. The mean salary data are from the Bureau of Labor Statistics, and the fringe benefit data as a percentage of salary are from the US Department of Labor. In the short run, an employer could capture the financial benefits of improvements in a worker's health-related productivity. However, employees who are absent less frequently due to improved health should capture the benefits in the form of higher wages if other potential employers observe improved productivity.²⁷

Although some employers consider the financial effect of reduced absenteeism when deciding whether to invest in the health of their workers, most employers are skeptical about whether to include presenteeism improvements in such calculations.²⁸ In this model, I report the benefits associated with improved on-the-job productivity separately so that an employer can include or omit them as he or she sees fit. Most of the research to date on impaired presenteeism is based on information collected from workers regarding their perception of how often health impairs their productivity and of the magnitude of the impairment on their usual productivity.^{21,29,30} Three studies summarized by Goetzel et al,^{10,11} which were already described in the absenteeism analysis, also examined presenteeism among workers who have DM. Workers reported that their productivity during the 4 weeks before the survey was 11.4% lower, on average, than their usual level because of their health condition. If this productivity decrement occurred persistently throughout the year, the productivity loss would amount to \$6138 based on the mean annual salary (with benefits) in the United States.

Based on this set of assumptions, the total health-related cost per worker with DM is \$21 749 per year (Table 1). About two thirds of these costs are direct medical expenditures and one third are indirect productivity-related costs. For a firm with 5000 workers, the total health-related costs for all workers with DM are estimated to be \$7.2 million per year.

SIMULATING THE EFFECT OF REDUCING DM DRUG COPAYMENTS

Are health-related costs likely to increase or decrease if an employer cuts the copayment for DM drugs? Most employers have instituted a 3-tier drug copayment sys-

tem. As summarized in **Table 3**, the mean copayment for generic drugs in employer-sponsored health plans was \$10 in 2005, while the mean copayments for preferred and nonpreferred branded drugs were \$22 and \$35, respectively.¹ Nationally, 53% of all prescriptions were for generic drugs in 2004.³¹ No information was available regarding the percentage of prescriptions that were for preferred versus nonpreferred branded drugs. For purposes of calculating a mean baseline drug copayment per prescription, I assume that 40% of prescriptions are for preferred branded drugs and that 7% are for nonpreferred branded drugs. This implies that employees paid a mean of \$16.55 per prescription at the point of care in 2005.

In this article, I simulate the effect if an employer were to put all DM drugs on the first tier. That is, employees would pay the \$10 generic copayment for all DM drugs, even for branded drugs. Therefore, for an employee with DM, the mean copayment would be reduced by \$6.55, from \$16.55 to \$10. The model is flexible enough so that an employer could simulate any possible copayment structure, such as eliminating copayments for DM drugs or raising all copayments to the nonpreferred branded amount.

The first outcome of interest is whether medication adherence rates would improve as a result of the \$6.55 reduction in the mean drug copayment. As summarized in Table 2, Dor and Encinosa⁷ found that a \$4 increase in drug copayments is predicted to reduce drug adherence rates by 3.4 percentage points, or 9%, among employees who have DM. As in other investigations, I assume that the measured relationship between changes in copayments and adherence, medical spending, absenteeism, and presenteeism are symmetric. For example, if copayments were reduced by \$4 per prescription instead of increased by \$4, I assume that adherence rates in the sample described by Dor and Encinosa would have increased by 9%. Furthermore, the measured relationships are assumed to be linear. In the model, the relationship between copayments and adherence in the study by Dor and Encinosa is calibrated to the magnitude of the simulated copayment change. Therefore, a \$6.55 reduction in the mean copayment would be expected to improve adherence by 14.7% [$[-\$6.55/\$4] [-9\%] = 14.7\%$). The model predicts that 209 of 332 workers with DM would adhere to their recommended drug treatment under the lower copayment design, an increase of 21 workers.

I adopt a similar approach to predict the effect of lower copayments on pharmaceutical and nonpharmaceutical spending. Three of the studies summarized in Table 2 examined the relationship between copayments and pharmaceutical spending for patients with DM.

Table 3. Estimated Financial Effect of Reducing Diabetes Mellitus (DM) Drug Copayments

Data Element	Baseline Value	Value After Reduction in Drug Copayments	Percentage Change
Drug copayment, mean*			
Generic	\$10	\$10	—
Preferred branded	\$22	\$10	—
Nonpreferred branded	\$35	\$10	—
Medical costs per worker with DM			
Pharmaceutical	\$3922	\$4399	12.2
Nonpharmaceutical	\$10 776	\$9860	-8.5
Total	\$14 698	\$14 259	-3.0
Annual absenteeism costs per worker with DM Without presenteeism	\$980	\$768	-21.7
Total annual direct and indirect medical costs per worker with DM	\$15 678	\$15 027	-4.2
Total annual direct and indirect medical costs for 332 workers with DM	\$5 204 300	\$4 987 900	-4.2
With presenteeism			
Annual presenteeism costs per worker with DM	\$6071	\$4757	-21.7
Total annual direct and indirect medical costs per worker with DM	\$21 749	\$19 784	-9.0
Total annual direct and indirect medical costs for 332 workers with DM	\$7 219 600	\$6 566 900	-9.0

*Data on baseline drug copayments are from Kaiser Family Foundation and Health Research and Educational Trust.¹

Goldman et al²⁵ reported that doubling the copayment, which represents an increase of \$9.39 in the mean copayment in their sample, was associated with a 23% reduction in spending on DM drugs; Garrett and Bluml¹⁴ found that a \$14.40 reduction in copayments was associated with a 27.3% increase in pharmaceutical spending for employees with DM; and Dor and Encinosa⁷ predicted that a \$4 increase in copayments would reduce pharmaceutical spending among patients with DM by 4.9%. Garrett and Bluml¹⁴ also examined a situation in which employers in Asheville entirely eliminated the copayments for DM drugs. Because the study did not indicate how large the copayments were before the change, I assume for purposes of calibrating the model that the copayments were equal to \$14.40, the national mean in 2004.¹ Based on these 3 studies, the simulated \$6.55 decrease in the mean drug copayment is predicted to increase pharmaceutical spending for employees with DM by 12.2%, on average, or \$477 per worker per year. The spending before and after the simulated reduction in drug copayments is summarized in Table 3.

Dor and Encinosa⁷ and Garrett and Bluml¹⁴ also examined the relationship between copayments and nonprescription drug spending, as summarized in

Table 2. They found evidence of cost offsets: reducing the price of pharmaceuticals via the copayment was associated with reductions in nonpharmaceutical expenses among employees who have DM, and increasing drug copayments had the opposite effect on nonpharmaceutical costs. Specifically, Dor and Encinosa found that a \$4 increase in copayments was associated with a 6.4% increase in nonpharmaceutical spending among persons with DM, and Garrett and Bluml found that a \$14.40 reduction in copayments was associated with a 14.4% decrease in nonpharmaceutical spending. Dor and Encinosa did not directly examine the effect of drug copayments on nonpharmaceutical expenses. Instead, they applied their results on the relationship between copayments and adherence to the findings by Wagner et al³² regarding the relationship between adherence, glycemic control, and medical costs. The estimated net spending increase associated with higher copayments in the study by Dor and Encinosa,⁷ combining pharmaceutical and nonpharmaceutical spending, was \$38 (or 3.7%) per patient with DM per year. Garrett and Bluml¹⁴ found that net spending fell by \$72 (or 0.9%) per person in the year following the reduction in copayments, whereas costs had been expected to rise by

14.6% during this period. Based on these 2 studies, the simulated \$6.55 decrease in the mean drug copayment is predicted to reduce nonpharmaceutical spending for employees with DM by 8.5% on average, or \$917 per worker per year. As summarized in Table 3, the total medical spending per employee with DM is predicted to fall by \$439 per worker per year, or 3%.

The intervention in Asheville analyzed by Garrett and Bluml¹⁴ had 2 components: (1) setting DM drug copayments to zero and (2) instituting a pharmaceutical care services program in which patients could meet with a pharmacist at no cost, learn about DM treatment and how to measure glucose levels from home, and obtain information on how and why to adhere to treatment. Therefore, the results cited likely overstate the effects of changing only copayments on pharmaceutical and nonpharmaceutical spending. Furthermore, because employees volunteered for the program, it is possible that employees who were highly motivated to improve their health participated, such that the results might be different if an employer required all employees to participate.

Employers who believe that access to medical services affects workers' productivity may be interested in whether and how copayments affect absenteeism and on-the-job productivity. Although we cited 8 published studies^{2,10,19-24} documenting how often employees with DM are absent, there is only a single study (to my knowledge) that examines whether absenteeism decreases when DM drug copayments are changed. Cranor et al²² and Cranor and Christiansen,²³ who examined the same intervention as Garrett and Bluml,¹⁴ tracked absenteeism of 164 employees during a 5-year period. They found that a \$14.40 reduction in the mean copayment for DM drugs reduced absenteeism in the first year by 48% (from 12.6 days to 6.0 days). Absenteeism during the second through the fifth years essentially remained at this new lower level. I assume that a similar effect would occur in the model. Specifically, absenteeism would decrease by 21.7% following a \$6.55 reduction in the mean DM drug copayment. Based on the mean daily wage, this translates into a \$212 savings (Table 3) for the employer or the employee, depending on how wages are subsequently established.

To the best of my knowledge, there are no studies that directly examine how a change in the copayment of DM drugs (or any other kind of drug) affects the productivity of workers with DM when they are present for work. Therefore, I assume that the direction and magnitude of the on-the-job productivity effect are the same as for absenteeism. That is, a \$6.55 reduction in the mean copayment is assumed to lead to a 21.7% improvement in the on-the-job productivity of workers with DM. There is some support for this assumption in the study

by Goetzel et al.^{10,11} The correlation between absenteeism and presenteeism across 10 health conditions was 0.44. Workers with diseases that were associated with frequent absenteeism also had low productivity while present for work. If lower drug copayments reduce presenteeism costs by 21.7%, this would translate into a savings of \$1315 per worker per year.

Because no published study (to my knowledge) exists on the relationship between copayments and on-the-job productivity and because many employers are skeptical about presenteeism in general, I first summarize the results without presenteeism savings. Decreasing copayments on DM drugs is predicted to reduce medical and absenteeism costs by 4.2%, from \$15 678 to \$15 027 per worker per year. For an employer with 5000 employees and 332 workers with DM, this policy is predicted to generate total savings of \$216 300 per year. About two thirds of the savings are due to reduced medical services and the remaining one third to reduced absenteeism. If estimated presenteeism savings are included in the model, reduced copayments are predicted to reduce total health-related costs by 9.0%. Twenty-two percent of the \$1965 reduction in costs per worker with DM are due to reduced use of medical services. Reductions in absenteeism costs (\$212) represent 10.8% of the total savings, and improvements in on-the-job productivity account for about two thirds of the savings.

The presumed strength of this study is also its weakness. Taking a broad perspective on how changes in drug copayments affect medical costs, absenteeism, and presenteeism can provide employers with a more complete understanding of the financial effect of their actions than now exists in the literature, but it also requires several simplifying assumptions that should make readers careful when interpreting the results. For example, I assume that the measured relationships in the literature are symmetric and linear. It is possible that the true relationships between copayments and adherence, medical spending, and productivity are nonlinear. For purposes of the model, I assume that the measured effects occur in the year following a change in copayments and are permanent, whereas in practice the effects may diminish or accelerate over time. Therefore, the model should be updated as additional studies create more refined estimates of the key variables.

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CONCLUSIONS

Although most employers are increasing drug copayments in an effort to slow down the growth rate of health insurance premiums, at least 20 employers are adopting the opposite strategy of selectively reducing drug copy-

ments for certain expensive health conditions.^{12,13} To my knowledge, there is no study that has performed a comprehensive financial analysis of the implications of reducing drug copayments. This article constructs a model based on different investigations that collectively examined the relationships between copayments and adherence to drug therapy, pharmaceutical spending, nonpharmaceutical spending, absenteeism, and on-the-job productivity. For DM, the model predicts that reducing drug copayments from their current levels would save money by decreasing nonpharmaceutical, absenteeism, and presenteeism costs, which are more than the resulting increase in pharmaceutical costs.

The model is flexible enough to examine the effect of any copayment structure an employer is considering. Furthermore, an employer can decide whether to include all health-related costs, including absenteeism and presenteeism, or whether to focus only on direct medical spending.

If reducing drug copayments more than pays for itself, why are more employers not adopting this strategy? One explanation is that DM is an exception; for many other health conditions, reducing copayments may increase pharmaceutical spending without conveying improvements in health and productivity. A second explanation is that employers or health benefit consultants do not want to treat (or are not used to treating) certain health conditions such as DM, asthma, and hypertension differently. Finally, two thirds of the savings in the DM model come from improved on-the-job productivity, and there is little published research demonstrating a connection between benefit design and tangible increases in employee productivity.

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