Diabetes Wellness Care

A Successful Employer-Endorsed Program for Employees

Cynthia C. Bevis, JD, MBA, MS, June M. Nogle, PhD, Barbara Forges, MD, Philip C. Chen, MD, PhD, Deborah Sievers, MSN, RN, CDE, Karlene Ranghell Lucas, MBA, RRT, John J. Mahoney, MD, MPH, and James M. Crawford, MD, PhD

Objective: A 12-month wellness program was provided for employees of a major employer in the Orlando area. **Methods:** The program involved screening and measurement of baseline indices, educational sessions, telephonic support, quarterly laboratory monitoring, and provision of glucometers and test strips. **Results:** For the 73 enrolled employees with prediabetes, serum hemoglobin A1c levels—mean (standard deviation)—decreased from 6.10% (0.53%) to 5.42% (0.51%) ($P < 0.0001$). For the 151 enrolled employees with diabetes, mean serum hemoglobin A1c levels—mean (standard deviation)—decreased from 8.03% (1.91%) to 7.48% (1.52%) ($P < 0.0001$). In the 12 months before, during, and after the program, 27, 15, and 27 diabetic employees required hospitalization, respectively. Health insurance per member per month claims costs for employees with diabetes rose only 1.2% over the prior 12 months, and self-reported presenteeism increased ($P < 0.0001$). **Conclusions:** This employer-endorsed program achieved favorable outcomes for employees with prediabetes and diabetes.

Employers and employees are at a crossroad in health care management. In the United States, chronic diseases now affect 73% of employees, in 2010 accounting for more than $3.35 per hour of employee costs.[1] Employer costs in employee health care insurance rose 110% from 1999 to 2010, an annual rate approaching 10%. In turn, the cost of health insurance premiums to employees has grown annually at a rate exceeding 9%.[1–3] Although starting in 2010 the annual increase in health care spending has slowed to the 4% range,[4] this may be a false hope, because the cost of insured health care is increasingly being borne by employees.[5,6] Likewise, the institution of employer-sponsored wellness programs under the auspices of the Affordable Care Act may not translate into cost savings for employees.[7] Nevertheless, employer-sponsored health management programs for employees have become a core strategy to counter cost trends for both employers and employees,[8] including a callout for such programs in the 2010 Patient Protection and Affordable Care Act (HR 3590[9]). There is urgent need to further build the evidence base to guide design and implementation of diabetes management programs.[10–12]

From a humanistic standpoint, the more fundamental objective for employers is to promote improved health among employees with illness, and help healthy employees avoid becoming ill.[13–16] The 2000 publication of the US Department of Health and Human Services, *Healthy People 2010*, set as goals that most employers (75%), regardless of the size, should offer a comprehensive employee health promotion program, and that most employees (75%) should participate in employer-sponsored health promotion activities[17]; *Healthy People 2020* also encouraged such programming, but did not set numerical targets.[18] The former objective may well be in hand, as even by 2000 more than 90% of employers with more than 50 employees reported having workplace wellness programs.[19] However, the latter objective of employee engagement requires sustained effort.

Type 2 diabetes mellitus features prominently in national statistics for the burden of chronic disease. For 2007, diabetes was estimated to affect 23.6 million people in the United States, representing 7.8% of the total population[20] and costing $174 billion in health care and lost productivity.[21] Moreover, another 54 million people (18% of the total population) were estimated as having prediabetes, placing them at risk for developing diabetes and its complications. By 2011, the estimated prevalence of diabetes in the United States was 8.3%,[22] with diagnosed diabetes affecting 5% of the workforce.[23] Approximately $1 of every $5 US health care dollars is spent caring for someone with diabetes, as reported both in 2007 and in 2012.[24,25] Against these staggering statistics is strong evidence that the care of adults with diabetes is suboptimal. In the United States, more than 50% of such adults have hemoglobin A1c (HbA1c, which reflects the average blood glucose levels over a 2-3 month period) levels above the American Diabetes Association target of 7%.[26] Given these statistics for diabetes, it stands to reason that employers should promote screening and wellness programs for employees at risk for diabetes or with undiagnosed diabetes, and should provide wellness programs for employees with previously diagnosed diabetes.

Massive data sets for insurance claims can be examined for the influence of workplace wellness programs on utilization of health care resources by large populations of insured employees.[27,28] In turn, improvements in key health indices as a result of workplace wellness programming can also be documented.[29,30] Nevertheless, there is only limited information linking the effect of workplace wellness programs on both employee clinical outcomes and the costs of their health care.[31,32] The Florida Health Care Coalition saw an opportunity to develop such linked data through a rigorous diabetes wellness program of 12-month duration, by reaching out to a major employer in the Orlando area that was actively seeking to further improve the health of their employees. The Florida Health Care Coalition is a coalition of major employers in the state of Florida that represents 60% of the employed workforce in the state. Inspiration

From the Department of Pathology and Laboratory Medicine (Ms Bevis and Dr Crawford), North Shore-Long Island Jewish Health System, Hofstra North Shore-LIJ School of Medicine, Manhasset, NY; Institute for Child Health Policy (Drs Nogle and Forges), University of Florida, Gainesville; Cognoscenti Health Institute (Dr Chen), Orlando, and University of Miami Miller School of Medicine; Florida Hospital Diabetes Institute (Ms Sievers); Florida Health Care Coalition (Ms Lucas and Dr Mahoney), Orlando.

Dr Nogle is deceased.

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This work is original, has not previously been published. All authors contributed significantly to the performance of the work.

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Address correspondence to: James M. Crawford, MD, PhD, North Shore-LIJ Laboratories, 10 Nevada Drive, Lake Success, NY 11042 (jcrawford1@nshs.edu).

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was drawn in part from a 2004 to 2006 workplace wellness program for diabetic employees of the Polk County School Board (in which Orlando, Florida, resides,[33]). That workplace wellness program was coordinated by the school board wellness management office, which helped inform establishment of the program reported herein.

For the current program, the Florida Health Care Coalition assembled a consortium of providers and served as a sponsor. The output data consisted first of extensive clinical data from the screening of employees at entry and from laboratory monitoring over an intervention period of 12 months, and second of 3 years of single-payer health care insurance claims data (12 months before, 12 months during, and 12 months after the intervention period). We found that significantly improved measures of health status during the program period were reflected in claims cost avoidance during this same period. However, claims cost avoidance seemed to cease after cessation of the program. This study therefore strengthens the argument not only for workplace wellness programming but also for its sustained continuation. This last implication has guided the employer in enhancing its workplace wellness programs moving forward.

RESEARCH DESIGN AND METHODS

Environment

This program was conducted at a major employer in the Orlando, Florida, area. This employer has chosen to remain anonymous, similar to the position taken by a major employer in a prior published study of the cost of diabetes in the workplace.[34] This employer offers a single-payer health insurance program for benefit-eligible employees, providing for their access to regional health care providers. Starting with access to participating primary care physicians, the employer had an existing portfolio of wellness programs for their employees, including the payer's telephonic disease management program for diabetes, the WebMD® resource, and Orlando Behavioral Health and PacifiCare Behavioral Health.

This was a program designed prospectively for voluntary participation. Modest cash card incentives were given for enrollment and for completion of the 12-month program. As a workplace wellness program, a case-control study was deemed inappropriate by the employer, and the employer did not grant permission for our identifying a cohort of employees with diabetes who would not be invited to participate in this program but whose insurance claims data would still be analyzed.

Study Groups

Two groups of employees were targeted for recruitment: employees considered at risk for diabetes who might benefit from a wellness program; and those with overt diabetes. Employees with diabetes were identified through well-publicized voluntary screening events, or by identification of employees with diagnosed diabetes through analysis of the payer's insurance database, followed by solicitation for voluntary participation under privacy guidelines approved by the University of Florida College of Medicine Institutional Review Board. Employees with prediabetes were identified entirely through the publicized screening events.

Screening and Enrollment

Screening events were scheduled on the employer campus, and consent was obtained at the time for communication of laboratory testing results to the participants and to their primary care physicians (if known). Height, weight, and blood pressure were measured, and a fasting blood sample was obtained for assessment of glucose, insulin, HbA1c, cholesterol—low-density lipoprotein cholesterol (LDL) and high-density lipoprotein cholesterol—and triglycerides. Also, with consent from the employees attending screening events, their primary care physicians were notified of the existence and design of this program and the possibility that their patient might be invited to participate. Although educational materials on diabetes were sent to the primary care physicians, there was no obligation for these physicians to alter their treatment or patient care plans. Rather, these physicians were notified of the laboratory and biometric findings obtained in their patients, both from the screening event and from quarterly laboratory evaluations.

For employees with diabetes identified through screening, criteria for program entry were as follows: 12 months' continuous employment before entry; age 18 years or more; fasting serum glucose 126 mg/dL or more, to be confirmed by follow-up testing in a physician office; and a score of 10 or greater on an American Diabetes Association Health Risk Assessment questionnaire. Entry criteria for employees with prediabetes were as follows: 12 months' continuous employment before entry; age 18 years or more; fasting serum glucose 100 to 125 mg/dL; and a score of 10 or greater on an American Diabetes Association Health Risk questionnaire.

For both employees with diabetes or prediabetes, criteria for exclusion at the time of entry were as follows: pregnant or lactating women ($n = 0$); a diagnosis of type 1 diabetes ($n = 0$); or any medical condition or hypercritical laboratory test that, in the clinical judgment of the University of Florida Division of Endocrinology, would make it unsuitable for inclusion into the study ($n = 10$). At the time of screening, which involved 455 total employees, there were two employees with a systolic blood pressure of more than 180 mm Hg, four employees with a diastolic blood pressure of more than 110 mm Hg, and four patients with a serum triglyceride level of more than 500 mg/dL. These 10 individuals were referred immediately for ambulatory medical care separate from this program.

Critical physiologic or laboratory test values generated alerts that our program communicated to both the employee and their existing primary care physician. In addition to the hypercritical values cited above (systolic blood pressure, >180 mm Hg; diastolic blood pressure, >110 mm Hg; serum triglyceride levels, >500 mg/dL), alerts were given to employees attending screening events if the following was identified (regardless of whether the employee ultimately enrolled in the program): HbA1c, 7.0% or more ($n = 60$); fasting serum glucose, 200 mg/dL or higher ($n = 21$); systolic blood pressure, 140 mm Hg or higher ($n = 65$); diastolic blood pressure, 90 mm Hg or higher ($n = 61$); low-density lipoprotein (LDL) cholesterol, 130 mg/dL or higher ($n = 104$); and serum triglycerides, 200 mg/dL or higher ($n = 65$). If an employee did not have a primary care physician, this program provided the employee with the names of those participating primary care practices in their region that were accepting new patients. The critical alerts did not exclude an employee from participation. Rather, the program approved by the employer and the University of Florida Institutional Review Board included our effort to ensure that employees with these abnormal findings would, indeed, receive timely medical care from a physician.

Program Initiation

Employees meeting entry criteria for diabetes or prediabetes were invited to a welcome meeting, held as a series of offerings in late March and early April 2008. At the welcome meeting, the program and its staff were introduced, and participants were provided with written educational materials about diabetes, nutrition, and lifestyle. The employees were made aware of an outstanding set of existing employer-supported programs, including an on-campus network of walking trails and biking paths, an on-campus fitness center, a program for healthy daily eating at the employee cafeterias, the Jenny Craig® weight loss program, and the Weight Watchers at Work® program. A variety of smoking cessation programs were offered: QuitNet®, the Smoking Cessation Center of the PacifiCare Behavioral Health's Web site, Tobacco Solutions®, and self-guided smoking cessation programs through WebMD®. All employees with diabetes who were enrolled in the program were also given

opportunity to obtain free glucometers and a free supply of glucometer test strips.

12-Month Program

During the first quarter of the program for employees with diabetes, a series of required four 2-hour educational sessions were given by a certified diabetes nurse educator, following a specific curriculum; attendance at two sessions was required for retention in the program. These were (1) about diabetes: introduction; (2) about diabetes: lifestyle changes for good health; (3) diabetes: nutrition; and (4) diabetes: a healthy daily management program. Greater than 90% of diabetic participants attended all four sessions. The importance of multiple hours of educational programming has been underscored in studies of workplace wellness programs.[35]

Quarterly, all enrolled employees with diabetes were required to have biometric measurements, fasting blood testing, and urine testing. These quarterly "lab draws" and the ensuant laboratory testing were provided free-of-charge at on-campus sites, usually over 3 weeks at multiple campus locations and generally before the start of the workday. Attendance at all quarterly "draws" was required for retention in the program. All laboratory and biometric testing results were communicated to the participating employee and their primary care physician. Outliers on key laboratory indices (HbA1C, $>7.0\%$; and fasting serum glucose, >100 mg/dL) were flagged by the database system and brought to the attention of the program endocrinologist for further review. This endocrinologist communicated critical value alerts to the respective primary care provider, and was available throughout the program for advice on advancement of hyperglycemic treatment if requested by the primary care physician.

A critical part of this program, which was affirmed by participants at the end, was the telephonic and mailing notices, scheduling, and reminders of education sessions and quarterly laboratory draw events. If employees failed to attend a scheduled educational session or draw event, program staff were diligent in their efforts to reschedule the employee, or as a last resort employees were scheduled for a quarterly laboratory draw directly through their physician office.

For employees with prediabetes, attendance at the first two education sessions was mandatory for retention in the program; the third and fourth sessions were voluntary. Employees with prediabetes were offered a voluntary program of eight telephonic sessions with a "health coach" (also a certified diabetes nurse educator), in which the following topics were the basis for the telephonic conversations: laboratory screening for diabetes; diet and nutrition; evidence-based guidelines for managing blood cholesterol, glucose, HbA1c, and blood pressure; lifestyle management; foot care; and screening for complications of diabetes such as retinopathy. Through these telephonic sessions, an effort was made to help the employees determine their own goals in a patient-centered fashion. The rationale for providing telephonic health coaching to the employees with prediabetes was based only on the premise that the employees with diabetes would already be under the care of a primary care physician, whereas those with prediabetes might not be. While not being "diagnosed" with diabetes, these latter employees would nevertheless benefit from a programmatic effort to educate them about this disease and coach them in avoiding its occurrence. Lastly, the employees with prediabetes were required to have the free-of-charge laboratory testing only at 6 and 12 months; the employee and their primary care physician (if known) were notified of the results.

Data Analysis

A University of Florida Institutional Review Board-approved database was developed by collecting and merging data from six distinct information systems: biometrics at the time of screening and the quarterly blood draws; the clinical laboratory data from all time points (Cognoscenti Health Institute); insurance claims; glucometer test strip readouts (Abbott™); surveys completed by the program enrollees (Health Risk Assessments, Stanford Presenteeism Surveys[36]); and program participation information compiled by educators (Florida Hospital) and the telephonic call center (University of Florida). After each quarterly update to the database, data were audited to ensure proper employee identification during the data integration process, and to verify employee retention at each quarterly time point (noting that virtually all participants who did not meet program participation criteria failed to do so during the first quarter, when the education sessions were held).

Quarterly monitoring of the insurance claims during the 12-month program period also was done, allowing 6 months for completion of claims processing. Claims data from the 12 months before the program and the 12 months after program cessation were pulled as a full-year data set, again allowing 6 months for completion of claims processing. The claims data included office visits; urgent care visits; hospitalizations; laboratory testing; pharmaceuticals; and other claims including nursing care, psychiatric care, and ambulatory surgery.

The final database consisted of participation data for education sessions and quarterly laboratory draw events; biometric and laboratory data; claims data; results of employee questionnaires; and a participating physician questionnaire at program end. The biometric data, laboratory data, and pre- and postparticipant responses to a questionnaire were subjected to statistical analysis, consisting of descriptive statistics on each parameter at each time point; and analysis of paired differences with paired *t* test to compute confidence intervals and significance. For claims data from the single insurance provider, costs and case volumes were compiled as absolute numerical values. Claims outcomes are reported on a cumulative basis, without statistical analysis, on the basis of the premise that the cumulative claims cost divided by the number of beneficiaries constitutes a calculation of absolute costs "per member." The claims data analyzed were the 12 months before the program start, the 12 months of program intervention, and the 12 months after program completion. Descriptive statistics, paired *t* test, and 95% confidence intervals were calculated as appropriate. STATA version 10.0 (Stata Corp LP, College Station, TX) was used to perform the analyses.[37]

RESULTS

Recruitment

The employer's publicity campaign for this program was launched on November 21, 2007, and involved multimedia publicity on the employer campus, and home mailings. Simultaneously, sequestered review by the single payer indicated potentially 2075 employees who were eligible for recruitment into this program on the basis of previously diagnosed and/or treated diabetes. A total of 455 employees attended one of the on-campus screening events, held in the interval of November 2007 to mid-January 2008. One hundred forty-five employees who voluntarily attended the screening events had previously been diagnosed with diabetes (as confirmed by analysis of the payer claims database), and may have been well-controlled at the time of the screening event. Regardless, these 145 employees were also invited to participate, in keeping with the voluntary nature of this program. Of the remaining 310 employees attending the screening events, only 13 employees were identified with newly diagnosed with diabetes. This low percentage (4%) is in keeping with the published low percentage of newly diagnosed diabetics among those with evidence of diabetes at the time of screening events.[38] An additional 27 employees identified through the payer claims database as having diabetes made themselves known to the program (out of the more than 2000 employees with diabetes in the insurance database) and expressed interest in participating in the program, separate from attendance at a screening event. Hence, a total of 185 employees with diabetes were enrolled at the program start. For the 27 diabetic employees for whom we did not already have screening event

biometric and laboratory data, "0 month" biometrics and laboratory data were obtained at the welcome meeting.

Through the screening events, 139 employees were identified as being prediabetic using our entry criteria and invited to participate in the program. In all, 215 employees with diabetes and 139 with prediabetes were invited to participate; 185 employees and 99 employees, respectively, actually attended one of a series of welcome meetings, held in late March to early April 2008, and were enrolled in the program.

Of the employees with diabetes, 175 participated in the full 12 months of the program (including all 13 of those newly diagnosed with diabetes). Of these, 151 of the 175 employees attended at least two education sessions and all four quarterly blood draws and so met all inclusion criteria. The 24 employees who did not meet these latter two inclusion criteria failed to do so for one key reason: inability to attend at least two education sessions in the first quarter. The primary anecdotal reason given for failing to attend was inability to obtain release time from work, requiring the employee to take a day off to attend an education session (which was not done). This was despite our program offering each education session four separate times, at different times of day and different days of the week, with mail and telephonic reminders of the dates, times, and locations of education sessions. Regardless, these 24 employees were identified in the first quarter of the program and excluded from data analysis, before any knowledge of claims accrual by program participants. In keeping with the voluntary nature of this program, the 24 employees were still given opportunity to attend the quarterly laboratory draw sessions through the full 12 months of the program.

Of the 99 employees with prediabetes enrolling in the program; 73 completed all 12 months of the program as indicated by attending the first two education sessions, attending the 6-month and 12-month laboratory draws, and participating in the telephonic health coaching program. The 26 employees with prediabetes who were excluded from data analysis had failed to attend two education sessions and/or failed to participate in the telephonic health coaching program.

The study group therefore consisted of 151 employees with diabetes and 73 with prediabetes, who had attended at least two of the four education sessions, participated in all laboratory monitoring events, and in the case of the employees with prediabetes, participated in the telephonic health coaching program. The entry statistics of this final group are given in Table 1. Three of the employees with prediabetes developed overt diabetes over the course of the 12-month program. Because they were identified as having prediabetes at the program start, their clinical data are retained as part of the prediabetic group in this report, and their claims data were not deemed part of the "diabetic" group. That being said, exclusion of the biometric (body mass index) and laboratory data (HbA1c, LDL cholesterol) of these three individuals in the prediabetic group had no significant effect on the reported outcomes (data not shown).

TABLE 1. Entry Statistics on Participating Employees

Category	Diabetic	Prediabetic
Number of employees	151	73
Average age, yrs	53 ± 9	50 ± 10
Male/female ratio	86:68 (56%:44%)	54:19 (74%:27%)
Fasting serum glucose, mg/dL		
Median	119.0	89.0
Mean ± SD	133.3 ± 53.2	89.8 ± 9.9
Entry HbA1c levels, %		
Median	7.50	6.10
Mean ± SD	8.03 ± 1.91	6.11 ± 0.53
Entry body mass index, kg/m^2		
Median	33.4	36.5
Mean ± SD	34.1 ± 6.8	38.2 ± 6.4
Entry low-density lipoprotein, mg/dL		
Median	81.0	103.0
Mean ± SD	89.7 ± 33.3	104.3 ± 26.7

SD, standard deviation.

Clinical Parameters Over the 12-Month Program

This program led to significant improvement in measurable clinical parameters for employees with diabetes. Table 2 shows key laboratory (HbA1c, LDL cholesterol) and biometric (body mass index) results from 0, 6, and 12 months. From HbA1C values of 8.02% ± 1.90% at 0 month, there was significant improvement in HbA1c levels at 6 months (7.13% ± 1.43%; $P < 0.0001$). Although the HbA1c improvement slipped to a more modest outcome by 12 months (7.48% ± 1.52%), the paired decrease in HbA1c over 12 months (−0.57 ± 1.41) was still highly significant ($P < 0.0001$).

Changes in LDL cholesterol levels were not significant at either 6 or 12 months. The body mass index of 34.06 ± 6.82 kg/m^2 at 0 month did not decrease significantly in the first 6 months. Nevertheless, by 12 months, body mass index had decreased to 33.45 ± 7.10 kg/m^2, which was significant ($P < 0.005$).

Results for the 73 employees with prediabetes are given in Table 3, and also showed a highly significant decrease in HbA1c from 6.11% ± 0.53% to 5.42% ± 0.51%. However, there was no change in LDL cholesterol levels, and the decrease in body mass index did not attain statistical significance.

As viewed from targets declared by *Healthy People 2020*,[18] our program saw diabetic employees' HbA1C levels "below 9%" move from 75.4% at the program start to 85.7% by the program end. The target is 85.4% of adults with diabetes having HbA1c levels "below 9%." For a *Healthy People 2020* target of 58.9% of adults with diabetes have HbA1c levels of "less than 7.0%", our employees moved from 36.4% having HbA1C levels "below 7.0%" at the program start to 49.2% at 3 months, 55.5% at 6 months; 46.9% at 9 months; and slipping to 40.4% at the program end.

Consumption of Health Care Resources

Claims

For the 151 employees with diabetes, the total cost of claims was $731 per member per month (PMPM) in the 12 months before the program, and rose 1.2% to $744 PMPM during the 12-month program. Total claims costs rose a further 8.3% to $806 PMPM in the 12 months after the intervention year, representing a 10.3% increase compared with the 12 months before intervention (a 24-month interval). The results were even more dramatic if the top 1% of charges were excluded. With this exclusion, PMPM costs, which were $684 PMPM in the 12 months prior, decreased 3.1% to $663 PMPM during the 12-month program period, and jumped 22% to $811 PMPM the year after.

It is worth noting that the overall costs of health care for patients with diabetes in the United States in 2010 were estimated to be $615 PMPM,[39] so this local population consumed slightly more resources than the national average. A geographically proximate comparison is from the Cognoscenti Health Institute-coordinated 2004 to 2006 workplace wellness program for the 1212 diagnosed diabetic employees of the Polk County School Board, central Florida, representing 7.5% of the school board employee workforce.[33] Before initiation of the Polk County program (2003), PMPM employer costs for the health care of these employees with diabetes were $1104. Hence, the diabetic employees in this study were starting at a lower

TABLE 2. Employees With Diabetes ($n = 151$): Changes in Laboratory Indices and Biometrics, 0 to 12 Months

					Paired *t* Test	
Index	**Descriptor**	**0 mo**	**6 mos**	**12 mos**	**6 mos**	**12 mos**
HbA1c, %	Median	7.50	6.70	7.15		
	Mean ± SD	8.02 ± 1.90	7.13 ± 1.43	7.48 ± 1.52		
	Paired difference*		−0.87 ± 1.75	−0.57 ± 1.41		
	95% confidence interval		−1.15 to −0.59	−0.80 to −0.33	<0.0001	<0.0001
LDL cholesterol, mg/dL	Median	81.0	73.5	81.0		
	Mean ± SD	89.7 ± 33.3	84.8 ± 39.0	86.0 ± 31.7		
	Paired difference*		−3.2 ± 27.1	−3.5 ± 32.1		
	95% confidence interval		−8.08 to 1.76	−8.73 to 1.72	0.2062	0.1877
Body mass index, kg/m^2	Median	33.40	32.50	32.70		
	Mean ± SD	34.06 ± 6.82	33.53 ± 6.94	33.45 ± 7.10		
	Paired difference*		−0.62 ± 4.70	−0.62 ± 2.44		
	95% confidence interval		−1.37 to 0.16	−1.02 to −0.22	0.1186	<0.005

*Paired difference compared with 0 month; 95% confidence intervals apply to the paired differences.
LDL, low-density lipoprotein; SD, standard deviation.

TABLE 3. Employees With Prediabetes ($n = 73$): Changes in Laboratory Indices and Biometrics, 0 to 12 Months

					Paired *t* Test	
Index	**Descriptor**	**0 mo**	**6 mos**	**12 mos**	**6 mos**	**12 mos**
HbA1c, %	Median	6.10	5.40	5.40		
	Mean ± SD	6.11 ± 0.53	5.43 ± 0.51	5.42 ± 0.51		
	Paired difference*		−0.67 ± 0.74	−0.68 ± 0.08		
	95% confidence interval		−0.84 to −0.50	−0.51 to 0.85	<0.0001	<0.0001
LDL cholesterol, mg/dL	Median	103.0	106.0	103.0		
	Mean ± SD	104.3 ± 26.7	101.8 ± 24.6	104.3 ± 23.6		
	Paired difference*		−2.5 ± 24.9	−0.0 ± 22.0		
	95% confidence interval		−8.32 to 3.31	−5.1 to 5.2	0.3934	0.9873
Body mass index, kg/m^2	Median	36.50	35.60	35.80		
	Mean ± SD	38.25 ± 6.39	36.65 ± 6.27	36.59 ± 6.11		
	Paired difference*		−1.59 ± 8.92	−1.66 ± 8.82		
	95% confidence interval		−3.67 to 0.49	−3.71 to 0.40	0.1315	0.1126

*Paired difference compared with 0 month; 95% confidence intervals apply to the paired differences.
HbA1c, hemoglobin A1c; LDL, low-density lipoprotein; SD, standard deviation.

level ($731 PMPM in the 12 months prior) than a local comparison employee population.

Hospitalizations

During the 12 months prior, 27 of the 151 employees with diabetes (18%) required hospital admissions, most frequently for 1, 2, 3, or 4 days, with five admissions for 6 to 10 days. For the 12-month program period, only 15 employees with diabetes were admitted to hospital (10%), nine for a duration of 1 to 5 days. There were three admissions for 6 or 7 days, and one each for 12, 16, and 33 days. For the 12 months after, 27 employees with diabetes were admitted to the hospital, all but two for admissions of 1 to 5 days. Hence, as measured by the number of employees admitted, diabetic employees stayed out of hospital more successfully during the 12-month program period. The hospitalization rate of 10% during the 12-month program period compares favorably to the 14.4% hospitalization rate of 52,668 diabetic patients during a published 2009 study period.[40]

Owing to the three hospitalizations of longer duration during the 12-month program period, total patient-hospital days increased from 89 during the 12 months prior, to 98 for the 12-month program. Total patient-hospital days for the 12 months after were 97.

Pharmaceutical Claims

This program was not designed to instruct primary care physicians in their management of participating employees with diabetes, either from the standpoint of their interpretation of program-derived laboratory testing, or in their prescribing of pharmaceutical therapies. Rather, our intent was to maximize the opportunity for participating employees to receive consistent care from a primary care physician. Nevertheless, insurance claims data permitted assessment of pharmaceuticals utilized by participating employees with diabetes (Table 4), and the differences in utilization between the 12 months before the program start versus the 12 months of the program (Table 5). For the 175 employees with diabetes participating in the entire 12-month program, without eliminating the 26 employees who did not meet full participation criteria, we observed that the percentage of employees receiving pharmaceutical management in accordance with American Diabetes Association guidelines[41] increased from

TABLE 4. Diabetes Medication Treatment Patterns Identified Through Insurance Claims Data*

Hypoglycemic monotherapy
Biguanide only
Sulfonylurea only
Insulins only
Thiazolidinedione only
Hypoglycemic combined therapy
Two agents
Biguanide + sulfonylurea
Biguanide + insulin
Biguanide + thiazolidinedione
Biguanide + antihyperglycemic
Sulfonylurea + insulin
Sulfonylurea + thiazolidinedione
Three agents
Biguanide + sulfonylurea + thiazolidinedione
Biguanide + sulfonylurea + insulin
Biguanide + sulfonylurea + antihyperglycemic

*As coded by insurance claims data.

TABLE 5. Medication Treatment Pattern for Employees With Diabetes*

Medication Pattern	12 mos Before	12-mo Program Period
Number of employees	175	175
Treatment pattern consistent with ADA guidelines	109 (62%)	134 (77%)
Oral hypoglycemic monotherapy	44 (25%)	61 (35%)
Multiple oral hypoglycemic agents	54 (31%)	62 (35%)
Oral hypoglycemic agent plus insulin	10 (6%)	11 (6%)
Insulin only	6 (3%)	7 (4%)
Atypical treatment pattern	38 (23%)	9 (5%)
No claims data for diabetic medications	22 (13%)	25 (14%)

*All diabetic employees enrolled in the program in April 2008.
ADA, American Diabetes Association.

62% in the prior 12 months, to 77% in the 12-month program. Conversely, the percentage of employees receiving atypical therapies decreased from 23% to 5%, respectively.

Endocrinologist Consultation

This observation has pertinence also to the interactions between the program endocrinologist and the primary care physicians caring for employees with diabetes. At the program's outset, the telephone call from the endocrinologist to the treating physician for participating employees having critical laboratory values gave opportunity for these two physicians to establish a working relationship. Over the course of the 12-month program, as follow-up "critical value" telephone calls occurred, the primary care physicians rarely needed counseling from the program endocrinologist regarding use of pharmaceuticals. Rather, these telephone calls helped provide a safety net for the participating employees, in that the treating physicians were assured of being made aware of the health status of their participating patients, as reflected through the quarterly laboratory values.

Utilization of Laboratory Testing

The free laboratory testing available through this program did not decrease insurance claims for laboratory testing by the primary care physician offices. PMPM laboratory testing costs actually went up 13% during the 12-month program period and another 45% for the 12 months after. It is possible that the inclusion of 13 employees with newly diagnosed diabetes in the roster of 151 participants might have driven this increase. That being said, the data suggest that primary care physicians continued to conduct their own laboratory testing regime on employees with diabetes during the program period and in the 12 months after, independent of the free laboratory testing provided during the 12 months of this program.

Self-Reporting

A detailed Health Risk Reporting questionnaire was filled out by participating employees with diabetes or prediabetes at the welcome meetings (0 month) and at the final quarterly monitoring session (12 months). Amid the extensive data available, a majority reported increased exercise, weight loss, decreased dietary intake of fat, and improved stress management (Table 6). Only a few employees reported reductions in alcohol intake or smoking. With regard to clinical indices, a majority reported lowered blood cholesterol levels and decreased blood pressure, which is interesting considering that there was no statistically significant reduction in LDL cholesterol levels in the employees with diabetes (Table 2).

Stanford Presenteeism Scale Survey Over 12-Month Program

This instrument addresses workplace performance using a point score system from 0 to 30, with higher numbers denoting favorable circumstances. Total 6-item Stanford Presenteeism Scale (SPS-6) scores for employees with diabetes or prediabetes were compared at the beginning and the end of the program (Table 7). For both groups, there was a highly significant increase in SPS-6 scoring ($P = 0.0000$ for both groups). When stratified, the SPS-6 scores increased for 78% of employees with diabetes and for 83% of those with prediabetes. For both employees with diabetes or prediabetes, improved stress management (one question) and perceived improvement in health (two questions) were the major contributors to improved scoring.

Physician Satisfaction Survey Outcome

On completion of the 12-month program, a survey was sent out to the 118 primary care physicians caring for the 151 employees with diabetes, and was returned by 44 physicians. These physicians reported that the program helped their patients in improving physical activity, and focusing on being healthy. In keeping with anecdotal

TABLE 6. Intervention Outcomes on the Basis of the Health Risk Reporting Questionnaire*

68% increased exercise
61% lost weight
70% decreased fat content of diet
52% stated improved stress management
16% decreased alcohol intake
14% decreased smoking
61% reported lowered blood cholesterol levels
64% reported decreased blood pressure

*For 151 employees with diabetes completing the program.

TABLE 7. Stanford Presenteeism Survey (SPS-6)[a]

	Diabetics	Prediabetics
Total SPS score[b]		
Baseline, 0 mo	18.5 ± 3.9	18.9 ± 2.3
Program end, 12 mos	24.8 ± 4.7	23.9 ± 5.7
Change from 0 to 12 mos	6.3 ± 6.8*	4.9 ± 6.2*
Change in scores, ordinal		
No change or decrease	24 (22%)	8 (17%)
Increase of one to four points	18 (17%)	14 (29%)
Increase of five to nine points	25 (23%)	15 (31%)
Increase of ≥10 points	41 (38%)	11 (23%)

[a]On the basis of 108 diabetic and 48 at-risk employees who completed all quarterly monitoring events and attended at least two education sessions, and also completed the SPS-6 Survey at 0 and 12 months.
[b]Total SPS Score: range 0 to 30 points. Positive values indicate favorable status.
*$P < 0.0001$.
SPS-6, 6-item Stanford Presenteeism Scale (25).

employee comments at the program end, strong physician endorsement was given in support of this program's educational component.

DISCUSSION

Program Outcomes

This program addressed a key issue for employee workplace wellness: management of diabetes through engagement of employees and their primary care physicians. As measured by clinical data, medical claims data, and employee self-reporting surveys, better control of diabetes was achieved, the frequency of hospitalization was reduced, cost increases of employee health care were held in check, and employees reported an improved sense of well-being. Participating primary care physicians reported satisfaction with the assistance that this program provided to their patients. This program thus provides data in support of the concept that employee engagement in health management can be achieved through an intensive employer-endorsed disease management program. Although we cannot claim that the statistically significant reductions in blood HbA1c levels for employees with diabetes or prediabetes and in body mass index for employees with diabetes were causally related to our 12-month intervention, these favorable effects were coincident with the program. We also cannot point toward one intervention that produced these observed results. Rather, the overall approach of providing these programmatic services was met with favorable qualitative outcomes as reported by participants, and was reflected in favorable outcomes for quantitative data.

This study documented a 1.2% increase in total PMPM health insurance costs from the period 12 months before the program to the 12 months of the program. PMPM costs then jumped 8.3% in the year after March 2009 to April 2010. By way of benchmarks, national health spending rose 4.8% in 2008 and a further 4.0% in 2009.[42] Nevertheless, national employer costs for employer-provided health care benefits, as measured by insurance claims costs, rose at a consistent annual rate of 10% to 11% in 2008 to 2010.[43] Hence, although our sample is small, the data for our 12-month intervention period compare favorably with available national benchmarks during the same interval. The reduction in hospital admissions among the 151 employees with diabetes from 27 in the 12 months before and after, compared with 15 during the 12-month program period, is equivalent to a reduction of 79 hospital admissions per 1000 patient-years, which compares very favorably with the published reduction of only 4 admissions per 1000 patient-years for employer-sponsored health management programs.[28]

A study conducted during a similar period (February 1, 2008, to February 1, 2009) retrospectively evaluated the effectiveness of an employer-sponsored diabetes management program involving pharmacists as the program coordinators.[44] Chart-based evaluation of HbA1c values was conducted at the start and end of the program. Ninety-eight patients completed the study, and exhibited a significant decrease of HbA1c from 7.8% to 7.1% ($P < 0.01$) from the start to finish of the program. Our report provides a more comprehensive view of an employer-sponsored diabetes management program with prospective data accrual to examine outcomes for patient health events, changes in laboratory parameters and biometrics, and consumption of health care resources. Moreover, we evaluated resource consumption in the 12 months before, during, and after program intervention. We thus are able to make the point that continuation of a wellness program may be required for sustainable outcomes.

A separate report involved a randomized comparison of the effectiveness of a telephonic versus print intervention diabetes management program on HbA1c values and pharmacy claims in a total of 526 diabetic participants in a low-income, insured population, over a 1-year period.[45] Against baseline HbA1c values of 8.6%, the telephonic group had a modest decline in HbA1c of 0.23%, whereas the print group experienced a rise of 0.13% ($P = 0.04$). The concept of telephonic coordination being part of logistical support for a workplace disease management program is further supported in this study.

Implications

Our findings demonstrate that employers can achieve success in a workplace wellness program by conducting focused demonstration disease management programs in areas of specific concern. This particular program for diabetes and prediabetes provided for employee access to primary care physicians, laboratory and biometric assessments, and for the employees with diabetes, free use of blood glucose meters. As such, this program was more extensive than most reports of workplace wellness programs.[46] A comprehensive program like ours is more likely than general health promotion programs to generate measurable return on investment, because it focuses on high-risk individuals who typically impact medical and related costs.[27] Therefore, and despite the trend away from randomized controlled workplace trials over the past 30 years),[27,47,48] high-quality observational studies such as ours can track both employee health status and employer health care expenditures over extended periods.[49,50] We add further evidence for the effectiveness of such comprehensive programs.[51]

The fact that, in the 12 months after cessation of this program, hospitalization rates returned to their former levels after cessation of the program, and PMPM claims costs jumped 8.3%, raises the issue that an intensive, proactive employee wellness program is only effective while operational, and does not have a sustaining effect after program cessation. A fundamental concern is that, at a population level, the routine individual interactions between patients and their primary care physicians are not sufficient for compliant chronic disease management, and that additional support mechanisms are needed. Although a program of our design is not the only means for providing additional support, it gives illustration of the potential benefits that may be derived and the mechanisms for doing so.

The strongest emphasis must be placed both on the employee experience and the position of the employer. In the first instance, a competently delivered wellness program that supports the fundamental relationship of patients to the treating physician is essential. The fact that the University of Florida Division of Endocrinology was consultant to the primary care physicians, and did not intervene in patient management per se, was a successful strategy. From the employees' perspectives, the educational programming was the greatest single strength of the program, and they were desirous of further education in dietary management. This is in keeping with the concept

that patient engagement and lack of knowledge about their disease are critical barriers to optimizing outcomes for this disease.[52] Indeed, education about dietary management may have particular value for individuals with prediabetes.[32] Likewise, the improvements in self-reported changes in lifestyle over the course of this program may play important roles in employee perception of their own health status.[53] Our program provides further support for the importance of employer leadership, health risk screening, individually tailored programs, and a supportive workplace culture in achieving favorable outcomes for workplace health promotion programs.[54]

From the employer's perspective, we found that protection of employee privacy and support of the employee–employer relationship were also essential to program design. From both a regulatory and ethical perspective, the penalties of failure are high if the program fails in these two domains. Conversely, we strongly endorse the positive working relationships that can be established among the providers of an employee wellness program consortium. The ability of multiple partners to work together has been considered a major barrier in the design and execution of such programs.[55] Our experience may help employers overcome the considerable infrastructural barriers for implementing worksite health promotion programs.[56] Although any employee wellness program will have its unique features, it is our hope that the solutions we arrived herein at will have value for future such efforts.

LIMITATIONS

This program was not designed to examine return on investment, owing both to the small population being studied, and to the fact that the program was for 12 months only and examined only health care costs and not workplace productivity. Workplace programs are not likely to achieve avoidance of health care costs in their first 1 to 2 years.[28,51] Savings are more likely to be cumulative and substantial over multiple years.[49,57] Nevertheless, with higher acuity chronic diseases, financial models suggest that return on investment can be realized in the first year,[58] including a reported first-year return on investment for employees already having heart disease.[31] Our program also does not provide information on whether risk for the long-term comorbidities and complications of diabetes can be diminished, owing to the short program duration (12 months) relative to the many years required for complications to develop. Nevertheless, the published evidence base indicates that favorable changes in lifestyle, as reported by participating employees in this program, and in clinical indices, as rigorously documented by this program, correlate well with improved long-term outcomes. Accordingly, larger scale programs that can use screening to identify employees with both diabetes and prediabetes may realize major cost-savings.[59]

In accordance with the employer's intent, this workplace wellness program was not designed or intended as a clinical trial, and so does not have a comparison group of employees with diabetes who were not offered participation in this program or were randomized to "nonparticipation." When randomized clinical trials examine the effectiveness of workplace health promotion programs, the observable effects are small.[46] Nevertheless, these reported randomized trials are limited to lifestyle interventions (exercise, diet), and have not involved intervention at the intensity level reported in this study. Although ours was not a randomized clinical trial, our ability to offer accessible primary health care, with free glucometers and test strips, while rigorously tracking biometric and laboratory data for each participant from the start (0 month) to end (12 months) of the program, and insurance claims data for the 12 months before, during, and after the program generated a robust data set upon which to make historical comparisons. As has been observed, the performance of randomized controlled trials in the workplace has become uncommon, but so-called quasi-experimental studies can provide valuable information.[27,46]

A second limitation is the fact that 26 employees with diabetes and 26 employees with prediabetes who were enrolled in the program did not meet participation criteria, raising the possibility that bias was introduced through loss of employees from the program who would have had worse health outcomes. Although we cannot wholly exclude this possibility, the predominant reason for employee nonparticipation was inability to attend the requisite education sessions in the first quarter of the program. The primary reason given by employees was inability or reluctance to take personal days off from work. By occurring in the first quarter of the program, the main outcomes of changes in biometrics, laboratory data, and claims accrual had not yet occurred. We therefore consider bias in participation rate, and hence potential regression-to-the-mean to be less likely than had drop-out occurred in the later months of the program. The inability of employees to participate owing to lack of release time also was a lesson learned for the employer, in their planning for future workplace wellness programs.

A final potential limitation is that we did not analyze the claims data statistically. Our rationale was that it is precisely the non-Gaussian nature of claims data that renders parametric analysis of limited value. The high-acuity events of emergency department visits and hospital admissions are not distributed evenly across the population of participants. Rather, it is these high cost events for a limited number of individuals which drive up health care costs for an entire population. These high-cost intercurrent events for individuals are key drivers of health care costs for a population, and are measured in absolute values.

CONCLUSIONS

We report on an employer-sponsored screening and comprehensive 12-month diabetes disease management program, in which quantitative indices (HbA1c, body mass index) and measures of employee engagement (Health Risk reporting, Stanford Presenteeism Scale) improved significantly. Employee hospitalizations decreased when compared with the 12-months before and 12 months after program intervention. As measured by PMPM claims costs for the employer, there was only a 1.2% increase in health care costs during the program period when compared with the 12 months before, but a jump of 8.3% in the 12 months after. Programmatic inclusion of employees with prediabetes in an education-and-health-coaching program also was met with significant reduction in HbA1c laboratory values. The documented outcomes of this program provided opportunity for the employer to assess its own strategies for workplace wellness and population health. Since completion of the intensive 12-month program and analysis of our data reported herein, the employer has integrated the lessons learned into their accredited patient-centered medical home model at their on-site medical facility. This also includes a follow-on sustained program for focused diabetes wellness programming that has been rolled out to a larger employee population, with favorable indications that both employee engagement and health outcomes have benefited.

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