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The Impact of the Highmark Employee Wellness Programs on 4-Year Healthcare Costs

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Learning Objectives

- Identify those elements of the Highmark Wellness Program that gained the most participants in the course of the 4-year study period.
- Compare employees who chose to take part in the program with risk-matched non-participants in regard to total healthcare expenditures, annual increases in healthcare expenditures, and return on investment.
- Recall whether and in what way participation in wellness programs influenced spending for preventive care.

Objective: *To determine the return on investment (ROI) of Highmark Inc.'s employee wellness programs.* ***Methods:*** *Growth curve analyses compared medical claims for participants of wellness programs versus risk-matched nonparticipants for years 2001 to 2005. The difference was used to define savings. ROI was determined by subtracting program costs from savings and alternative discount rates were applied in a sensitivity analysis.* ***Results:*** *Multivariate models estimated health care expenses per person per year as $176 lower for participants. Inpatient expenses were lower by $182. Four-year savings of $1,335,524 compared with program expenses of $808,403 yielded an ROI of $1.65 for every dollar spent on the program.* ***Conclusions:*** *Using sophisticated methodology, this study suggests that a comprehensive health promotion program can lower the rate of health care cost increases and produce a positive ROI.* (J Occup Environ Med. *2008;50: 146–156*)

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According to Thorpe[1], about a quarter of the increase in health care spending in the United States between 1987 and 2002 can be explained by health conditions attributable to lifestyle changes among Americans, especially the dramatic rise in overweight and obesity rates. Reducing morbidity associated with behavioral and biometric risk factors is a public health priority for the nation.[2] Employers, too, are beginning to recognize that they play an important role in improving the health and well-being of their workers, and they can do so by providing evidence-based worksite health promotion programs.[3]

A 1999 survey of worksite health promotion, fielded by the US Office of Disease Prevention and Health Promotion, reported that 90% of worksites offered at least one type of health promotion activity to workers.[4] However, updated survey results indicate that only about seven percent of employers provide comprehensive worksite programs.[5] To encourage the adoption of sufficiently intensive worksite programs, employers are seeking evidence that these programs not only improve workers' health but also achieve a positive return on investment (ROI).[6]

The majority of studies done to date show positive health and financial impacts of worksite health promotion programs over the past three decades; however, relatively few calculate the ROI, and the methodological rigor of these studies varies considerably.[7–10] Pelletier[9] recently examined 12 new studies published between 2000 and 2004 and concluded that outcomes from worksite programs were consis-

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tently positive in terms of health risk improvements and economic benefits. Chapman[10] also published a review that examined the economic impacts of worksite health promotion programs. The 28 studies examining health care utilization of participants and nonparticipants in programs showed a 26% difference in their medical costs. The average ROI for 22 studies that reported costs and benefits was $5.81 saved per dollar spent on these programs. However, Chapman's review did not adjust for study design as rigorously as previous authors did, so his estimates of savings and ROI may be inflated.

Despite the growing body of evidence that worksite programs may achieve a positive ROI, heroic claims from such studies should be tempered given the problems of conducting rigorous economic evaluations in business settings. Many of the studies reporting savings compare health and productivity-related expenditures of participants with nonparticipants. Thus, many of these studies suffer from self-selection bias where healthier and more motivated employees are more likely to participate in programs than their less healthy and more costly counterparts. Until recently, methods to control for selection bias have not been widely applied in evaluations of worksite programs. In fact, many of the studies examining worksite programs have not been prospective, and several have relied on descriptive statistics and cross-sectional designs to estimate cost savings.

This study attempts to overcome some of the shortcomings common to applied worksite research. To control for the major measurable differences between participants and nonparticipants, we used a matching technique developed by statisticians at the Mayo Clinic to compare health care costs over time for participants and nonparticipants in the health promotion program offered by Highmark, Inc. (Highmark) to its employees. The matching technique, described in more detail below, allowed us to track the multiyear health care experience of a cohort of program participants who were similar on several key variables to a cohort of nonparticipants. We hypothesized that health care cost trends for the two groups, who started out virtually identical to one another on key measures, would differ over time, and that the differences in their cost trends would be attributed to participation in wellness programs. If savings were found for program participants at the study's conclusion, those savings would be compared with program expenses and an ROI could be calculated.

Materials and Methods

Setting

Highmark employs approximately 12,000 workers and serves as a Blue Cross Blue Shield health insurance provider in western Pennsylvania and as a Blue Shield plan provider in Central Pennsylvania. The company is headquartered in Pittsburgh, with a major operating facility in Camp Hill, PA and other locations in Johnstown, Erie, and Williamsport, PA.

In the summer of 2002, Highmark began offering a comprehensive health promotion program to its employees. The Highmark Wellness Program offers health risk assessments (HRAs), on-line programs in nutrition, weight management and stress management, tobacco cessation programs, on-site nutrition and stress classes, individual nutrition and tobacco cessation coaching, biometric screenings and various 6- to 12-week campaigns to increase fitness participation, and awareness of disease prevention strategies. Highmark employees are also able to use state-of-the-art fitness centers, located at corporate headquarters in Pittsburgh and at Camp Hill.

Intervention

The Highmark Wellness Program was launched with the administration of an HRA and a biometric screening for cholesterol, glucose, and blood pressure measurements. The program was developed and operated by a team of Highmark staff including registered dietitians, exercise physiologists, a psychologist, a program evaluator, and health educators. An implementation plan, developed before program launch, was based on feedback from employee surveys and employee wellness committees established in the central and western regions of Pennsylvania. At its launch in 2002, the program included the following components, offered free of charge to employees: on-line sessions for nutrition, weight management, stress management, and smoking cessation; telephonic smoking cessation counseling; individual nutrition coaching with a registered dietician; and on-site classes in stress and weight management. The program was promoted through the company intranet and via monthly e-mail newsletters to all employees, with strong ongoing and visible support from senior management. In subsequent years, additional components were added including company-wide health promotion campaigns such as a 10,000-Step Walking Program and a program to earn points toward a half-day vacation. Fitness centers were opened in Pittsburgh in September 2003 and in central Pennsylvania in October 2004. These fully staffed centers offered a variety of exercise classes and incentive-based competitions in addition to a full complement of fitness equipment.

Sample

All Highmark employees were eligible to participate in the wellness program. The number of employees ranged between 8936 and 10,105 over the study period, and almost all (n = 9666) participated in a wellness program sometime between the years 2002 and 2005. In addition, 82% of those participating in a wellness program also had biometric screenings done.

Employees with Highmark coverage (including participants and nonparticipants in the wellness program) were also eligible and encouraged to

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participate in available disease and condition management intervention programs. Condition management services were offered to those with the following health conditions: asthma, diabetes, coronary artery disease, congestive heart failure, and chronic obstructive pulmonary disease.

Healthcare Expenditures

Medical claims paid during the period of January 2001 through June 2006 were extracted from the Highmark data warehouse and included in the analysis. As an HRA could have been completed by employees at any time during 2002, we set 2001 as the preintervention or baseline period for the study. Dollar values presented in this study reflect the amounts that Highmark paid to providers (Highmark's net payments), incurred through the end of each calendar year and paid by June 30 of the next calendar year. Aggregated claims per person per year include inpatient, outpatient, professional, and pharmacy services.

Those who met study criteria could have zero dollars in claims, but we restricted the analyses to those with less than $100,000 in any 1 year. Of the wellness program participants, four people were excluded because of this high claim level. These four individuals had predictive risk scores that were nonindicative of higher risk for future expenditures, and their baseline claims were similar to those of other wellness participants. Nonparticipants were also screened for this level of claims before being matched to participants. Copayments and deductibles were not included in the calculation of medical claims paid, because they were not relevant to the calculation of ROI for Highmark. In a separate analysis, we examined total charges that incorporated deductibles and copayments and found no meaningful difference from the results reported here. All dollar amounts were adjusted to 2005 values using the Consumer Price Indices as follows[11]: the Medical Care Index was used to adjust total payments, and the inpatient, outpatient, pharmacy, and professional services indices were used to adjust claims of those types.

Study Participants

The following inclusion and exclusion criteria defining program participants were set a priori: employees had to be younger than age 65 (to exclude Medicare beneficiaries), had medical claims coverage through a Highmark plan for at least 9 months before taking the HRA, had Highmark coverage through 2005 and had total health care claims for any given study year that did not exceed $100,000. Further, participants were defined as employees who participated in the company's wellness program in 2002, who completed an HRA in 2002, had coverage in 2001, and for whom 3 years of follow-up data were available (ie, had Highmark coverage from 2001 through 2005). This approach allowed us to compare the same people over time creating stability in basic characteristics of the population. Of the 4084 who participated in the HRA screening in 2002, 1892 (19% of all employees) met the above inclusion/exclusion criteria and were therefore considered the participant cohort (see Fig. 1).

Of the 1892 program participants, 1092 were located at the Pittsburgh office, 679 were from Camp Hill, and the remaining 121 employees were from Allentown, Erie, Johnstown, or Williamsport.

In addition to reviewing data comparing participants with nonparticipants, participants were also subdivided into categories based on the types of wellness programs used between 2002 and 2005: 1) employees who only participated by completing an HRA and did not participate in other wellness programs at any time (HRA only group, $n = 338$); 2) employees who completed an HRA and also participated in any of the on-line, group or individual health improvement sessions (HRA and other group, $n = 522$); and 3) employees who completed an HRA and used the fitness center and who may have also participated in another program (HRA and fitness center group, $n = 1031$).

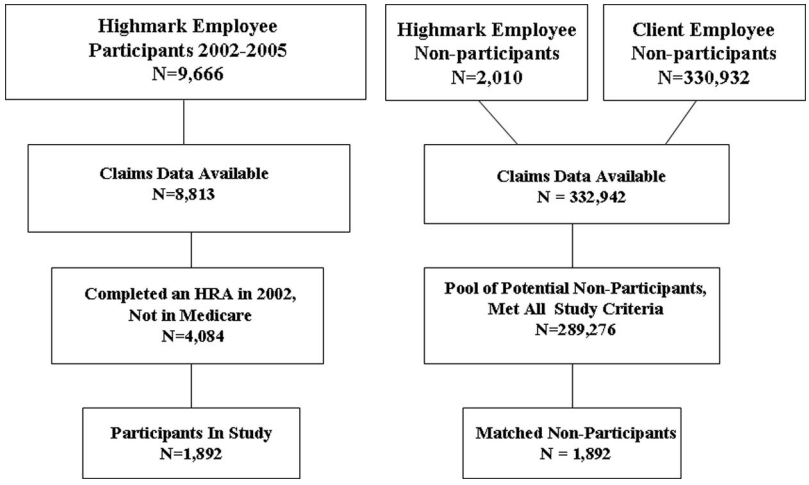

Fig. 1. Selection of participants for study.

Comparison Group

Potential comparison group subjects were chosen from two pools of nonparticipants (Fig. 1). The first included Highmark employees who did not participate in the wellness program at any time between 2002 and 2005 ($n = 2010$). Because of the growth of wellness program participation over time, there were not enough nonparticipants in the Highmark employee pool who could be matched to participants on character-

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istics thought to influence program engagement and health care utilization. Therefore, a supplemental pool of nonparticipants was identified. This second pool of nonparticipants had Highmark coverage through selected client accounts in similar industries as Highmark (financial, real estate, and insurance—standard industry codes 6000 to 6800). These employee-members (n = 330,932) showed no evidence of having used the wellness programs offered to employer clients (ie, they were not included in wellness program data files) but medical claims data for them were available for the years 2001 through 2005. Claims data were extracted for the comparison pool in a similar fashion as used for study participants, applying the same exclusion and inclusion criteria, resulting in a pool of 289,276 people available for the matching program.

Matching Strategy

Participants and nonparticipants were matched using a method developed by researchers at the Mayo Clinic Division of Biostatistics.[12] Match-strategy variables were chosen because they were associated with higher health care expenditures over time and included individuals' gender, age (within 2 years), 2001 total medical expenditures (within $500), claims-based evidence of heart disease or diabetes, and subjects' Charlson Comorbidity Index scores.[13–15] The Charlson Comorbidity Index has been shown to predict mortality,[16] stroke,[17] and hospital length of stay[18,19] and reflects the presence of 19 serious health conditions. In bivariate analyses performed before modeling, χ^2 and t tests were used to assure that there were no statistically significant differences in the characteristics of participants and matched nonparticipants.

Wellness Program Expenses

Program expenses were calculated by combining fixed and variable costs for the wellness program only. The fitness center and on-line programs were available to all employees and annual costs were provided; therefore, fixed costs were estimated on a per participant basis by dividing total costs by total number of employees and applying those costs to participants who used the programs. For example, variable costs were estimated based on their per participant expense (eg, for HRAs, individual counseling sessions, and group education programs). Costs were derived and applied to each participant as follows: Costs for HRAs were applied as either $55 or $70 per person for those with and without biometric data, respectively. The fitness center total cost for the newer facility (Camp Hill) was $577,000 in 2006 and included wages and benefits for the center manager (only). This cost was divided by 10,000 employees (estimate based on 10,510 employees in 2003, 9896 in 2004, and 8936 in 2005), yielding a per employee cost of $57. On-line costs were the result of a $50,000 contract for up to 10,000 users, therefore, a $5 per employee cost was applied. Group programs were valued at $35 per person per program, and individual coaching sessions cost $40 per person per session. Other program costs applied per person were $2 for Maintain Don't Gain newsletters, $9 for the 10,000 Step Program, and $3 for the administrative costs related to the Highmark Challenge. Therefore, per participant costs averaged $130.28 in 2002, $135.34 in 2003, $138.38 in 2004, and $150.98 in 2005.

After completing the Highmark Challenge, employees were awarded a one-half day paid time off. Individual salary data are confidential; however, applying a median hourly wage of $19.32[20] to the 112 employees who were eligible for the vacation time off in 2004 and the 910 in 2005 would have resulted in an estimated expense of $77 per person per year and a total expense of $8655 for 2004 and $70,324 for 2005, and a concomitant lowering of ROI to $1.48. As was the case for health care expenditure data, program expenses were inflation-adjusted to 2005 dollars, using the Consumer Price Index (Medical Care Index, Professional Services).[11]

Preventive Screenings and Annual Physicals

Using methodology developed for use in client reporting, payments for preventive screenings included annual physical examinations, preventive medicine counseling (CPT codes for individual or group counseling 99,401 through 99,412, 99,420, and 99,429 and ICD-9 codes 89.06 and 89.07), and cancer screenings for breast, cervical, colorectal, and prostate cancers for those without prior diagnosis of disease in the subject area. These amounts represented Highmark's inflation-adjusted net payment for services incurred January through December of each year, 2001 through 2005, and paid through March 31 of the following year.

Analysis

Differences between participants and nonparticipants were assessed at baseline using either χ^2 for categorical variables or t tests for continuous variables. Participants were matched to nonparticipants before subsetting the data into program participation-specific groups (HRA only, HRA and other, HRA and fitness center). Therefore, pairwise comparisons of each group with nonparticipants were performed using a generalized linear model with Scheffe adjustment for multiple comparisons. The Scheffe adjustment was not used in models estimating program impact (the growth curve models).

To prepare an estimate of the growth in costs over time, growth curve techniques were used to assess changes across participation groups, in a process developed by the Rand Corporation in the 1980s,[21] further developed for use in wellness studies by Goetzel et al.[22] and Ozminkowski et al.[23] Direct medical costs alone are used in these calculations. These techniques use a two-step approach: the first step assesses medical expenditure growth per subject and results

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in a coefficient, which directly measures the trend in medical costs over time. The trend value is then used as the dependent variable in a second model. This second model adjusts for demographic and health differences between participants and nonparticipants and is then used to estimate the impact of overall and specific program participation (ie, HRA only, HRA and other, HRA and fitness center, as described earlier) on medical expenditures.

A 4-year savings estimate was calculated as the sum of each participation group's beta score estimate, multiplied by the number of people in the group times −1 (to show savings as a positive number), ie, $-1(\sum(\beta n))$ where n = the number in group. This savings estimate is most likely an underestimate of benefit as it does not include savings realized from improved productivity or reduced absenteeism or presenteeism. A separate study of these elements, prepared by Mercer Human Resource Consulting in 2007, found that employees who participated in one wellness program in 2005 were absent a third of a day less the following year (one-half day less for those participating in more than one program) compared with nonparticipants (Highmark Wellness Participation Impact Analysis, Mercer Human Resource Consulting, February 2007). Further, a survey of Highmark employees administered in 2005 found that morale, productivity, job satisfaction, and overall health and fitness levels were rated higher among wellness participants than among nonparticipants (The Highmark Wellness Story, Accenture, January 2007).

ROI was calculated by dividing the 4-year savings estimate by program expenses. To account for the changes in prices other than inflation, we discounted program expenses by 3%, 5%, 7%, 9%, and 11% and calculated a net present value[24] to show the range of possible savings given differing conditions. Statistical analyses were completed using the SAS system.[25]

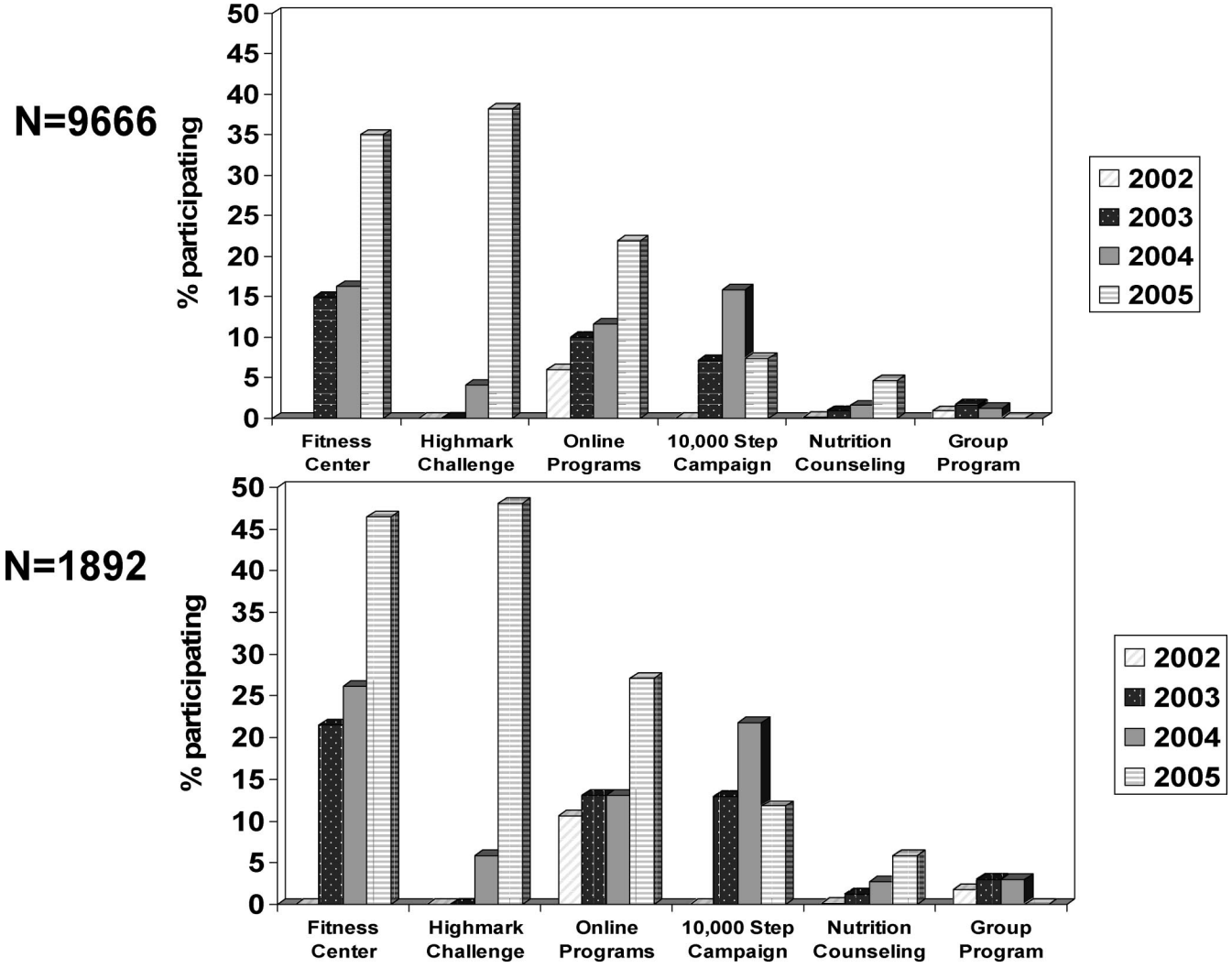

Fig. 2. Participation rates in programs for all Highmark employees from 2002 to 2005 and for those included in this analysis.

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Results

The Highmark Wellness Program attracted 9666 participants between 2002 and 2005. Of these, 1892 qualified for inclusion as participants in this study because they completed an HRA in 2002 and could be tracked using medical claims data through 2005. Program participation rates for all employees and for the study population are displayed in Fig. 2.

The matching strategy yielded exact matches for gender and comorbidity variables, baseline medical expenditures within a range of $200, and age (within 6 months). Therefore, at baseline, participants and nonparticipants were considered similar enough on these variables known to affect future health care costs (Table 1). In comparing the program-specific participation groups with nonparticipants, we found the only difference to be that employees in the HRA only group were slightly older than nonparticipants (43.2 vs 41.6 years, $P = 0.039$).

The number of health promotion programs available to employees, and participation in them, grew over time. In 2002, for four programs tracked by this study, 51% of men and 53% of women participated in any program at least once. By 2005, eight programs were tracked and 72% of men and 75% of women participated in any program at least once. The largest growth in participation was in the use of fitness centers, from 21% in 2003 (Pittsburgh only) to 46% in 2005 (when both Pittsburgh and Camp Hill centers were open). On-line programs were also popular, and participation in them grew from 11% in 2002 to 27% in 2005. Individual nutrition coaching also showed a steady increase in participation from less than 1% in 2002 to almost 6% by 2005. In 2005, women participated in more programs than men did (on average 2.34 vs 1.75 programs per person, respectively).

Multivariate growth curve models showed that total health care expenditures grew more slowly from 2001 through 2005 for participants than for nonparticipants (Table 2 and Fig. 3).

This slower rate of growth in total health care expenditures was also found for each of the three program participation groups (data not shown).

Models used to estimate the growth in net payments from 2001 to 2005 for participants compared with nonparticipants showed that wellness program participants had lower annual health care expenditure increases when compared with nonparticipants (with savings of $176.47 per person per year, $P = 0.037$; Table 3, Model 1). The greatest differences between participants and nonparticipants were found in inpatient expenditures, which averaged $181.78 per person per year ($P < 0.0001$) in savings.

Health care expenditures for those in groups categorized by program-specific participation also experienced slower health care cost increases than for nonparticipants (Table 3, Model 2); however, differences were only statistically significant for those who used an HRA and the Fitness Center ($151.36 in savings, $P = 0.016$). Although a higher magnitude of difference was found in the HRA only group ($172.49 savings), statistical significance was not found, possibly because of sample size ($n = 338$, while 1031 used the HRA and fitness center). Comparisons of the HRA and fitness center group with nonparticipants in each subcategory of medical expenditures indicated a slower growth in net payments, and this achieved sta-

TABLE 1
Characteristics Used in Match Strategy for the 4-yr Study of Healthcare Costs After Participation in Wellness Programs, Highmark, Inc.

	Overall Comparison			Participation-Specific Groups		
	All Participants	Nonparticipants		HRA Only	HRA and Other	HRA and FC
Calendar Year 2001	$n = 1890$	$n = 1890$	P	$n = 338$	$n = 523$	$n = 1031$
Male, *n* (%)	484 (25.6)	484 (25.6)	0.98	105 (31.1)	125 (23.9)	255 (24.7)
Age, 2001 mean yr	41.7	41.6	0.94	43.2*	42.0	41.0
Net payments for healthcare expenditures in 2001, mean	$1414	$1318	0.94	$1390	$1430	$1413
Comorbidity prevalence (%)						
Heart disease, *n* (%)	183 (9.7)	184 (9.7)		37 (10.9)	51 (9.8)	96 (9.3)
Diabetes, *n* (%)	13 (0.7)	13 (0.7)	0.99	5 (1.5)	4 (0.8)	5 (0.5)
CCI Group 1 comorbidity, *n* (%)	849 (44.9)	849 (44.9)	0.98	153 (45.3)	223 (42.7)	473 (45.9)
CCI Group 2 comorbidity, *n* (%)	528 (27.9)	528 (27.9)	0.98	96 (28.4)	157 (30.0)	275 (26.7)
CCI, median (range)	1.75 (0–17)	1.75 (0–18)	0.97	1.76 (0–17)	1.79 (0–12)	1.73 (0–11)

*Compared with nonparticipants: $P = 0.039$.

Group 1 comorbidity includes presence of any of these: chronic obstructive pulmonary disease, rheumatologic disease, stomach ulcer or dementia, all as coded by using the Charlson index.

Group 2 comorbidity includes presence of any of these: cancer, renal failure, liver disease, cirrhosis, or autoimmune disease.

HRA indicates health risk assessment; FC, fitness center participation 2003–2005; CCI, Charlson comorbidity index.

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TABLE 2
Growth in Net Payments for Healthcare Expenditures for Participants and Nonparticipants of the Highmark, Inc. Wellness Programs, Expressed in 2005 Dollars; Adjusted for Gender, Age, Baseline Healthcare Expenditures and Comorbidity

	Healthcare Expenditure Net Payments, Highmark, Inc.				
	2001	2002	2003	2004	2005
Total net payments					
Participants	$1414	$2191	$2842	$2694	$2685
Nonparticipants	1318	2429	2651	3059	3167
Inpatient					
Participants	113	347	392	351	285
Nonparticipants	174	445	454	712	619
Outpatient					
Participants	392	569	719	769	729
Nonparticipants	457	755	736	829	838
Pharmacy					
Participants	452	518	604	551	664
Nonparticipants	494	612	731	775	779
Professional					
Participants	610	885	1255	1153	1130
Nonparticipants	618	920	1088	1150	1276

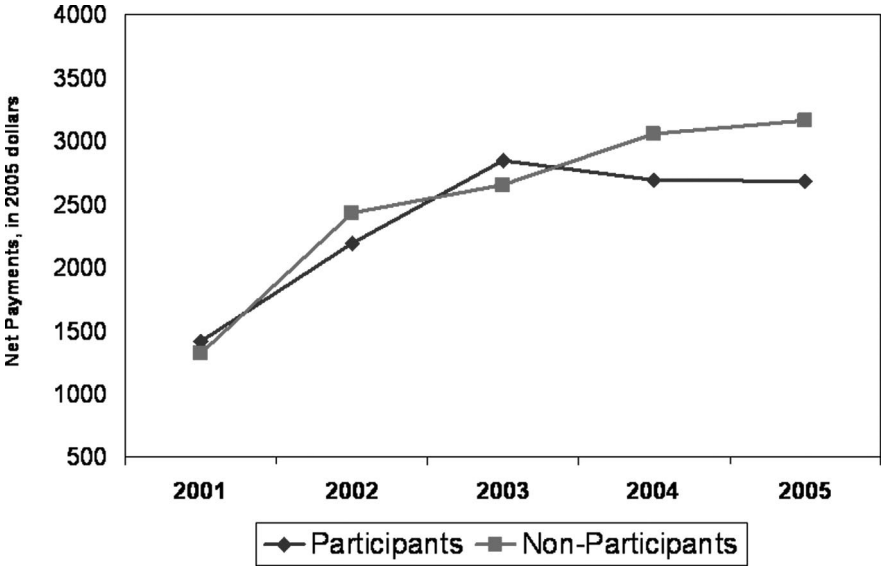

Fig. 3. Annual growth in total net payments for healthcare, Highmark, Inc.

tistical significance for inpatient expenditures ($76.84 in savings, $P = 0.042$).

ROI was assessed by calculating Highmark's expense for each wellness program component and contrasting that expense to estimated savings obtained from the growth models. Program expenses (averaging $138.74 per employee per year) totaling $808,403 over 4 years used as the divisor for annual program savings of $1,335,524 over 4 years (Table 4) yielded an ROI of $1.65 for every dollar spent and net present values ranging from $377,236 to $527,121 depending on the discount rate used (Table 5).

To assess whether participation in the wellness programs encouraged preventive care and, further, whether preventive care represented a higher proportion of total expenditures for participants, we reviewed utilization of recommended preventive screenings and annual physicals for the program-specific participant groups compared with nonparticipants. In the comparison of year-end data for 2001 and 2002, preventive visit screening rates increased from 56% to 60% for those only completing an HRA (HRA only); from 57% to 60% for those completing an HRA and also participating in on-line, group, or individual programs (HRA and other); and from 62% to 64% for those in the HRA and fitness center group. Rates remained stable at 55% for nonparticipants. In the period following wellness program initiation (2002 through 2005), rates remained stable for the HRA only group, the HRA, and fitness center group, and for the nonparticipants but increased from 60% to 63% for those participating in on-line, individual or group programs (HRA and other). By 2005, prevention-visit net payments were 16.5% of total health care expenditures for each of the participant groups and 13.5% of total health care expenditures for nonparticipants.

Discussion

The Highmark Wellness Program was designed to improve the health and well-being of employees and produce health care savings that could potentially justify the expense of providing the program. In this article, we present results from an economic evaluation of the Highmark wellness program in an effort to determine whether it saved the company money in health care expenditures and whether a positive ROI was achieved. To improve upon previous research that examined the financial impact of worksite health promotion programs, we took pains to establish a quasiexperimental design where participants and nonparticipants were carefully matched at baseline on factors known to contribute to higher health care costs using a sophisticated matching technique. Such matching is never perfect, though, and there are always variables that cannot be controlled in the matching process, such as the motivation to improve one's health. Nevertheless,

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TABLE 3
Estimates of Annual Savings After 4-yr Follow-Up for Wellness Participants vs Nonparticipants, the Highmark Employee Wellness Study

	Net Payments β Estimate	Inpatient Payments β Estimate	Outpatient Payments β Estimate	Professional Payments β Estimate	Pharmacy Payments β Estimate
Model 1: Participation in any program vs nonparticipants					
Intercept	−964.51***	77.27****	−98.52	139.45	−323.87****
All participants, $n = 1892$	−176.47*	−181.78****	−84.30*	0.82	−136.05****
Male gender	497.09****	−3.19	61.15	66.11	98.62****
Age, per year	46.05****	8.10**	12.75****	12.38***	16.02****
Heart disease at baseline	576.59****	85.47	135.13*	95.55	189.09****
Diabetes at baseline	1704.01****	634.40*	113.61	303.24	798.05****
Group 1 comorbidity	1133.20****	121.85**	243.31****	404.24***	254.46****
Group 2 comorbidity	397.80****	−5.78	164.52****	103.93***	81.21***
4-yr savings estimate from participation (β n)	$333,881	$343,928	$159,496	−$1550	$257,407
Per person estimate	176.47	181.78	84.30	0.82	136.05
Model 2: Program-specific groups vs nonparticipants					
Intercept	−223.09	−79.57	−31.51	−33.92	−80.90
Participation group					
HRA only, $n = 338$	172.49	−55.06	−32.04	−38.87	−27.13
HRA and other, $n = 523$	−51.69	−81.74*	48.51	31.30	−25.64
HRA and fitness center, $n = 1031$	−151.36*	−76.84*	−7.26	−33.56	−14.97
Male gender	134.22*	4.05	56.37*	17.61	55.92*
Age, per year	10.87***	3.88**	1.12	4.04**	1.46
Heart disease, 2001	−48.07	25.41	−19.34	−38.17	−15.72
Diabetes, 2001	834.57**	465.00**	53.27	279.97	105.89
Group 1 CCI comorbidity	−38.96	26.27	−39.90	−54.60	0.69
Group 2 CCI comorbidity	−144.47*	−7.09	−59.97*	−38.17*	−20.35

CCI indicates Charlson Comorbidity Index.

Group 1 comorbidity includes presence of any of the following: chronic obstructive pulmonary disease, rheumatologic disease, stomach ulcer or dementia.

Group 2 comorbidity includes presence of any of the following: cancer, renal failure, liver disease, cirrhosis, or autoimmune disease.

Independent predictors of growth, designated as: *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$, ****$P < 0.0001$.

we established a nonparticipant cohort that was drawn from a pool of Highmark employees supplemented by approximately 300,000 Highmark members from companies in similar industries as Highmark.

The study sought to determine whether there were differences in the growth of health care expenditures over 4 years for program participants compared with nonparticipants. Our analysis found that health care costs grew more slowly for wellness program participants compared with matched nonparticipants, and we interpreted the differences in growth rates as savings. For the cohort groups analyzed in our study, average annual program expenses per participant varied between $130 and $150, and the medical expenditure savings were estimated as $176 per year per participant. After subtracting wellness program expenses from our estimated savings, we established a net savings of $1,335,524 over 4 years, program costs of $808,403 yielding an estimated ROI of $1.65 for every dollar invested. Overall, we calculated a net present value of between $377,236 and $527,121 for the 4-year study period, depending on the discount rate used (0% to 11%).

Examining the three subsets of program participants, we found a slower rate of growth in health care costs for participants versus nonparticipants, regardless of whether employees only completed an HRA, participated in coaching, on-line, group or individual programs, or visited a fitness center along with engaging in other wellness programs.

As noted in the introduction to this article, literature reviews of worksite health promotion programs have reported median ROI values of approximately $3.00 saved for every dollar invested.[6,7] Our analysis yielded an ROI estimate of $1.65 for every dollar spent. The Highmark program expenses included maintaining fitness centers, providing on-site health education classes, offering health coaching, administering biometric screenings, and providing other elements of a comprehensive worksite health promotion program. It should be noted that Highmark's annual per capita

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TABLE 4
Wellness Program Costs, Highmark, Inc., Inflation-Adjusted to 2005 Dollars

	2002		2003		2004		2005		
	N	Total	*N*	Total	*N*	Total	*N*	Total	Total
HRA and incentive	1892	$243,731	1303	$143,111	1308	$140,785	1355	$142,605	
Online	201	$1142	247	$1372	248	$1300	512	$2575	
Group	34	$1544	56	$3077	56	$3010	0	$0	
Nutrition coaching	2	$66	23	$740	51	$1585	111	$3420	
10,000 Steps			244	$2441	413	$3851	223	$2061	
Fitness center			407	$25,603	495	$29,939	879	$50,958	
Highmark challenge					112	$348	910	$2766	
Maintain don't gain newsletter					85	$182	93	$192	
Wellness program costs		$246,483		$176,343		$181,000		$204,577	
Cost per participant		$130.28		$135.34		$138.38		$150.98	$808,403 Per capita: $139
Estimated annual savings from Model $176.47/person		$333,881		$333,881		$333,881		$333,881	$1,335,524
Net savings (estimated savings − Wellness Program Costs)		$87,398		$157,538		$152,881		$129,304	$527,121

Total savings estimated 4 yr after baseline: $1,335,524.
Total 4-yr costs (2002–2005): $808,403.
Return on investment: $1.65.

TABLE 5
Net Present Value Calculations, Discounting ROI for Highmark, Inc. Wellness Programs

	2002	2003	2004	2005	Net Present Value
Savings	$333,881	$333,881	$333,881	$333,881	
Program costs	$246,483	$176,343	$181,000	$204,577	
Discount rates					
0	$87,398	$157,538	$152,881	$129,304	$527,121
3%	$84,852	$148,495	$139,907	$114,885	$488,139
5%	$83,236	$142,892	$132,064	$106,379	$464,571
7%	$81,680	$137,600	$124,796	$98,645	$442,722
9%	$80,182	$132,597	$118,052	$91,602	$422,432
11%	$78,737	$120,522	$102,299	$75,678	$377,236

investment in the health promotion program (approximately $139) was far lower than its investment in the provision of medical care services for the treatment of illnesses whereby 65% of employees incur health care costs of $350 or less annually, 24% incur costs between $350 and $2300 and the remaining incur costs greater than $2300 annually.

Limitations

The main limitation of this study is the remaining concern related to possible selection bias; that participants in the wellness programs may have been more motivated to manage their health than nonparticipants. This bias would result in lower expenditures for health care over time for participants, resulting in overstated savings estimates. Our study attempted to control for selection bias by matching nonparticipants to participants based on prior health care costs and comorbidities present at baseline in addition to demographic factors. Participants and nonparticipants were matched on key variables thought to influence health care spending and, while the matching process is imprecise and important differences between groups could remain, we believe that this study provides a useful and real world alternative to experimental designs that are difficult to implement in worksites.

Another limitation is a possible measurement bias in the categorization of participants into the various program categories. There may have been individuals placed in the HRA only group or in the nonparticipant group who were actually physically active or actively pursuing wellness activities outside Highmark's programs.

Next, program expenses and benefits are imprecise and, therefore, probably over- or underestimate ROI. In particular, we had limited data regarding salary and benefits for fitness center staff and for education program group leaders. On the other hand, we may have overestimated the cost for some programs delivered via e-mail. Other costs such as those related to on-line programs are likely accurate, because they were provided as a contracted service to Highmark. Our estimate of program cost also did not include the incentive of a half-day vacation given to employees completing the Highmark Challenge. If these expenses were included in our analysis, the ROI would be reduced from $1.65 to $1.48 per dollar invested. On the other hand, because our program benefit estimates did not include productivity increases or reduced absen-

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teeism or presenteeism, the ROI may be underestimated.

Finally, when analyzing medical expenditures in the study, we asked whether expenditures may have increased among program participants because of an increase in medical screenings for health risks and the identification of underlying disease, which was then treated. We found that expenditures for screenings and annual physicals were higher for participants than nonparticipants, though for many, screening rates may have increased before beginning participation in the program. Our analysis also showed that the slowest growth in medical spending for participants was for inpatient care, followed by pharmaceutical and outpatient services. This suggests that participants were using appropriate medical services that may lead to prevention and early detection of disease. Then again, nonparticipants in the Highmark program may have participated in wellness programs outside the company. Both of these issues would bias the study results toward the null (not finding significant differences between participants and nonparticipants). For these reasons, we believe that the true ROI lies within a range of $1.19 to $2.52 saved per dollar spent, based on several analyses undertaken to simulate alternative modeling scenarios (not shown).

Conclusions

The analysis of the Highmark Wellness Program is significant in several respects. First, as a health plan, Highmark was the developer of a comprehensive health promotion program based on its review of evidence-based health promotion interventions at the workplace. It offered these programs to its plan members and employees and then chose to evaluate program outcomes. It is rare that a health plan rigorously evaluates health promotion programs that it offers its own employees and members.

Second, Highmark applied an innovative design in evaluating its interventions by creating matched cohorts of program participants and nonparticipants using a sophisticated matching technique. Although not perfect, and certainly not a substitute for a randomized design, this approach to program evaluation is practical and realistic when assessing large-scale population-based intervention programs in real-world settings.

Other unique aspects of this evaluation are that it used as a large enough sample (approximately 2000 participants and an equal number of nonparticipants) that allowed investigators to detect statistically significant and meaningful changes in health care expenditures. The study also examined different categories of participation in the programs to determine whether any one combination of programs was more effective than another. Finally, the study was of sufficient duration (4 years) to establish whether health care cost trends were ephemeral or stable over time, and whether savings can be sustained for a period of several years. Our results suggest that lower future health care costs and a positive ROI are achievable through the application of well-designed worksite health promotion programs that encourage employees to take a proactive stance in lowering their health risks.

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