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Using a Return-On-Investment Estimation Model to Evaluate Outcomes From an Obesity Management Worksite Health Promotion Program

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Objective: *Certain modifiable risk factors lead to higher health care costs and reduced worker productivity. A predictive return-on-investment (ROI) model was applied to an obesity management intervention to demonstrate the use of econometric modeling in establishing financial justification for worksite health promotion.* ***Methods:*** *Self-reported risk factors (n = 890) were analyzed using χ^2 and t test methods. Changes in risk factors, demographics, and financial measures comprised the model inputs that determined medical and productivity savings.* ***Results:*** *Over 1 year, 7 of 10 health risks decreased. Of total projected savings ($311,755), 59% were attributed to reduced health care expenditures ($184,582) and 41% resulted from productivity improvements ($127,173), a $1.17 to $1.00 ROI.* ***Conclusions:*** *Using an ROI model to project program savings is a practical way to provide financial justification for investment in worksite health promotion when risk reduction data are available.* (J Occup Environ Med. *2008;50:981–990*)

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The benefits to employers of having a healthy workforce are widely acknowledged as a means of lowering an organization's medical costs and achieving higher levels of worker productivity.[1–12] Nevertheless, the decision by employers to invest in health improvement programs often requires an economic justification that includes an estimate of the return-on-investment (ROI) from such programs.[13] In addition, after the programs have been in place for some time, program sponsors may increasingly require evidence that health improvements have produced measurable cost savings, and that these savings outweigh program expenses.[14,15] Of particular interest to employers are programs aimed at managing overweight and obesity among workers.[16] Employers instituting these programs are requiring health management program managers to demonstrate that these interventions achieve health improvements and a positive ROI.[17]

Previous examples of the application of ROI forecasting models to estimate program savings associated with risk reduction in employed populations are found in studies conducted at The Dow Chemical Company, Motorola, and Union Pacific Railroad.[18–20] The ROI models applied were based on the research conducted by Goetzel et al[21] for the Health Enhancement Research Organization (HERO). This research found that employees with certain modifiable risk factors were more costly for employers when compared to employees lacking the targeted risk factors. In this article, we apply an adaptation of previously developed ROI models to estimate cost savings and ROI realized from an obesity management program implemented at several employer sites. Results for 890 workers enrolled over a 6- to 12-month period in the program were analyzed and input into the ROI model.

Background: The Cost Burden of Obesity

Obesity is now recognized as a national epidemic, with more than two thirds of Americans being overweight (34%) or obese (31%).[22,23] Obesity is linked to many deleterious health conditions, including high blood pressure, type 2 diabetes, coronary artery disease, respiratory problems, osteoarthritis, and cancer.[24,25] Moreover, obesity is associated with an increased risk of death, accounting for approximately 300,000 premature deaths each year in the United States.[26,27]

The large number of overweight and obese Americans places a significant burden on society in general and on employers in particular. Much of this burden is manifested through increased medical care costs and reduced worker productivity, both of which directly impact US businesses. Obesity is associated with greater medical care utilization and higher medical costs.[28,29] Medical expenditures are estimated to be one-quarter to one-third higher for obese workers compared to their normal-weight counterparts.[21,30] Employers are also affected by the lost productivity from obese employees. Obesity is associated with greater absenteeism from work, reduced productivity on the job ("presenteeism"), and higher usage of short-term disability.[31–33]

Nevertheless, overweight and obese individuals who lose even a small amount of weight can improve their health and reduce their likelihood of having an obesity-related disease.[24,34] The Surgeon General promotes weight loss among overweight and obese people, characterizing overweight and obesity as "preventable and treatable problems" where weight loss can "improve health and save lives."[22] By offering obesity management programs to their workers, employers can support employees in their efforts at losing weight, increasing physical activity, and eating a healthful diet.[4,6,9] In return, employers gain healthier employees who have lower health care costs and achieve higher levels of productivity.[11]

Estimating an intervention's ROI involves comparing the cost of offering the program to expected savings resulting from health improvements among workers who participate in that program (ie, monetized as direct medical cost savings and indirect worker productivity improvements). Output from an ROI analysis can then be used to make judgments about the benefits of ongoing investment in health promotion programs.[7,10]

In this study, we apply a predictive ROI model developed for American Specialty Health, Inc (ASH) and its health improvement coaching program operated by its subsidiary Healthyroads, Inc. The purpose of the study is to 1) test whether ASH's obesity management program, *Healthyroads*, produced reductions in participants' health risks, most notably overweight and obesity rates, and 2) explore whether using a predictive ROI model is a practical way of offering financial justification for worksite health promotion programs.

We present our findings by first focusing on behavior change and risk reduction observed by *Healthyroads* program participants, and then translating those health benefits to estimates of direct and indirect cost savings and ROI. In this way, this analysis highlights a practical way in which health improvements in an employed population can be used to predict cost savings and ROI. This, in turn, can be used to establish financial justification for employers' continued investment in worksite health promotion programs.

Materials and Methods

Design

A preexperimental pretest/posttest study design was used to assess changes in health risks among program participants over 1 year. These health risk changes, along with demographic and financial data, were then entered as inputs into a predictive ROI model developed by Thomson Reuters. The ROI model was based on methods described in Leutzinger et al[19] and Ozminkowski et al.[18] In short, the model uses changes in health risks and demographics of employee populations to estimate medical cost savings and productivity savings translated into dollar terms. These, in turn, are compared to program expenses to calculate an ROI estimate.

Intervention

ASH developed the *Healthyroads* health improvement and obesity program to support individuals' attempts at losing weight, improving eating habits, and increasing their physical activity. *Healthyroads* provides telephone counseling to program participants and access to educational materials through a health improvement Web site.

The type and quantity of *Healthyroads* coaching services were customized to individual participants' needs; however, all participants received a standard set of services including access to a personal health coach for up to 48 sessions, written materials to support the coaching sessions, a personal health improvement plan, exercise planning support, nutrition education, and web-based health trackers. Health coaches included registered dieticians, certified personal trainers, certified health education specialists, and other professionals with backgrounds in psychology and health-related fields who supported behavior change and offered health improvement education. The health coaching team was aided by medical staff that provided triage and dealt with clinical issues and referrals to participant's personal physician or health plan disease management program, as necessary. Health coaches guided participants to healthier lifestyle habits using techniques grounded in behavior change theories such as the transtheoretical model, motivational interviewing, choice theory, locus of control, social learning theory, positive psychology, and resiliency training. Participants were eligible to receive up to four, 30-minute, telephone-based coaching sessions per month for 1 year. During these coaching sessions, participants set short-term health improvement goals related to physical activity, nutrition, stress management, and weight loss. The coaches also helped participants create a plan to achieve those goals.

Outcomes

Health and financial outcomes were the focus of this investigation. Health outcomes were determined using a pre-post study design by comparing the prevalence of modifiable risk factors for a study cohort at baseline and at the program's conclusion. Health risk data included in the analysis were collected using a custom designed health risk assessment (HRA) mirroring the type of instrument used to collect health risk data for the HERO study.[21] The instrument developed by ASH was modeled after the one used in the HERO study, which has demonstrated adequate reliability and validity.[21,35–37] The HRA contained 23 questions asking about individuals' health risk factors and demographics. The self-reported risk factors measured were height, weight, blood pressure, total cholesterol, blood glucose, physical activity, eating habits, stress, depression, alcohol consumption, and tobacco use (current and former).

Data related to changes in behavior and health risks over the course of the intervention were entered into the *Healthyroads* ROI forecasting model to determine potential cost savings arising from reductions in medical care utilization and improved worker productivity. Savings were then compared to program costs to estimate the ROI from the program.

Participants

Employees from 119 companies of varying sizes contracting with ASH to provide the *Healthyroads* program were eligible to participate in the research study ($n = 1542$). (A few spouses were also allowed to participate in the program and were included in the sample; however, spouses represented a negligible portion of the study sample. The exact number was not available due to data limitations.) Data used for this study represent the experience of 890 employees who volunteered to participate in the program in 2006 and for whom baseline and follow-up data were collected. Companies purchasing the program from ASH offered it directly to their employees, so the location, incentives, and type of recruitment activities varied by employer. Some employers only targeted employees determined to be at high risk (based on their HRA results) whereas others offered the program to all who wished to participate. In some cases, individuals enrolled themselves. Participation rates ranged from about 5% to 40% of eligibles, depending upon the employer.

Individuals were eligible to participate in the program if they were 18 years or older and had a body mass index (BMI) equal to or greater than 30. Also eligible to participate were individuals with a BMI of less than 30 but greater than or equal to 25 and with a comorbid condition of type 2 diabetes, high blood pressure, other cardiovascular conditions, or other obesity-related conditions. Nevertheless, some program participants did not meet either of the above eligibility criteria because they were referred to the program by a disease management or health advocate program where counselors there felt they would benefit from the program.

After enrolling in the program, participants were subject to medical triage. If they were identified with a condition requiring immediate medical attention or an exercise restriction, they were directed to their primary care provider and enrollment was postponed until medical clearance from a physician was obtained.

Participants completed a baseline HRA just before or immediately after an initial consultation with a personal health coach. The baseline HRA was administered on-line and in some cases over the telephone with a health coach. The follow-up HRA was administered by a third party vendor and mailed to participants at the 1-year anniversary of the individual's initial consultation with the health coach. A $25 American Express Reward Card was offered as an incentive to complete and return the HRA. If the individual did not reply after 2 weeks, a second invitation was sent.

Statistical Methods

Data were reviewed to determine whether missing values were systematic (defined as at least half of the responses missing) or random. Missing values were random with responses only missing on 3 of the 13 outcome variables and ranging from 0.1% to 3.5% missing per measure (ie, high alcohol consumption [0.1%], BMI [3.5%], and weight [0.9%]).

Means and standard deviations, where applicable, were calculated for the following descriptive variables at baseline: age (continuous), gender (categorical), race/ethnicity (categorical), marital status (categorical), and program completion rate (categorical). Job type data were not available, so default values from the 2000 US Census were used.[38] Differences between baseline and follow-up period were assessed for the following 10 risk factors: poor eating habits, inadequate physical activity, smoker (former and current), high total cholesterol, high blood glucose, high blood pressure, high stress, depressed, high alcohol consumption, obese or overweight (derived from weight and BMI). These 10 risk factors were measured as categorical variables (ie, measured in a binary fashion where 1 equaled high risk and 0 equaled lower risk); however, weight and BMI, which were used to determine obese and overweight, were measured as continuous variables. The appendix lists the operational definitions for each categorical risk variable assessed. Means, confidence intervals, and standard deviations, where applicable, were calculated for the risk factors for baseline and follow-up periods, as were the average percentage changes over the two periods. A McNemar's χ^2 test for each categorical risk variable was then conducted. For the two continuous risk variables, t-tests were applied. Statistical significance was determined at the $\alpha = 0.05$ level and analyses were completed using the SAS system (SAS institute, Inc, Cary, NC).

Estimating ROI

Medical expenditures for program participants were projected over time using the ROI Model, which relies upon the demographic and health risk data inputs provided.[21] Medical benefits (or savings) were calculated as the discounted difference between medical expenditures for program participants compared to an artificially created reference group exhibiting no changes in risk over time. Baseline annual medical expenditures were estimated as USD $4804 per person, a figure derived from the 2006 Thomson Reuters MarketScan database, adjusted to 2007 values using the June 2007 Medical Care Consumer Price Index from the Bureau of Labor Statistics. (The average yearly medical cost is calculated from the 2006 MarketScan Database. It includes inpatient, outpatient, and pharmaceutical expenditures for employees with noncapitated health insurance plans.)[39]

Productivity-related benefits were limited to presenteeism (ie, on-the-job productivity gains). Productivity benefits were defined as the discounted difference between productivity-related expenditures for program participants compared to an artificially created reference group exhibiting no changes in risk over time. Productivity-related losses linked to having certain health risks were derived from the medical literature examining these relationships. (For example, the calculation of productivity benefits related to weight loss were based on the following assumptions described by Burton et al.[40] 1) If a person loses significant weight and also reduces another risk factor, 40 hours of productivity are gained annually due to reduced presenteeism. 2) An additional 20 hours are gained for those who lose significant weight and reduce a third risk factor. 3) An additional 20 hours are gained for those who lose significant weight and reduce a fourth risk factor. 4) Finally, an additional 10 hours are gained for those who lose significant weight and reduce a fifth risk factor. Thus, the maximum productivity gain from losing weight and modifying another health risk factor is 90 hours.[40] Annual productivity gain was monetized by multiplying total hours of productivity gained in the year by the participant's average hourly wage.)[30–33,40–43] Average hourly wage data were not available for participants, so an estimated value was derived from national data reported in the June 2007 Bureau of Labor Statistics report on private employer costs for employee compensation (USD $25.93 per employee).[44] Program expense for the *Healthyroads* program averaged USD $300 per employee per year.

Applying the ROI Model

Projected ROI from the *Healthyroads* program was determined by comparing program costs to the medical and productivity savings derived from reductions in health risks as a result of participating in the program. ROI is expressed as a ratio of program savings, or benefit, to program costs. For example, an ROI of 2:1 implies a program saved twice the expense of the program. The Model did not discount program benefits or costs since this program only lasted 1 year. Nevertheless, the Model can discount for analyses that go out more than 1 year.

The *Healthyroads* ROI Model utilizes two types of input. First, the user supplies the current demographic characteristics of employees or beneficiaries in the organization, along with the projected annual

TABLE 1
Demographic Characteristics of the Study Cohort at Baseline

Demographic Characteristic	Average or Percentage	Standard Deviation
N	890	—
Age (avg.)	44.2	10.9
Female (%)	74.3	—
Ethnicity (%)		
American Indian or Alaskan Native	0.7	—
Asian	3.2	—
Hispanic	9.2	—
Black	6.6	—
White	75.3	—
Pacific Islander	0.9	—
Multiracial or other race	0.8	—
Unknown	3.4	—
Overweight or obese (%)	76.4	—
Weight (avg.)	191.4	50.3
Body mass index (avg.)	30.6	7.3

Note: "avg." refers to average value; "—" indicates an inapplicable metric.

increase or decrease in each characteristic. This input generates a demographic profile of the employer's target population. Second, the user provides the risk profile of the targeted population (based on results from HRA administrations) and the actual or expected annual change in each risk factor. The result of the user's input is a health risk profile for the target population.

By analyzing the supplied demographic and health risk inputs, the Model produces estimates of the ROI from the program. The results provide projected savings (both medical and productivity) and projected program costs over a multiyear period. A net present value is also calculated as the present (discounted) value of the projected savings less the program costs, which equals zero under the break-even scenario. The break-even scenario depicts how much each risk factor should be reduced annually in order for the benefits of risk reduction (ie, medical and productivity cost savings) to exactly offset the investment costs of purchasing and administering the program. ROI values larger than 1.00 for the user's defined scenario indicate savings exceeding program investments.

Results

Sample

The cohort group consisted of 890 individuals who participated in either the weight management or wellness *Healthyroads* program. Participants represented a convenience sample with a 42.3% attrition rate from baseline ($n = 1542$) to follow-up period ($n = 890$).

The study cohort was on average 44.2 years old, 74.3% women, 75.3% Whites, 38.0% professional job category, and 11.2% sales job category. At baseline, participants weighed an average 191.4 pounds, had an average BMI of 30.6, and 76.4% were overweight or obese (see Table 1).

TABLE 2
Changes in Health Risks Factors for the Cohort Group

				T1				T2					
	***N* (T1/T2)**	**Min.**	**Max.**	**Mean**	**SD**	**Lower CI**	**Upper CI**	**Mean**	**SD**	**Lower CI**	**Upper CI**	**% pt Δ**	***P* (McNamar's χ^2)**
Poor eating	890/890	0	1	0.66	N/A	0.63	0.69	0.45	N/A	0.41	0.48	−21.3%	<0.0001
Poor exercise	890/890	0	1	0.64	N/A	0.61	0.67	0.49	N/A	0.46	0.52	−15.1%	<0.0001
Former smoker	890/890	0	1	0.25	N/A	0.22	0.28	0.22	N/A	0.19	0.25	−3.3%	0.0032
Current smoker	890/890	0	1	0.07	N/A	0.05	0.09	0.06	N/A	0.05	0.08	−0.7%	0.3763
High cholesterol	890/890	0	1	0.22	N/A	0.20	0.25	0.06	N/A	0.04	0.07	−16.4%	<0.0001
High glucose	890/890	0	1	0.06	N/A	0.04	0.08	0.03	N/A	0.02	0.04	−2.9%	0.0005
High blood pressure	890/890	0	1	0.11	N/A	0.09	0.13	0.02	N/A	0.01	0.03	−8.5%	<0.0001
High stress	890/890	0	1	0.18	N/A	0.15	0.20	0.12	N/A	0.10	0.14	−6.0%	<0.0001
Depressed	890/890	0	1	0.06	N/A	0.04	0.08	0.05	N/A	0.03	0.06	−1.2%	0.1658
High alcohol	890/889	0	1	0.13	N/A	0.11	0.15	0.16	N/A	0.14	0.18	2.9%	0.0132
Overweight or obese	890/890	0	1	0.76	N/A	0.74	0.79	0.71	N/A	0.68	0.74	−5.8%	<0.0001
												Absolute Δ	*P* (*t* test)
BMI	890/859	16.2	64.1	30.6	7.3	30.1	31.0	29.7	6.9	29.2	30.2	−0.9	<0.0001
Weight	890/882	98.0	406.0	191.4	50.3	188.1	194.7	186.9	48.5	183.7	190.1	−4.5	<0.0001

Note: "T1" and "T2" refer to times 1 (baseline) and 2 (follow-up at year 1); "Min" refers to minimum value across T1 and T2, with a value of "0" representing low risk for categorical variables; "Max" refers to maximum value across T1 and T2, with a value of "1" representing high risk for categorical variables; "SD" refers to standard deviation; "N/A" indicates an inapplicable metric; "CI" refers to 95% confidence interval; "Δ" refers to change; "BMI" refers to body mass index.

Program Participation and Cost	
Number of participants enrolled in the base year?	890
Annual change in the number of participants?	0 %
Program cost per participant in the base year?	$300.00
Medical payment per participant in the base year?	$4,804
Discount rate applied for ROI calculation?	0 %
Time horizon (1 to 10 years)?	1
Number of years until program levels off?	1

Demographics of Program Participants

Demographic Factors	Value in Base Year *	Expected Annual Change
Average age in years	44.2	0.0 %
Female (%)	74.3 %	0.0 %
African American (%)	6.6 %	0.0 %
Hispanic (%)	9.2 %	0.0 %
Other non-white (%)	5.5 %	0.0 %
Sales job (%)	11.2 %	0.0 %
Professional job (%)	38.0 %	0.0 %

Fig. 1. ROI model inputs screen—demographics and financial measures.

Changes in Health Risks

Over 1 year, there were statistically significant reductions in 7 of 10 health risk categories for participants, 1 risk category (high alcohol consumption) significantly increased (from 13% prevalence to 16%), and smoking status and depression remained unchanged (see Table 2). There were sizable decreases in high-risk prevalence for poor eating habits (21.3% reduction) and poor physical activity (15.1% reduction). All of the biometric measures related to overweight and obesity decreased significantly, including percent overweight or obese (5.8% reduction), weight (4.5 pounds reduction), and BMI (0.9% reduction).

ROI Analysis

Figure 1 presents a screenshot of the inputs entered into the ROI Model. As shown, the inputs mirror the baseline characteristics and health risk profile of program participants at baseline as well as additional financial metrics needed to execute the mathematical calculations in the Model.

Figure 2 highlights the changes in weight and BMI experienced by study participants, ie, a 4.5-pound reduction in weight and a 0.9-point reduction in BMI. Also shown are the other changes in the risk profile of program participants from time 1 to time 2. Although the Model inputs call for "expected" changes, the values inserted reflect the actual changes in risks for program participants from baseline to follow-up.

Table 3 presents the results of the ROI analysis performed for the *Healthyroads* program. As shown, compared to the reference scenario where no changes would have been expected to occur during the study period, total employer expenses were reduced by $311,755. Of total projected expense reductions, 59% are attributed to a 4.3% reduction in health care expenditures ($184,582) and 41% are attributed to productivity enhancements ($127,173). When combined, projected medical and productivity savings in year 1 are higher than the cost of the *Healthyroads* program ($267,000), thus producing an net present value of $44,755 and an ROI of $1.17 to $1.00. Also shown is the break-even point for the program estimated to be 3.20, meaning that all risks would need to be reduced an average of 3.20% points in order for the program to pay for itself.

Discussion

This article describes the application of an econometric ROI Model to estimate the financial impact of 1 year changes in health risks for individuals participating in the *Healthyroads* Obesity Management Program. The Model was applied to demonstrate how medical and productivity cost savings may be estimated by observing reductions in the health risks in an employed population. To populate the Model, actual health risk data for 890 individuals participating in a year-long risk reduction program were entered. The Model then estimated cost savings due to changes in that population's health risk profile.

In 1 year, program participants experienced significant reductions in seven risk factors (poor diet, inadequate physical activity, high total cholesterol, high blood glucose, high blood pressure, high stress, and obesity) whereas high alcohol consumption increased. Two risks remained unchanged (depression and smoking). All biometric measures related to overweight and obesity decreased significantly (weight, BMI, and percent overweight or obese). These improvements in the risk profile of participants drove projected reductions in health care expenditures and improved worker productivity as estimated by the Model. Specifically, 59% of projected employer savings totaling $311,755 were related to reductions in health care spending

	Average Body Weight in Base Year (BMI)	Expected Annual Change in Body Weight (BMI) **
2. Review Average Body Weight and Annual Change in Weight Then Revise Either Entry or Both Entries If Desired.	30.6	-0.9
3. Enter Percentage of Beneficiaries at High Risk from Being Overweight in the Base Year.	76.4 %	

Risk Factors	Percentage of Beneficiaries at High Risk in Base Year	Expected Annual Change in Health Risks, in Percentage Points
Poor exercise habits	64.0 %	-15.1 %
Poor eating habits	66.0 %	-21.3 %
Current smoker	7.0 %	-0.7 %
Former smoker	25.3 %	-3.3 %
High cholesterol	22.2 %	-16.4 %
High blood glucose	6.1 %	-2.9 %
High blood pressure	10.6 %	-8.5 %
High stress	17.6 %	-6.0 %
Depression	6.1 %	-1.2 %
Heavy alcohol use	13.0 %	2.9 %

Fig. 2. ROI model input screen—time 1 and time 2 changes in weight and health risks for program participants.

TABLE 3
Year 1 Results

	Reference Scenario (No Program)	Program Scenario	Break-Even Scenario (Risks are Reduced by 3.20% Per Year)
Total expenditure (2009–2009)	$4,275,560	$4,090,978	$4,029,345
Change between baseline and year 1 follow-up	0.0%	−4.3%	−5.8%
Medical savings		$184,582	$246,215
Productivity savings		$127,173	$20,782
Total savings		$311,755	$266,998
Program cost		$267,000	$267,000
Net present value		$44,755	−$2
Return on investment		$1.17	$1.00

and the remaining savings were due to improvements in productivity. Our findings were consistent with other research examining the relationship between risk reduction and cost savings. Specifically, a recent study by Mills et al[45] also found correlations between reductions in health risk, absenteeism, and presenteeism and several literature reviews have shown decreases in health care and productivity expenditures associated with risk reduction in an employed population.[1,7,10]

A modest $1.17 savings for every dollar invested in the program was estimated by the Model. Put into context, this represents a potential return of 17% over 1 year for the employers funding the program. Although such immediate, short-term returns on investment from risk reduction programs are unlikely, several studies have found larger returns over longer time periods.[7,45] Employers could potentially achieve bigger savings in health care costs and productivity if the observed risk changes persisted beyond the study period.

To test whether the savings projected match actual savings, these employers would need to initiate a retrospective analysis of medical claims and productivity data, an endeavor that is time-consuming, intensive, and expensive. In reality, a rigorously conducted retrospective claims analysis could cost hundreds of thousands of dollars and may not be justified given the total expense of the program itself.

Limitations

This analysis has several limitations worth noting. First, the analysis of changes in health risks over time for study participants relied on a pre-post test research design. Thus, in the absence of a control group, one cannot be certain that the changes observed in the study sample might not have occurred naturally in the absence of the program. Nevertheless, naturally occurring improvements of such magnitude as observed here are unlikely without some type of intervention. In fact, most health risks, especially overweight and obesity, generally worsen over time as people age.[46,47]

Second, attrition in the study sample was observed whereby only 57.7% of the individuals beginning the program returned for a follow-up assessment. The health risk profile of participants not returning for follow-up assessments is not clear. To avoid a potential selection bias, participants were offered financial incentives to complete their surveys and so even those who did not change their health habits could gain by returning the survey. Nonetheless, the assessment of cost savings due to risk reduction may be biased in favor of showing greater effect than was realized.

Third, the ROI model assumes that individuals who improve their risk profile will spend fewer medical care dollars and improve their productivity proportionately. To date, most studies that have examined the relationship between health risk factors and financial outcomes such as those reported here have relied upon cross-sectional analyses rather than longitudinal studies.[21,48] The research literature is lacking studies that correlate changes in costs to specific changes in risk factors. Nevertheless, longitudinal studies by Edington et al[49] have shown that, in general, as health risks improve, costs go down.

A fourth limitation pertains to the possibility of selection bias because participants in the program self-selected into the program and thus were likely to be more motivated to improve their health than workers in general. This is true for almost all voluntary health promotion programs and their evaluations.

A fifth limitation is possible regression to the mean. Many of the health risk metrics were notably high at baseline (eg, 66% had poor eating habits and 46% were obese). Therefore, it is possible that some participants in the study sample experienced a ceiling effect and that a reduction in health risks was likely due to regression to the mean. Nevertheless, as noted above, with rare exception, many risk factors, especially those that involve biometric measures, tend to deteriorate over time when left unattended. Another possibility is that some participants may have reported better health habits at the study's conclusion as a means of providing a socially desirable response.

Sixth, the data collected using the HRA were self-reported. There is evidence that self-reporting of health habits is not always accurate.[50] In future studies, the investigators may wish to collect biometric data alongside self-reports to validate the measures and make adjustments where necessary.

Conclusions

Our study demonstrates ways in which an econometric ROI Model can be used by employers to estimate cost savings from risk reduction programs and provide a business justification for their health promotion programs. In this case, significant improvement in program participants' health risk profile over 1 year produced an estimated $1.17 to $1.00 ROI.

Using the ROI Model featured here, or other similar models built on an empirical database, offers employers a lower-cost alternative to very resource intensive evaluation studies that require extensive analysis of financial data to provide a business case for health promotion programs. Most employers cannot justify the time and expense needed to conduct rigorous evaluations of their programs. Also, financial analyses that tap into administrative claims databases often require thousands of subjects for the analysis to be valid, and such analyses are not feasible for small employers. The approach presented in this study offers an alternative strategy for program evaluation when these barriers exist. Having available modeling programs that simulate cost savings associated with risk reduction in an employed population can help program managers develop credible and defensible business cases for initial and continued investment in health promotion programs that can satisfy the requirements of company finance officers.

Appendix

Poor eating: 3 or more times per week eating at fast food restaurant, or less than two servings of fruits and vegetables per day

Poor exercise: not currently following an exercise program, or exercise less than 2 days per week

Former smoker: smoked at one point in their lives, but not currently

Current smoker: currently smoke

High cholesterol: 240 mg/dL or higher

High glucose: greater than 126 mg/dL

High blood pressure: greater than 140/90 mm Hg

High stress: poorly manage stress in life

Depressed: feel sad or depressed almost all the time, or most of the time

High alcohol: consume five or more alcoholic beverages on 1 day or more per week

Obese or overweight: BMI ≥25.

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