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# Ten Modifiable Health Risk Factors Are Linked To More Than One-Fifth Of Employer-Employee Health Care Spending

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**ABSTRACT** An underlying premise of the Affordable Care Act provisions that encourage employers to adopt health promotion programs is an association between workers' modifiable health risks and increased health care costs. Employers, consultants, and vendors have cited risk-cost estimates developed in the 1990s and wondered whether they still hold true. Examining ten of these common health risk factors in a working population, we found that similar relationships between such risks and total medical costs documented in a widely cited study published in 1998 still hold. Based on our sample of 92,486 employees at seven organizations over an average of three years, \$82,072,456, or 22.4 percent, of the \$366,373,301 spent annually by the seven employers and their employees in the study was attributed to the ten risk factors studied. This amount was similar to almost a quarter of spending linked to risk factors (24.9 percent) in the 1998 study. High risk for depression remained most strongly associated with increased per capita annual medical spending (48 percent, or \$2,184, higher). High blood glucose, high blood pressure, and obesity were strongly related to increased health care costs (31.8 percent, 31.6 percent, and 27.4 percent higher, respectively), as were tobacco use, physical inactivity, and high stress. These findings indicate ongoing opportunities for well-designed and properly targeted employer-sponsored health promotion programs to produce substantial savings.

**S**ection 4303 of the Affordable Care Act of 2010 and section 2705 of the Public Health Service Act of 1944, which was amended by the Affordable Care Act, contain provisions that encourage employers to adopt health promotion and risk reduction programs, also known as employee wellness programs. An underlying premise of these provisions is that modifiable health risks, such as obesity and high blood pressure, are associated with increased health care costs in the employed population. Therefore, employers that undertake risk-reduc-

tion programs may save on health care expenditures.

The largest employer-based study that supported the association between higher health risks and higher costs used data that are now seventeen years old. Also, both personal health behavior and health care services have changed over time. We therefore revisited this pivotal assumption using more current data. In doing so, we demonstrated that the relationships shown more than a decade ago between employee health risks and subsequent total health care costs still hold today. These enduring rela-

tionships continue to indicate the potential to reduce health care spending by putting in place evidence-based health promotion programs.

## Background

In 1998 an article was published in the *Journal of Occupational and Environmental Medicine* that reported on the economic impacts of ten modifiable health risk factors commonly found in a working population.<sup>1</sup> This frequently cited article, reporting on what was widely referred to as the HERO study, was inspired and funded by a consortium of employers and worksite health promotion advocates convened by the Health Enhancement Research Organization (hence, the acronym HERO).<sup>2</sup> The study sought to quantify the financial consequences to employers of having workers with elevated health risks detected through the administration of a health risk assessment—a staple of most worksite health promotion programs.<sup>3,4</sup> Health risk assessment involves collecting and analyzing selected health-related data to evaluate a person's health status and risk for disease.

Prior to the HERO study, attempts to determine the association between health risks and costs among workers had not controlled for demographic variables that affect health care costs or for the co-occurrence of multiple health risks in any given person.<sup>5-9</sup> Furthermore, the HERO study was unique in evaluating the independent contribution of risk factors to costs—separating, for example, the effects of being obese from those of also having high blood pressure. The HERO study was also notable because it analyzed data from a large and diverse population of 46,026 employees from six organizations and followed these workers for 113,963 person-years.

But despite the HERO study's strengths, much has changed since it was published. For one thing, employees' health habits and health care use and costs are different now than they were during 1990–95, the time period from which the HERO data were drawn. During the early to mid-1990s, the managed care movement in the United States was at its height. The health risk profile of American workers was unlike what it is now; most notably, a dramatic increase in obesity rates has since occurred.<sup>10,11</sup> Moreover, spending on prescription drugs was lower at the time of the original HERO study (about 6 percent of total national health expenditures),<sup>12,13</sup> so it was not included in the cost analysis. Today, prescription drugs account for 10 percent of total spending.<sup>13</sup>

Such considerations have led several employers, consultants, and vendors to question the

stability of risk-cost estimates developed in the 1990s and to request that they be revisited to determine whether they still hold true (William Whitmer, HERO, personal communication, July 1, 2011; Robert Soroosh, Affinia Group, personal communication, July 5, 2011; Andrew Crighton, Prudential, personal communication, July 8, 2011; David Anderson, StayWell, personal communication, July 15, 2011).

The Congressional Budget Office, in an August 2009 memo, also underscored the need for updated and more refined examination of the issues explored in the original HERO study. That memo stated: “Although some case studies suggest that certain health promotion programs reduce subsequent medical care, little systematic evidence exists. The findings from case studies may not be applicable to programs that would be implemented more broadly. ...Because the evidence about such programs continues to evolve, CBO will continue to examine that evidence closely.”<sup>14</sup>

In this study we revisited the questions posed by the 1998 HERO analysis with contemporaneous data and enhanced methods. We again examined the strength of the association between the ten modifiable health risk factors previously evaluated and subsequent total health care costs. In doing so, we drew on the experience of 92,486 employees at seven organizations, contributing 272,874 person-years of data over an average of three years—roughly twice the population examined previously.

We posed three central questions. First, have the health risks of workers improved or worsened? Second, have the relationships between risks and costs shifted? Third, what are the implications for the design and implementation of worksite health promotion programs, as many employers now contemplate introducing or expanding such initiatives in response to new federal legislation encouraging them to do so?

## Study Data And Methods

**OVERVIEW** We sought to replicate the methods employed in the original HERO study, with selected enhancements. Among the latter were the inclusion of prescription drug data, a doubling of the sample size, and the performance of additional sensitivity analyses to check the robustness of the results.

Because health risk assessment instruments used by vendors of employee health promotion programs differ, as do the risk definitions and high-risk cutoffs they apply, we elected to use the StayWell health risk assessment instrument as the source for employees' health risk data—the same health risk assessment tool used in the

original HERO study. The use of a common instrument for the two studies facilitated comparisons across time and increased our confidence that any observed change, or lack thereof, was “real.” Also, the instrument has not changed substantially in the interim.

We identified and recruited seven employers that had administered the StayWell health risk assessment to their employees and had contributed data to the MarketScan databases. Complete health risk assessment, medical claims, prescription drug, and benefit eligibility data were available from MarketScan for the period spanning 2005–09. Person-level data were linked to one another and were deidentified to ensure anonymity and confidentiality.

**SAMPLE** The study population included active, full-time employees, at least age eighteen at the time of health risk assessment completion and no older than age sixty-four during their last year of eligibility for medical benefits. To be included in the study, employees had to be continuously enrolled in a self-insured health plan for at least 180 days after completing a health risk assessment, and any gaps in enrollment could not exceed 40 days. Employees were not required to have submitted claims during the study period to be included in the analysis. Thus, workers eligible for benefits who did not submit any claims had zero costs. Women were excluded from the analysis if they were pregnant at any time during the study period.

**MEASURES** The StayWell health risk assessment instrument included forty-seven questions about people’s health habits and biometric values. Biometric data for blood pressure, total cholesterol, obesity, and blood glucose were automatically linked to the health risk assessment record from screening results. Alternatively, employees entered the information obtained in preventive screening exams performed by their physicians or other health professionals.

Although fasting cholesterol and blood glucose levels were requested, they might not have been provided consistently. Health risks related to physical inactivity, alcohol consumption, nutritional and eating habits, tobacco use, depression, and stress were self-reported. All health risks were dichotomized into high-risk and lower-risk categories. Risk thresholds were consistent with the original HERO study and are described in the online Appendix.<sup>15</sup>

The dependent variable, total medical expenditures, included employer and employee payments—such as deductibles, copayments, and coinsurance—for all inpatient and outpatient services as well as for prescription drugs during the period after the employee completed the health risk assessment. All dollar amounts were

annualized and inflation-adjusted to 2009 values. Outlier cases, defined as employees whose annual costs were equal to or greater than the ninety-fifth percentile of total medical costs, were included in the study and were later removed in a sensitivity analysis to determine whether results were biased by high-cost claimants.

**ADJUSTING FOR CONFOUNDERS** To estimate relationships between risk status and subsequent medical expenditures, we controlled for confounding variables that might also influence costs. Confounders included employee age, sex, type of health plan in which the employee was enrolled, location, industry type of employer, employment category (hourly versus salaried), number of months followed in the database, and the specific employer contributing data. Because it is not always clear whether a given risk factor precedes an illness or co-occurs with it, we conducted several sensitivity analyses to control for illness at baseline and disease comorbidities.

All of the regression equations used a generalized linear model to estimate risk-spending relationships. The outcome for all models was total medical expenditures post-health risk assessment. The predictor variables included indicators for each health risk and all confounding variables described above.

**ESTIMATING EXPENDITURES FOR PEOPLE WITH MULTIPLE RISKS** In addition to calculating the incremental cost of each risk factor, we developed cost estimates for combinations, or clusters, of risk factors that represent multiple risks for a disease outcome. We did so for three common conditions for which modifiable risk factors play a prominent role: heart disease, stroke, and psychosocial problems. This analysis was accomplished by comparing predicted mean expenditures for employees with specific risk factors for a given disease condition to those for employees without these risk factors.

The risk factors associated with heart disease were tobacco use, high blood pressure, high blood glucose, high total cholesterol, physical inactivity, obesity, and high stress; for stroke, they were tobacco use, high blood pressure, high cholesterol, and high stress; and for psychosocial problems, they were high stress and depression. Additional details on methods can be found in the Appendix.<sup>15</sup>

**LIMITATIONS** A key limitation to the current and prior HERO analysis was the cross-sectional nature of the study, which limits the ability to draw any straight-line relationships between modifiable health risks (causes) and costs associated with disease outcomes (effects). As was the case in the prior study, this analysis under-

scores the association between having certain health risks and subsequent health care expenditures. Furthermore, the analysis does not address the question of whether employers' efforts at reducing workers' health risks achieve cost savings in the short or long term.

In addition, the health risk assessment used here and in most employer-based programs is focused on a finite set of risk factors assessed at a single point in time. Therefore, employee composition in any given high-risk group, and related future costs, may shift over time.

## Study Results

**STUDY SAMPLE** The final sample consisted of 92,486 employees representing 272,834 person-years of experience. The average observation period for people in the sample was 2.95 years following the completion of a health risk assessment.

Subjects were mostly male (68.9 percent) and relatively young, with an average age of forty-one. Most (72.1 percent) were in preferred provider organization health insurance plans, 56.7 percent were hourly employees, and almost half (46.2 percent) resided in the North Central US census region (Appendix Exhibit 1).<sup>15</sup>

**BIOMETRIC, BEHAVIORAL, AND PSYCHOSOCIAL HEALTH RISKS** In the area of biometric risks, 32.2 percent of employees were obese, 9.9 percent had high cholesterol, 9.5 percent had high blood glucose, and 7.6 percent had high blood pressure. In the area of behavioral risks, 64.1 percent had poor nutrition and eating habits, 36.4 percent were physically inactive, 21.5 percent reported tobacco use, and 4.9 percent reported high alcohol consumption. In the area of psychosocial risks, 17.4 percent reported having high stress that they were unable to handle well, and 10.9 percent reported depression.

A comparison of results to those from the HERO study conducted seventeen years earlier found that the risk prevalences reported for the majority of risks during the two time periods covered were within five percentage points of each other. Exceptions were poor nutrition and eating habits (64.1 percent in the current study versus 20.2 percent in the original study), obesity (32.2 percent versus 20.0 percent), high total cholesterol (9.9 percent versus 18.8 percent), and depression (10.9 percent versus 2.2 percent).

**RELATING RISKS AND COSTS** Total annual per capita medical expenditures (employer and employee costs) for study group members averaged \$3,961 in 2009 dollars. Exhibit 1 presents expenditures for each risk factor examined compared to the expected amount (that is, the

counterfactual, or the amount for someone without that risk). Also shown are the unadjusted and adjusted percentage differences in cost per employee. Most unadjusted differences were larger than the adjusted differences, which highlights the value of multivariate modeling when controlling for confounding variables.

For example, whereas a worker without high blood pressure cost \$4,356 in combined employer and employee expenditures, a worker with high blood pressure cost \$5,734, holding all other variables in the model constant. Consequently, the additional annual medical expenditures for a worker with high blood pressure were \$1,378, or 31.6 percent higher than for a worker without high blood pressure.

A review of results for other biometric health risks found that workers with high blood glucose were 31.8 percent more costly than were those at lower risk (\$1,653 more expensive), and obese workers were 27.4 percent more costly than normal or overweight employees (incurring \$1,091 in additional costs). In contrast, people with high total cholesterol were slightly less costly, although those findings were not statistically significant.

A review of behavioral health risks found that tobacco users were 16.3 percent more costly than nontobacco users (incurring \$587 in additional costs), and physically inactive employees were 15.3 percent more expensive than those physically active (\$606 more so). People with poor nutrition and eating habits were less costly than those reporting good nutrition and eating habits, but here, as in the case of high cholesterol, the difference was not significant.

In the category of psychosocial risks, people with depression were 48.0 percent more expensive than were people not at risk (\$2,184 in higher costs), and workers reporting high stress were 8.6 percent (\$413) more costly.

**COMPARING RESULTS TO THE ORIGINAL HERO STUDY** The positive and negative relationships among risks and costs found in the current analysis were directionally similar to those reported in the HERO study, even though the risk profile of American workers changed over time, as did health care use and cost patterns. Specifically, depression was the most important predictor of higher health care costs in the 1998 study and also the most important predictor in the current analysis, although the magnitude of the association was lower—70.2 percent in higher costs reported in 1998 and 47.8 percent in the current analysis (Exhibit 2).

High stress—second in priority in 1998 with a 46.4 percent potential impact on costs—exhibited a lesser, although significant, relationship

## EXHIBIT 1

## Average Unadjusted And Adjusted Medical Expenditures, In 2009 Dollars, By Risk Level

Risk measure and level	Unadjusted means (\$)	Adjusted means (\$)	Unadjusted difference (%)	Adjusted difference (%)
Depression				
High	6,207	6,738	59.1	48.0
Lower	3,902	4,553	— <sup>a</sup>	— <sup>a</sup>
Blood glucose				
High	6,532	6,849	70.0	31.8
Lower	3,842	5,196	— <sup>a</sup>	— <sup>a</sup>
Blood pressure				
High	5,264	5,734	27.4	31.6
Lower	4,132	4,356	— <sup>a</sup>	— <sup>a</sup>
Body weight				
High	4,956	5,078	41.7	27.4
Lower	3,498	3,988	— <sup>a</sup>	— <sup>a</sup>
Tobacco use				
High	4,192	4,184	10.8	16.3
Lower	3,784	3,597	— <sup>a</sup>	— <sup>a</sup>
Physical inactivity				
High	4,477	4,582	26.6	15.3
Lower	3,537	3,976	— <sup>a</sup>	— <sup>a</sup>
Stress				
High	5,024	5,249	13.0	8.6
Lower	4,444	4,836	— <sup>a</sup>	— <sup>a</sup>
Cholesterol				
High	4,780	4,913	2.0	-2.5
Lower	4,688	5,037	— <sup>a</sup>	— <sup>a</sup>
Nutrition and eating habits				
High	3,245	3,261	-23.2	-5.2
Lower	4,226	3,440	— <sup>a</sup>	— <sup>a</sup>
Alcohol consumption				
High	3,857	3,843	-3.9	-9.5
Lower	4,015	4,246	— <sup>a</sup>	— <sup>a</sup>

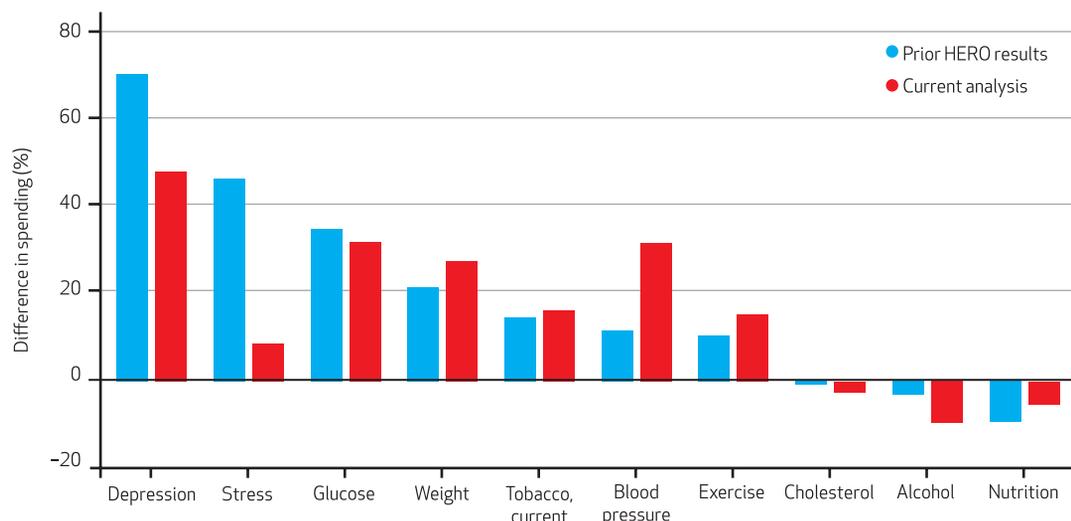
**SOURCE** Authors' analysis of data from 92,486 people from seven companies in the MarketScan Commercial Claims and Encounter Database, 2005–09. **NOTES** Medical expenditures include employer and employee portions of medical payments. The differences were attained by comparing adjusted costs from the model with and without the risk, while holding all other variables constant at their average value for the at-risk population. The incremental cost associated with the high risk was calculated as a percentage difference in costs compared with the reference category (lower risk). All costs are standardized to 2009 dollars, adjusted for inflation using the Medical Care Services Consumer Price Index (CPI) for medical care costs and Medical Care Commodities CPI for pharmaceuticals. <sup>a</sup>Reference category.

to cost here (8.6 percent impact). Obesity was linked to a 27.4 percent increase in costs in the current study compared to 21.4 percent previously. Notably, in the current study, a larger proportion of workers were classified as obese (31.8 percent) compared to the HERO study, where 20.0 percent had weight problems—primarily obesity, but, in a very small proportion of the overall study population, also low body weight (that is, 20 percent or more below ideal body weight).

Having high blood glucose (31.8 percent higher costs) and high blood pressure (31.6 percent higher costs) were also significant predictors of expenditures in this study, compared to 34.8 percent and 11.7 percent previously. Physical inactivity and tobacco use were also signifi-

cant predictors of increased medical costs (15.3 percent and 16.3 percent higher, respectively)—more so than in the original HERO study, where those risks contributed 10.4 percent and 14.5 percent increases, respectively.

**SENSITIVITY ANALYSES** After we controlled for baseline disease by adding the Charlson Comorbidity Index<sup>16</sup> and a measure of psychiatric health, Psychiatric Diagnosis Groups,<sup>17</sup> to the regression model, high blood pressure, obesity, physical inactivity, tobacco use, and depression remained significant predictors of increased health care costs. However, the predicted impact of these risks was muted compared to the results where baseline physical and mental diseases were not controlled in the prediction model (Appendix Exhibit 2).<sup>15</sup>

**EXHIBIT 2****Difference in Medical Expenditures Between High-Risk And Lower-Risk Employees: Prior HERO Study Results Versus Current Analysis**

**SOURCE** Authors' analysis of data from 92,486 people from seven companies in the MarketScan Commercial Claims and Encounter Database, 2005–09. The Health Enhancement Research Organization (HERO) study results were from 46,026 people from six employers from the HERO database, 1990–95. **NOTES** Blue bars show the adjusted percentage difference in medical expenditures between high-risk and lower-risk employees from the HERO study. Red bars show the adjusted percentage difference in medical expenditures between high-risk and lower-risk employees from the current study.

A second sensitivity analysis excluded 4,624 high-cost or outlier cases from the database. Once these expensive employees were excluded, high blood pressure, high blood glucose, obesity, physical inactivity, tobacco use, and depression remained significant predictors of future medical costs, although, here again, the magnitude of their additional costs was less pronounced (Appendix Exhibit 2).<sup>15</sup>

**COMBINING RISKS** As previously noted, people with one risk for a specific health problem often have additional risks associated with the same problem. We therefore estimated the combined contribution of risk factors for three conditions: heart disease (seven risks), stroke (four risks), and psychosocial problems (two risks). We found that such risk-factor clustering predicted increased costs by 213.6 percent, 62.1 percent, and 60.6 percent for heart disease, stroke, and psychosocial problems, respectively. In a similar analysis performed in the 1998 HERO study, those risk clusters predicted higher costs at 228 percent, 85 percent, and 147 percent, respectively. The main difference between the two sets of results was the diminished influence of stress in the current study as a predictor of costs (Appendix Exhibit 3).<sup>15</sup>

**POPULATION IMPACT OF RISK FACTORS** Finally, in an analysis that sought to determine the population impact of the ten modifiable risk factors, we multiplied the prevalence of each individual

risk factor by its incremental costs and added the dollars to calculate the combined impact of the ten risks. We also calculated the per capita expenditures for each risk and for all ten risks. Exhibit 3 summarizes this analysis.

Of the \$366,373,301 spent annually by the seven employers and their employees in the study, \$82,072,456, or 22.4 percent, was attributed to the ten risk factors studied. This amount was calculated by adding positive contributors to cost (risk factors that predicted increased costs) as well as the negative contributors to costs (risk factors where people at high risk were less expensive—that is, high alcohol consumption, poor nutrition and eating habits, and high total cholesterol).

Thus, on a population basis, more than a fifth (22.4 percent) of the costs borne by the seven employers and their employees were related to the ten health risks, compared to almost a quarter (24.9 percent) found in the original HERO study. Spending on these risk factors resulted in excess medical costs totaling \$887 per employee per year, with obesity contributing most of the excess cost, at \$347 per capita.

## Discussion

The central question addressed in this study was whether the measurement of ten modifiable health risk factors, as part of a routine workplace

## EXHIBIT 3

## Estimated Effect Of Each Health Risk On Annual Medical Expenditures By Employers And Employees

Risk factor	Estimated annual effect per high-risk person (\$)	Prevalence: number of people at high risk	High-risk group annual effect		
			Cost (\$)	% of total annual expenditures	Cost per capita (\$)
High stress	413	8,582	3,544,366	1.0	38.3
Tobacco use	587	16,735	9,823,445	2.7	106.2
Obesity	1,091	29,416	32,092,856	8.8	347.0
Physical inactivity	606	27,251	16,514,106	4.5	178.6
High blood glucose	1,653	5,823	9,625,419	2.6	104.1
Depression	2,184	5,427	11,852,568	3.2	128.2
High blood pressure	1,378	5,423	7,472,894	2.0	80.8
High alcohol consumption	-402	3,213	-1,291,626	-0.4	-14.0
High total cholesterol	-124	4,734	-587,016	-0.2	-6.4
Poor nutrition and eating habits	-179	38,964	-6,974,556	-1.9	-75.4
Total expenditures attributable to high risk	— <sup>a</sup>	— <sup>a</sup>	82,072,456	22.4	887.4

**SOURCE** Authors' analysis of data from 92,486 people from seven different companies in the MarketScan Commercial Claims and Encounter Database, 2005–09. **NOTES** Medical expenditures include employer and employee portions of medical payments. The annual effect figures, both per capita and overall, are the effect of each of the risk categories, independent of all other risk categories and covariate factors. Expenditures are expressed in constant 2009 dollar figures. Total annual expenditure for the study sample was \$366,373,301. High-risk group annual effect is calculated as effect per high-risk person × prevalence. High-risk group annual effect on a per capita basis is calculated as high-risk group annual effect/sample size of 92,486. <sup>a</sup>Not applicable.

health promotion program, can help employers and their workers predict future health care costs. If costs can be predicted in this way, such an assessment would be helpful to business and labor groups wishing to manage workers' health habits and related costs through health promotion and risk-reduction programs.

After connecting health risk and medical cost data for 92,486 workers employed by seven employers, we determined that seven of ten health risks were statistically significant positive predictors of future costs. The risks most associated with increased expenditures included having biometric values related to obesity, high blood pressure, and high blood glucose; having certain health habits, such as being physically inactive and using tobacco; and reporting being depressed and unable to manage stress. Because the focus of this study is on an employed population, a group that is relatively younger and healthier than the overall US population, caution is advised when generalizing about the results.

As was true in the HERO study, three risk factors (excessive alcohol consumption, poor nutrition and eating habits, and high cholesterol) were negatively correlated with future health care costs, which means that workers with these risks had lower costs, although the negative associations were not significant. For alcohol, the findings suggest that the nationally recognized threshold for high risk (three drinks a

day for men and two for women) may need to be revisited, because drinking at these levels would not constitute alcohol abuse. According to the *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition, alcohol abuse is characterized by a pattern of drinking harmful to one's health, interpersonal relationships, or ability to work.<sup>18</sup> There is also accumulating evidence that moderate alcohol consumption may be protective.<sup>19,20</sup>

Our finding that high total cholesterol is not associated with higher costs may reflect the complex relationship between total cholesterol and health and indicate that a simple dichotomous risk factor (high versus not high) is not likely to capture this complexity.<sup>21–23</sup> Regarding poor nutrition and eating habits' not predicting higher costs, this finding is likely because of the difficulty of determining the healthfulness of a person's diet, especially when nutrition habits are self-reported. Moreover, the assessment of nutrition habits was, in this instance, limited to fruit and vegetable consumption; it did not consider other factors, such as consumption of sugared beverages, high-fat diets, and total calories.

The main purpose of this analysis was to determine whether the relationships found in the 1998 HERO study were relevant today, given the changes in employees' health risks and health care costs that have occurred in the seventeen years since the original data were reported. We

# The consistency of relationships between risks and costs over a long stretch of time and changing health care landscape is remarkable.

found that positive relationships shown more than a decade ago between risks and costs still hold true, although the magnitude of those relationships shifted somewhat. This was the case even after we controlled for baseline disease severity, excluded outliers, and drew upon a different population almost twice the size of the original employee count. The consistency of positive and negative relationships between risks and costs over a long stretch of time and changing health care landscape is therefore remarkable.

**IMPLICATIONS FOR BUSINESSES AND POLICY MAKERS** What do these and the previous findings tell us that is relevant to employers and policy makers? Employers seeking guidance on where to invest resources in health promotion programs can make informed decisions based on which risks are most prevalent and costly for their organization. Data pointing to risk factors that are common and expensive can help these employers design cost-effective risk-detection and reduction programs likely to affect large segments of their workers and potentially produce substantial cost savings for businesses and workers alike.

It should be reemphasized that this analysis was cross-sectional and not focused on whether cost savings can be realized from risk-reduction programs. Just because risks are associated with higher costs does not mean that they cause higher costs, or that reducing risks saves money. Such inferences are reasonable, however, in light of abundant medical literature and recent worksite studies that have documented cost savings from risk-reduction efforts, as summarized in a recent meta-analysis.<sup>24</sup>

A sensible employer action emerging from these data would be to offer routine health risk assessment and biometric screenings to workers, followed by evidence-based health promotion programs aimed at improving population

health. Today, unlike the time when the HERO study was published, we are well into the process of amassing evidence on the effectiveness and cost-effectiveness of worksite health promotion programs.

We now know that effective programs provide individualized risk-reduction counseling within the context of a “healthy company” culture.<sup>25</sup> Best and promising practice programs have strong senior and middle management support, are grounded in behavior-change theory, are adequately resourced, have dedicated staff, have reasonable goals, use state-of-the-art interventions, and are regularly evaluated.<sup>26,27</sup>

A systematic review of worksite health promotion programs by the Centers for Disease Control and Prevention’s Community Guide Task Force concluded that multicomponent programs employing assessment of health risk, with feedback, followed by health education and behavior-change interventions, exert a positive influence on health behaviors, biometric measures, and financial outcomes important to employers.<sup>28</sup> The task force conclusions are magnified when one considers the relatively low costs of providing risk-reduction programs at worksites compared to prevention services delivered in clinical settings.<sup>29</sup>

A recent review by Harvard economists Katherine Baicker, David Cutler, and Zirui Song also highlighted savings from worksite programs and their potential for achieving a positive return on investment.<sup>30</sup> The investigators’ cost-savings estimates, drawn from a review of many decades of research, underscored the potential of a three-to-one return on investment from medical and absenteeism savings, over a three-year time horizon.

For policy makers, the results of the present analysis point to the value of health risk assessments as a way to measure associations between modifiable health risks and health care costs, as well as to identify potential targets for risk-reduction programs.

**CONCERNS REGARDING INTERPRETATION** Critics may argue that there is the potential for unintentional consequences arising from our findings. Some employers may choose to avoid hiring or even discontinue the employment of high-risk people to reduce organizational expenses. One problem with this course of action is that the risk factors examined here are common among workers and in the US population as a whole. Hence, limiting prospective hires to those at lower risk for key risk factors might not be a realistic or smart solution to the problem of high health care costs from a human resources perspective. More important, taking this approach would also be unethical and illegal.<sup>31</sup>

Another concern is that an employer attempting to act on the current findings may limit its health promotion program to the mere administration of a health risk assessment. The research is clear that health risk assessment administration by itself does not produce population health improvement.<sup>25</sup> Carefully crafted, and effectively implemented, follow-up health promotion programs are needed if there is hope of achieving long-lasting behavior change and risk reduction among workers.

## Conclusion

The HERO study published more than a decade ago broke new ground because it supported the untested idea that health risks prevalent among workers are associated with future health care spending. Moreover, these risks could be assessed with relative ease using a specific tool:

the health risk assessment. Many years later, the present study finds similar relationships between risks and costs and indicates that some of the more costly risks are now more prevalent.

Today, many employers are implementing health promotion programs that include regular behavioral and biometric screenings with the expectation that these initiatives will lead to cost savings. Although the Affordable Care Act encourages health promotion in the workplace, more research is needed to determine the impact of risk-reduction programs to help employers put in place practices that are both cost-effective and evidence-based. Achieving long-term behavior change and risk reduction in an employed population is, admittedly, difficult. Employers that succeed in doing so, however, may reap benefits from both lower medical spending and a more productive workforce. ■

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In this month's *Health Affairs*, Ron Goetzel and coauthors report on their effort to revisit the conclusions of a widely cited 1998 study, which showed a clear association between workers' modifiable health risks and increased health care costs. Examining ten common health risk factors in a working population, they found that the link still held—and that about one-fifth of the spending by employers and employees was attributable to the ten risk factors, such as depression, high blood pressure, and obesity. These findings indicate ongoing opportunities for well-designed and properly targeted

employer-sponsored health promotion programs that could produce substantial savings, the authors write.

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