

Financial Impact

Impact of a Health Promotion Program on Employee Health Risks and Work Productivity

Peter R. Mills, MD; Ronald C. Kessler, PhD; John Cooper, MD; Sean Sullivan, JD

Abstract

Purpose. Evaluate the impact of a multicomponent workplace health promotion program on employee health risks and work productivity.

Design. Quasi-experimental 12-month before-after intervention-control study.

Setting. A multinational corporation headquartered in the United Kingdom.

Subjects. Of 618 employees offered the program, 266 (43%) completed questionnaires before and after the program. A total of 1242 of 2500 (49.7%) of a control population also completed questionnaires 12 months apart.

Intervention. A multicomponent health promotion program incorporating a health risk appraisal questionnaire, access to a tailored health improvement web portal, wellness literature, and seminars and workshops focused upon identified wellness issues.

Measures. Outcomes were (1) cumulative count of health risk factors and the World Health Organization health and work performance questionnaire measures of (2) workplace absenteeism and (3) work performance.

Results. After adjusting for baseline differences, improvements in all three outcomes were significantly greater in the intervention group compared with the control group. Mean excess reductions of 0.45 health risk factors and 0.36 monthly absenteeism days and a mean increase of 0.79 on the work performance scale were observed in the intervention group compared with the control group. The intervention yielded a positive return on investment, even using conservative assumptions about effect size estimation.

Conclusion. The results suggest that a well-implemented multicomponent workplace health promotion program can produce sizeable changes in health risks and productivity. (*Am J Health Promot* 2007;22[1]:45-53.)

Key Words: Health Promotion; Efficiency; Absenteeism; Health Status Indicators; Prevention Research. Manuscript format: research; Research purpose: intervention testing/program evaluation; Study design: quasi-experimental; Outcome measure: productivity, absenteeism, behavioral; Setting: workplace; Health focus: fitness/physical activity, nutrition, smoking control, stress management weight control; Strategy: education, skill building/behavior change; Target population: adults; Target population circumstances: education/income level

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INTRODUCTION

Epidemiologic research has consistently documented a positive association between a variety of health risk factors and direct costs of illness among working people in a variety of settings.¹⁻⁴ Both the number and type of health risks have been shown to correlate directly with future medical and pharmacy claims costs.^{1,5,6} Individuals with multiple concurrent health risk factors have been shown to incur approximately double the costs of those with few or no risks.^{1,7} In addition, specific lifestyle risk factors such as tobacco use (current and previous), obesity, stress, and lack of regular physical activity individually confer consistently greater risks of incurring higher costs.^{4,8-11}

In addition to the relationship between employee health risks and direct costs, there is a significant amount of evidence linking health risks and indirect business costs in the form of absenteeism, workers' compensation costs, and decreased work performance (presenteeism).^{2,12-16} A number of studies have shown that health promotion programs can have positive effects on both individual health risk status and the associated costs.¹⁷⁻²¹

Improvements in health risk status can yield significant reductions in medical claims costs, which are all the more relevant when one notes that increases in health risks over time lead to sharp increases in incurred costs.¹⁷ In addition, participation in health promotion programs can reduce absenteeism compared with preprogram levels and in relation to nonprogram participants.²²⁻²⁴

More recently researchers have focused upon the area of presenteeism,

Table 1
Number of Participants in Each Group at Baseline and 12-Month Follow-up

	Intervention Group	Control Group
Total eligible population invited to participate	618	2500
Baseline questionnaire respondents (% of total population)	519 (84.0)	1679 (67.2)
Study end questionnaire respondents	266	1242
Study end questionnaire respondents as % of total eligible population at baseline	43.0	49.7
Study end questionnaire respondents as % of baseline respondent population	51.3	74.0

and in particular, quantifying the decrements in work performance associated with health risks.^{15,25-30} Indeed, the putative indirect workplace costs of illness have been the subject of growing interest in recent years as part of the larger interest in value-based purchasing.³¹ It has been suggested that the cost of presenteeism to a business may exceed the combined costs associated with medical claims and absenteeism.³² Another reason for the increase in interest in the area of work performance may be due to the shift away from manufacturing to service-based economies in the developed world, with attendant increases in competitive advantage based on human capital investment.³³

A number of self-report questionnaires designed to assess work performance have been developed and validated to help objectify research in this area.³⁴⁻³⁷ Studies using these instruments have documented strong associations between employee health and work performance.^{15,38-40} In addition, some uncontrolled studies have shown positive associations between improvement in health status and work performance.^{41,42} To our knowledge, there are no prospective controlled investigations that have looked specifically at the impact of workplace health promotion programs on presenteeism to date. The current report presents the results of such a study in which a quasi-experimental design was used to evaluate the effects of a multicomponent health promotion program on change in health risk status and work performance in a large corporation over a 12-month intervention period, compared with changes in the same outcomes among propensity score-matched controls.

METHODS

Design

This was a quasi-experimental 12-month before-after intervention-control study. Participants in both the control and intervention groups completed a health risk appraisal (HRA) questionnaire and the work performance section of the World Health Organization health and work performance questionnaire (WHO-HPQ) at baseline and in a follow-up survey 12 months after baseline. A multicomponent health promotion program was delivered to the intervention group during the intervening 12 months. No health promotion initiatives were provided to the control population during the study period.

The primary outcome variables were differences between the intervention and control groups in (1) cumulative count of health risk factors (derived from the HRA), as well as the WHO-HPQ derived measures of (2) workplace absenteeism and (3) work performance at the 12-month follow-up interview, adjusting for baseline differences on these same outcomes. Because the control group was not completely comparable to the intervention group at baseline, a weighting adjustment was made to correct for these differences using the method of propensity score.⁴³ The results reported here are based on those weighted data.

Sample

The intervention group consisted of the 618 full-time employees from three United Kingdom business units of Unilever PLC, a multinational manufacturer of food, home care, and personal care products. Employees of

the three business units were office based and engaged in service delivery rather than manufacturing. All intervention group members were asked to complete a secure online survey about their health and work performance both at baseline and 12 months after baseline. The response rate was 84.0% (n = 519) at baseline and 43.0% (n = 266) at follow-up. The control group consisted of a convenience sample of 1679 individuals, recruited from the community by a market research firm, who completed the baseline survey. A total of 2500 requests to participate were made by the firm, representing a 67.2% response rate. Control group members were selected to be employed full time in office-based service delivery jobs to match the intervention sample. The control group response rate at the 12-month follow-up was 49.7% (n = 1242). Table 1 details the numbers of respondents within each group at baseline and 12 months.

Measures

The baseline and 12-month follow-up surveys both included an HRA questionnaire³⁸ and the absenteeism and work performance questions from the WHO-HPQ.³⁷ The full details of the validation research that each questionnaire has undergone are published elsewhere; however, briefly, the HRA is a 24-item instrument that was specifically designed to capture health risk data within the corporate setting. The questions cover a number of domains, either as single items or as composites of multiple items, and capture data on risk status in 12 areas that have been shown to strongly predict future costs among employed people, either from medical care utilization, absenteeism, or presenteeism^{1,4,8,44} (see Table 2 for

Table 2
The 12 Health Risk Factors Assessed in the Survey

Health Issues and Risks	High-Risk Definition	Maximum Contribution to Cumulative Health Risk Factor Count
Alcohol	Consuming more than the United Kingdom Department of Health's recommended weekly levels for safe alcohol consumption by gender (21 units [approximately 169 g] of alcohol for men and 14 units [approximately 112 g] of alcohol for women)	1
Smoking	Smoking on a daily basis	1
Body weight	Body mass index >27.5	1
Physical activity	Being sedentary or doing <1 h of moderate-intensity physical activity per wk	1
Nutrition	Low daily consumption of fruit and vegetables (<3 combined servings) and dietary fiber (<12 g), together with excess consumption of high-fat foods	1
Medical health	≥1 of the following chronic conditions: asthma, cancer, chronic obstructive pulmonary disease, diabetes, heart disease, hypercholesterolemia, hypertension, migraines, depression, other, undefined serious medical condition (respondents were given the option to state that they had other diagnosed medical conditions that were not included in the above list)	9
Pain	Moderate to severe bodily pain during previous 3 months	1
Stress	Frequent feelings of being overwhelmed with pressure and stress together with rarely feeling calm; Regularly feeling sad and having low energy	1
Sleep	<7 h of sleep per night together with feeling unhappy with sleep quality and feeling tired and unrefreshed during the day	1
Perception of general health	Indicating that overall health is "poor" on five-point scale (possible answers: excellent, very good, good, fair, or poor)	1
Job satisfaction	Low levels of job satisfaction and low levels of job control	1
Seat belt usage	Using a seat belt "seldom" or only "sometimes" when driving or riding as a passenger in a car	1

a complete list and explanation of all risks captured by the HRA). Questions are displayed as either five-point Likert-scales or as structured multiple-choice questions. The multi-item domains showed good interitem correlations, with Cronbach's α values between .73 and .83. Construct validation against SF-36 scales showed good correlation in the relevant areas of mental and physical health. Test-retest validity over a 4-week period yielded a correlation coefficient of .9 between answers at both time points. Data from the HRA was used to code individuals as either high risk or not high risk in each of the areas assessed. The medical health domain attributes one risk factor for each medical condition on the checklist of nine possible conditions; hence, the maximum possible health risk factor count for an individual is 21, with a minimum of zero.

The work performance section of the WHO-HPQ is a 12-item questionnaire that is structured to capture data about an individual's role and responsibilities and how he or she performs in comparison with others in similar roles. It culminates in a self-report assessment of work performance over

the preceding 4 weeks. Validation against specific employer-collected work performance measures in four different groups of employees (reservation agents, customer service representatives, executives, and railroad engineers) showed good correlation between the output from the WHO-HPQ and the work performance data collected by employers, with the odds ratio of the WHO-HPQ identifying those individuals in the lower quintile of work performance in each of the four employee groups ranging from 3.2 to 12.3. Sample questions from both the HRA and WHO-HPQ are shown in Table 3.

The three primary outcome measures used in this study were a summary count of the 12 health issues or risks obtained from the HRA, the HPQ measure of the past 4 weeks' absenteeism (number of full and partial days of sickness absence in the 4 weeks prior to the interview), and the HPQ measure of the past 4 weeks' work performance (score on a 0–10 self-anchoring scale, in which 0 is equivalent to doing no work while on the job and 10 is equivalent to the performance of a top worker). Secondary outcomes were (1)

an estimate of the likely value of any observed changes in health risk status in the form of a return on investment (ROI) calculation for the employer and (2) an assessment of the impact of the intervention upon the individual health risk factors captured by the HRA. Health care utilization data were not available for the study population; hence, calculations of financial benefit were limited to attributing value to improvements in absenteeism and presenteeism based upon employee salary costs.

Lottery tickets for a prize draw were used as incentives to increase the response rate at the baseline and follow-up surveys in both the intervention and control groups. All participants were required to sign an electronic consent form prior to beginning the baseline survey agreeing to allow their personal data to be used for research purposes. All data transfer used 128-bit encryption, and all data storage and access were fully compliant with the United Kingdom Data Protection Act (1998). The United Kingdom Central Office for Research Ethics Committees waived the need for ethical review of this study.

Table 3
Sample Questions for the Health Risk Appraisal and the World Health Organization Health and Work Performance Questionnaire

Question Text	Answer Text	Source
How often do you eat a portion of fruit or vegetables?	Rarely or never Occasionally, less than once a day 1 to 2 times a day 3 to 4 times a day 5 or more times a day	HRA
How much of the time over the past three months have you felt depressed or sad?	Not at all A little of the time A moderate amount of the time Most of the time All of the time	HRA
On a scale of 0 to 10, where 0 is the worst job performance anyone could have at your job and 10 is the performance of a top worker, how would you rate your overall performance on the days you worked during the past 4 weeks?	0–10 scale labeled at 0 with worst performance and at 10 with top performance	WHO-HPQ
In the past 28 days, how many days did you miss an entire work day because of problems with your physical or mental health?	Number input box	WHO-HPQ

Intervention

HRA data from the intervention group participants were used to inform and drive the implementation of health promotion programs at each of the three intervention worksites. All individuals who completed the initial baseline HRA (n = 519) were offered all elements of the intervention program via e-mail communication. Each respondent received a personalized health and well-being report that gave them a wellness score and information and advice tailored to his or her readiness to change health-related behaviors. The report highlighted the personal health areas in need of improvement and gave practical suggestions as to how to achieve the recommended changes. Intervention group participants were also given unlimited access to a password-protected personalized health, well-being, and lifestyle web portal that included articles, assessments, and interactive online behavior-change programs. Participants also received tailored e-mails every 2 weeks on personal wellness topics that were relevant to them. Tailoring was based upon age, gender, and known health risks for the individual (derived from the individual's HRA data). Each e-mail was approximately 400 words and was designed to provide practical tips for self-improvement and encourage use of the health

portal. In addition to the Internet-delivered materials, intervention group participants received four paper-based packs during the study period based upon the four most prevalent health risks identified across the whole population from the HRA. Each pack contained a two-page newsletter and health promotional literature. The first pack contained literature on stress management, the second on sleep improvement, the third on nutritional balance, and the fourth on physical activity. A series of four on-site seminars, also focusing on the four most prevalent wellness issues, were offered to the intervention participants during the 12 months of the study. Individuals from the control group received none of these interventions and were merely asked to complete the questionnaires at both time points with no feedback on their health status.

Analysis

As noted above, a weighting adjustment was made for baseline differences between the intervention and control groups on annual salary (categorized into three bands), age, gender, number of health risk factors (from HRA), absenteeism in the previous 4 weeks (from WHO-HPQ), work performance scores (from WHO-HPQ), and hours the employer expected the employee to work in a typical week, using the propensity score-weighting method.⁴³

The same method was then used to adjust for differences between 12-month follow-up survey respondents and those that completed the baseline questionnaires but not the 12-month follow-up within both the intervention and control groups. Linear regression analysis was used to analyze the weighted data to estimate the significance of differences in changes in the outcomes between intervention and control respondents. The regression equations used a dichotomous predictor coded 1 for intervention group respondents and 0 for control group respondents to predict the outcomes, controlling for age, sex, baseline salary, and baseline scores on the outcome variables. The control for baseline scores on the outcomes included both a linear term and polynomials to capture the effects of systematic non-linear elements of change. The overall impact of the intervention was evaluated by looking at the significance of the regression coefficients associated with the intervention-control dichotomy. Subsample variation in intervention effects across subgroups of the sample was also evaluated. This was done by creating interactions between the intervention-control dichotomy and various subgroup variables (age, sex, baseline salary, and number of health risk factors). The statistical significance of these interactions was

Table 4
Baseline Demographic Characteristics Comparing the Intervention and Control Groups for Unweighted and Weighted Samples

	Unweighted			Weighted		
	Intervention	Control	<i>z</i> (<i>p</i>)	Intervention	Control	<i>z</i> (<i>p</i>)
Gender, % male	46*	38	2.4 (0.02)	46*	54	-2.1 (0.04)
Mean age, y (SEM)	35.2* (0.47)	41.9 (0.33)	-9.0 (0.001)	34.5 (0.4)	34.3 (0.69)	0.2 (0.81)
Mean no. of health risk factors (SEM)	2.66* (0.12)	4.36 (0.08)	-9.8 (<0.001)	2.92 (0.1)	2.74 (0.15)	1.5 (0.14)
Mean HPQ work performance rating (SEM)	7.54 (0.008)	7.36 (0.007)	1.2 (0.23)	7.60 (0.07)	7.49 (0.12)	1.0 (0.32)
Mean absences in preceding month, d (SEM)	0.35* (0.05)	1.62 (0.13)	-4.5 (<0.001)	0.38 (0.04)	0.58 (0.13)	-1.5 (0.13)

HPQ indicates health and work performance questionnaire; and SEM, standard error of the mean.
 * Significant intervention-control difference at the 0.05 level, two-sided test.

used to determine whether the magnitude of intervention effects varied across subgroups. Finally, in an effort to interpret the effect of the intervention on the summary count of health risk factors, logistic regression analysis was used to estimate the effect of the intervention on change in each of the 12 individual health risk factors over time (linear regression analysis was used to analyze the count of medical conditions), controlling for baseline risk status. Statistical significance was consistently evaluated using .05-level, two-sided tests.

RESULTS

The weighted baseline intervention and control samples were 46% and 54% male, with mean ages of 34.3 and 34.5 years, means of 2.9 and 2.7 health risk factors, means of 0.4 and 0.6 absenteeism days in the month before baseline, and means of 7.6 and 7.5 on the 0 to 10 scale of work performance, respectively (see Table 4 for demographic characteristics). Gender, but not the other variables, differed significantly between the two groups, although, as noted above, the effects of gender were controlled in the regression analyses.

Individuals who completed the baseline survey but did not complete the study end survey showed no significant differences in terms of gender, baseline work performance score, or absenteeism. Individuals who were lost

to follow-up, however, tended to be younger and have fewer baseline health risk factors than those who completed the follow-up interview, both in the intervention and in the control samples. Unweighted mean age (standard error of the mean) for intervention dropouts was 33.2 (0.5) vs. 35.2 (0.5) for those who remained engaged ($p = .004$). Unweighted baseline health risk count was 1.9 (0.1) and 2.7 (0.1), respectively ($p < .001$). Similarly for the control group, mean age for dropouts was 39.2 (0.4) vs. 41.9 (0.3) for completers ($p < .001$) with baseline health risk count being 3.0 (0.06) vs. 4.4 (0.08), respectively ($p < .001$).

Although individual use of the different elements of the health promotion program was not tracked, group usage data for the online portal showed regular engagement across the intervention group. Over the 12 months of the study, log-ins to the portal showed cyclical peaks, with increased use following the biweekly e-mail communications. Annual log-ins averaged 12.3 for the 266 individuals who completed the questionnaires at baseline and study end and 8.9 for all 519 eligible individuals.

The average number of health risk factors assessed in the HRA decreased significantly in the weighted intervention group between baseline and the 12-month follow-up, with a mean decrease of -0.48 health risk factors (Table 5). The average score on the

work performance scale increased significantly in the intervention group by 0.61 points (from a baseline mean of 7.6). No significant changes occurred in any of the comparable outcomes in the weighted control group. Improvements in all three outcomes were significantly greater in the intervention group than the control group in regression analysis: a greater average reduction of nearly one-half a health risk factor (0.45), more than one-third of a monthly absenteeism day (0.36), and close to one point on the 0 to 10 scale of work performance (0.79). In the case of absenteeism, the significant effect was due more to an increase in the control group than to a decrease in the intervention group.

The regression analysis was expanded to evaluate the significance of differential intervention effects based on respondent age, sex, salary, and baseline number of health risk factors (Table 6). None of these interactions was significant in predicting either change in health risk factors ($z = 0.2-1.9$; $p = .06-.84$) or change in work performance ($z = 0.4-1.3$; $p = .18-.70$). Significant interactions were found with both age ($z = 2.1$; $p = .033$) and sex ($z = 3.0$; $p = .003$) in predicting change in absenteeism. Joint analysis of these two interactions showed that the intervention had a strong effect on absenteeism reduction (3.02 days) in the month before the follow-up survey among women older than sample-wide mean age,

Table 5
Linear Regression of Outcomes Assessed in the 12-Month Follow-up Interview on a Dichotomous Predictor for Intervention vs. Control Group, Controlling for Baseline Measures of Sociodemographics and Outcomes (n = 1508)†

	Mean Change in Outcome		b (SE)	z	p
	Intervention Mean (SE)	Control Mean (SE)			
Health risk factors	-0.48 (0.09)	-0.05 (0.11)	-0.45* (0.13)	3.5	<0.001
Absenteeism	-0.03 (0.05)	0.18 (0.18)	-0.36* (0.13)	2.7	0.007
Work performance	0.61 (0.07)	-0.06 (0.13)	0.79* (0.11)	7.1	<0.001

SE indicates standard error.

† The sample consisted of 266 intervention respondents and 1242 controls, all of whom participated in both the baseline and 12-month follow-up surveys. Cases were weighted to adjust for baseline differences between intervention and control samples, as well as for differences between respondents and nonrespondents to the 12-month follow-up survey on a wide range of baseline survey measures. Controls included age, sex, salary, and baseline measures of the outcomes. Both linear and nonlinear (polynomial) transformation of baseline outcome measures were included to control for systematic nonlinear changes unrelated to the intervention.

* Significant at the 0.05 level, two-sided test.

a statistically significant but much more modest effect on this same outcome among younger women (0.42 days), and insignificant effects on this outcome among older and younger men (-0.05 and 0.04 days, respectively).

Regression analysis investigating the impact of the intervention on each of the 12 health risks factors assessed by the HRA showed a significant effect in favor of the intervention in seven of the 12 assessed areas. The intervention significantly improved risk status (i.e., changing from high risk to not being high risk) in the areas of alcohol consumption, nutrition, sleep, stress, physical activity, perception of general health, and seat belt usage ($p < .05$ for all).

The value of the observed 0.36 less days of absenteeism and the 0.79-point (10.4%) productivity improvement to the employer in the previous month can be crudely quantified by calculating the annual salary cost of this extra productive time. It is assumed that the improvements occurred in a linear fashion over the 12-month period of the study and that absenteeism and presenteeism remain unchanged within the nonparticipant groups (both those who did not engage at all over the 12-month period and those that engaged at the beginning but not at the end). The average pretax annual employee salary of the intervention group was £35,000 (approximately \$69,000), which equates to a daily employment cost of £145.83 for a 48-week year and an hourly cost of £18.23

for an 8-hour day. The cost of the full year-long program to the employer was £70.00 (\$138) for each of the 618 eligible employees. Based upon this base cost and the observed annual improvements in absenteeism, the ROI for the program, presuming the improvements occurred in a linear fashion over the course of the year, for the observed 4.3 fewer annual absenteeism days is 1.9:1 in salary costs alone. Monetizing the documented improvements in work performance is slightly more difficult. The 0.79-point improvement in the work performance score, if considered linear, represents full productivity for an additional 7.9% of working time over a 4-week period. It is unrealistic to presume that this time was previously spent idle; however, it is probable that it was spent at less than optimal performance. If one presumes that prior to the commencement of the program this time was spent working at 50% capacity, whereas in the month prior to program end it was spent at full capacity, then a monetary value based upon salary costs can be attributed to the improvement in work performance in a similar fashion to absenteeism. In this case, an additional 6.32 hours of fully productive working time was gained over a 4-week period (160 hours \times 0.079 \times 0.5), which has a salary cost within the study organization valued at £115.21 (\$227). Over the period of a working year, and again assuming the improvement in work performance was linear over the course of the 12-month study, this is equiva-

lent to a return of £691.26 (\$1364) per individual. Combining the returns from both the absenteeism and work performance models yields an ROI of 6.19:1.

DISCUSSION

A limitation of this study is that outcomes were based entirely on self-reports, rather than medical examinations (to assess the presence of disease or health risk factors) or administrative records (to document absenteeism and work performance). It is noteworthy, though, that previous longitudinal research has consistently shown that each of the self-reported health risk factors considered here significantly predict increases in health care costs documented in claims data, that the HPQ self-reported absenteeism measure significantly predicts payroll records, and that the HPQ self-reported work performance measure significantly predicts administrative records of work performance.^{1,4,37,39,44}

Another limitation is that the use of group-level intervention components (i.e., the on-site seminars and workshops) made it impossible to randomize at the individual level, requiring the evaluation of intervention effects to be quasi-experimental rather than experimental. We attempted to address this limitation by constructing a control group that was similar to the intervention group in terms of job type and by using propensity scoring weighting to adjust for residual differences on key study variables. Propensity score ad-

Table 6
Linear Regression of Absenteeism in the Month Before the 12-Month Follow-up Interview on a Dichotomous Predictor for Intervention vs. Control Group, Separated into Subsamples Defined by the Cross-Classification of Age and Gender, Controlling for Baseline Measures of Sociodemographics and Outcomes†

	Mean Change in Absenteeism		b (SE)	z	p	n
	Intervention Mean (SE)	Control Mean (SE)				
Young women‡	-0.04 (0.06)	0.01 (0.31)	-0.42* (0.20)	2.1	0.039	527
Young men‡	-0.02 (0.10)	0.08 (0.17)	-0.05 (0.22)	0.2	0.82	236
Older women‡	-0.24 (0.14)	2.45 (1.96)	-3.02* (0.52)	5.8	<0.001	383
Older men‡	0.16 (0.23)	0.12 (0.23)	0.04 (0.32)	0.1	0.90	362

SE indicates standard error.

† The number of intervention respondents and controls, respectively, in the four subsamples were 112 and 415 young women, 85 and 151 young men, 31 and 352 older women, and 38 and 324 older men. All of these respondents participated in both the baseline and 12-month follow-up surveys. Cases were weighted to adjust for baseline differences between intervention and control samples, as well as for differences between respondents and nonrespondents to the 12-month follow-up survey on a wide range of baseline survey measures. Controls included age, sex, salary, and baseline measures of the outcomes. Both linear and nonlinear (polynomial) transformation of baseline outcome measures were included to control for systematic nonlinear changes unrelated to the intervention.

‡ Older women and men were older than the sample-wide mean age, and younger women and men were younger than the sample-wide mean age.

* Significant at the 0.05 level, two-sided test.

justment was also used to address the problem of the relatively low follow-up survey response rate in the intervention group. We recognize, though, that these approaches cannot compensate for the lack of individual-level randomization and incomplete follow-up ascertainment, resulting in uncertainties about the extent to which results generalize beyond the subsample of respondents. This limitation could be partially obviated by conducting future research in a large company with multiple facilities. Different locations could be cluster randomized either to receive a health promotion intervention or to serve as controls.

Although 84% of the total eligible intervention group population completed the questionnaires at baseline, at study end the response rate fell to only 43% of the total population (51% of the population who completed the original baseline questionnaires). Without conducting poststudy interviews of noncompleters (both those who did not complete any questionnaires and those that only completed baseline questionnaires), it is difficult to be certain about reasons for this fairly significant drop-off in engagement. However, it is clear that significant business reorganization during the period of the study had an impact. Of the 519 individuals who completed the questionnaires at baseline, 73 (14%) were either made redundant or were relocated, and it is indeed possi-

ble that participating in the study took on a lower priority for those remaining. Despite this, the participation rates exceed those commonly reported within the industry for completion of HRAs.⁴⁵

There may also be some concern regarding nonequivalence of the intervention and control groups in terms of survey response rates at baseline and at the 12-month follow-up. The control group was recruited as a “convenience” sample (i.e., without any effort to achieve a high response rate from an initial probability sample) by a market research company; although there was a difference between the two groups in initial response rate (84.0% vs. 67.2%), the study end response rate was similar in terms of the total eligible population for both groups (43.0% vs. 49.7%). In addition, it is also possible that differences in employer policies toward attendance, time away from work, and rewarding productivity between the intervention and control groups could be an additional contributor to nonequivalence between the two groups. The extent to which these differences led to bias within the results is difficult to quantify but should be kept in mind when interpreting the results.

It is possible that the baseline intervention group respondents who did not participate in the interventions were especially likely to be nonrespondents in the follow-up survey, leading

to an upwardly biased estimate of positive change in the subsample of intervention subjects who participated in the follow-up survey. Site usage data do indeed suggest that engagement with the online component of the intervention was less by those individuals who did not respond to the follow-up survey, with average log-ins for the whole eligible population being approximately 28% lower than for those that completed both surveys. Future research should focus on increasing survey response rates and developing outcomes that can be measured for all workers (e.g., administrative data on sickness absence and productivity).

Within the context of these limitations, the results reported here present valuable additional evidence that a well-implemented multicomponent workplace health promotion program can produce sizeable positive changes in health risk status, absenteeism, and work performance in engaged individuals. Importantly, in light of the concern raised in the last paragraph about selective survey nonresponse in the intervention group, the improvement in work performance in the intervention sample is so large that it would remain statistically significant even if we assumed that there was no effect on this outcome among the survey nonrespondents in the intervention group. This can be seen by noting that the 0.79 estimated effect on increased work performance in the

43% of the workforce that participated in the follow-up survey is equivalent to a 0.34 increase in the total workforce assuming no effect among the 57% of workers who were final survey nonrespondents. An effect size of 0.34 remains statistically significant due to the standard error of the estimate being 0.11 ($z = 3.0$; $p = .009$).

Another way to evaluate the significance of the intervention is to think in terms of cost-benefit from the employer perspective in the form of ROI. The intervention cost to the employer was approximately £70.00 (\$138) per worker, which is equivalent to approximately £165.00 (\$325) per worker who participated in the follow-up survey. Based upon salary costs alone, the improvements in absenteeism and work performance can be modeled to represent a good ROI for employers such as Unilever, with highly skilled and well-paid employees. The financial modeling presented in this paper is likely to represent an underestimate of the true benefits of such a program on the employee population. It is possible that individuals who did not complete the 12-month follow-up survey did gain some benefit from the intervention. This is indeed shown by appreciable usage of the health portal by this group, and although this usage was lower than full respondents within the study, it can be postulated that this had a positive effect upon health-related behaviors. In addition, although difficult to quantify, factoring in savings associated with greater productivity to the organization as a whole (e.g., client satisfaction, improved revenues) could increase the potential ROI even further.

The magnitude of improvements seen in health risk status, absenteeism, and work performance within the intervention population are broadly similar to those documented in uncontrolled studies of health promotion efficacy.^{17,24,41} These earlier studies, lasting ≥ 12 months, showed an average before-after health risk factor improvement in the range of 0.5 to 1.0 and annual reductions of ≤ 6 days in absenteeism when compared with nonprogram participants. The one uncontrolled before-after study that evaluated change in work performance after health promotion intervention

found a significant increase of 9% in this outcome over a 12-month follow-up period.⁴¹ It would therefore appear that the observed improvements documented by this study are not only in keeping with previous research in this area but, in the case of the improvement in health risk status within the intervention group, are “clinically” relevant due to the fact that work performance also improved.

We are unaware of any previous research that has investigated the differential effects of health promotion interventions on workers as a function of age, gender, salary, or number of baseline health risk factors. The consistency of the estimated intervention effects on health risk factors and work performance across all of these segments of the workforce is striking. This is especially so with regard to consistency as a function of baseline number of health risk factors because it can be interpreted as showing that the intervention was as effective in preventing onset of new risks as it was in reducing preexisting risks.

It is unclear how to explain the one major exception to the general pattern of consistent intervention effects across subgroups: the finding that the estimated effect of the intervention in reducing absenteeism was confined to women and was much stronger among older than younger women. In addition, the estimated effect of the intervention on absenteeism was associated more with increased absenteeism in the control group than with decreased absenteeism in the intervention group. Previous methodologic research has shown increases in absenteeism in nonparticipant groups as well as little or no improvement in those receiving interventions. In addition, Schultz et al.²⁴ and Knight et al.⁴⁶ showed an increase in absenteeism in both participants and nonparticipants in such settings. Control variables played an important part in determining the estimated effect, as the raw intervention-control difference in the mean difference score was not significant before introducing these controls. It is clear that further investigation is needed in this area to better understand the impact of health promotion interventions upon absenteeism in different occupational settings. Based

on all of these observations, the estimated effect of the intervention on absenteeism should be interpreted with caution.

Even if we accept the evidence reported here as demonstrating the effectiveness of a low-cost model health promotion intervention on a range of outcomes of importance both to workers and to employers, this has to be seen as merely a first step in what should be a series of related investigations to determine whether interventions of the sort studied here have effects that persist beyond the 12-month follow-up period and in broader segments of the workforce than the relatively well-educated and well-paid part of the service sector considered in this report. By extending the follow-up period of such research beyond 12 months, the likelihood of the observed effects being due to a Hawthorne effect are diminished. It would also be useful for future research to contain an intervention arm that provided only self-directed tools such as books or videos to help evaluate the relative importance of these materials compared with the group process and tailored elements in the full intervention.

SO WHAT? Implications for Health Promotion Practitioners and Researchers

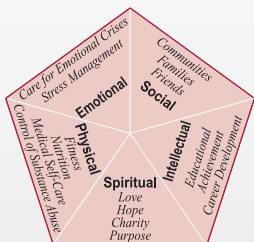
The current study seems to indicate that a well-implemented multicomponent health promotion program can not only improve the health status of participants but also improve their work performance. When other recent research in the area of work performance and presenteeism is combined with the study presented here, there seems to be good support for the assertion that health promotion programs can improve work performance and hence have the potential to provide an ROI to employers. However, caution is needed in interpreting the results of this study because of the relatively low response rate and inexact matching of cases and controls. Further research is still needed in this area, with the ideal study design being a randomized controlled trial.

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(O'Donnell, *American Journal of Health Promotion*, 1989, 3(3):5.)

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