

A Novel Stress and Coping Workplace Program Reduces Illness and Healthcare Utilization

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Objective: The purpose of this study was to determine if a novel workplace stress management program, delivered either face-to-face or by self-help, would reduce illness and health services utilization among participants. **Methods:** Five hundred one volunteers were randomly allocated to one of three groups: full intervention, which received assessment and personalized self-study feedback and was offered six face-to-face, small-group sessions; partial intervention, a self-help group that received assessment and personalized feedback by mail; and a wait-list control group. All participants completed questionnaires for stress, anxiety, and coping at the start of the study and 6 and 12 months later. Health reports were completed at 0, 3, 6, 9, and 12 months. A subsample of subjects who subscribed to a single health maintenance organization provided objectively recorded doctor visit data across the study year. **Results:** All three groups reported significant improvement in their stress, anxiety, and coping across the year. Full intervention participants showed a more rapid reduction in negative responses to stress than did participants from the other groups. Full-intervention subjects also reported fewer days of illness than subjects in the other groups. Objectively measured physician visits showed a large (34%) reduction in healthcare utilization for full intervention subjects in the HMO subsample. **Conclusions:** These results indicated that a work-site program that focuses on stress, anxiety, and coping measurement along with small-group educational intervention can significantly reduce illness and healthcare utilization. **Key words:** stress, coping, stress management, healthcare utilization, illness reporting, work site.

ANOVA = analysis of variance; HMO = health maintenance organization; QHRQ = Quarterly Health Report Questionnaire; ROC = relative operating curve; SCI = Stress and Coping Inventory; STAI = State-Trait Anxiety Inventory.

INTRODUCTION

Stress management intervention studies designed for implementation in the workplace have steadily increased in number during the past two decades (1–7). A primary stimulus for the development of these programs has been the rapidly escalating healthcare and insurance costs borne by American industry today (2, 3, 8, 9). The existing assumption is that stress management programs can help contain these costs (2–4, 8, 10).

Workplace stress management programs vary widely (1, 7, 11–13). Primary prevention efforts attempt to identify and correct major stresses at the work

site, whereas secondary prevention efforts focus on helping employees cope more effectively with workplace demands (11, 14, 15). Our study was a secondary prevention approach that used stress and coping measurement, personalized feedback, and small-group education, in contrast to more commonly used approaches that focus on physical fitness training, relaxation, and meditation (1).

Educational materials used in a stress management program are important to consider. Printed materials, by themselves, have been shown to have minimal effects (1, 7). Although more costly in terms of professional time, educational materials used in small-group settings have significantly reduced illness recurrence and healthcare utilization in post-myocardial infarction patients over a subsequent 3- to 4-year interval (16). Therefore, we used a small-group settings approach in this investigation (17).

Stress and coping measurement is a complex area. Self-reports have included the types and numbers of recent life-change events, the perceived impact of such events on an individual, and various assessments of coping (11–15, 18–21). These reports can be obtained in the form of questionnaires, personal logs, or by interview. During the past several years the first author developed the Stress and Coping Inventory (SCI) as a comprehensive set of questionnaires designed to gather self-report data in four areas of life stress along with four aspects of coping (18–20). The SCI has demonstrated potential utility for health risk appraisal for morbidity. Persons with stress scores that are higher than their coping assessments proved to be at greater risk for illness than those with balanced stress and

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coping scores. Lowest risk was seen for persons with coping assessments higher than their stress scores (20).

Lastly, workplace stress management programs have suffered from several methodological difficulties. In a recent review, only 16% of studies had more than 100 participants and only 2% had more than 300 persons included (1). Follow-up intervals in these studies exceeded 3 months' time in only 13% of the investigations and were longer than 6 months in just 6% of studies. Women outnumbered men at a ratio of 2 to 1. Random allocation of subjects to treatment and control groups was done in only half of these investigations.

The purpose of this study was to examine the effects of a stress and coping measurement, personalized feedback, and an educational program, delivered either face-to-face in small groups of subjects or using a self-study approach, on reducing illness and healthcare utilization in a large sample of working men and women. The novel aspect of this investigation was the use of sophisticated stress and coping measurements for health risk appraisal of all-cause morbidity and personalized feedback along with small-group education as our intervention (16–22). We hypothesized that both interventions would significantly reduce both illness and healthcare utilization among participants in the two intervention groups as compared with those in the wait-list control group and that the face-to-face intervention would prove significantly more beneficial than the self-study program.

METHODS

Recruitment of Subjects

Participants were employees at one of three work sites in Santa Clara County, California. Two workplaces were involved with the manufacture of computer equipment, and the remaining site was a local city government. Participants were recruited through notices placed in employee newsletters or posted on bulletin boards as well as booths set up at computer industry and city government health fairs.

Instructions to Volunteers

Volunteers were invited, approximately 10 to 40 persons at a time, to a conference room to be briefed on the study. Supervisors approved 1½ hours of work time for reading and signing informed consent, questions and answers about the study, and completion of the questionnaires.

The purpose of the study was presented on the first page of the informed consent document, which was approved by the Committees for the Protection of Human Subjects at the University of Nevada School of Medicine and at Stanford University School of Medicine. The informed consent document stated in its opening paragraph, "You are invited to participate in a study of the effectiveness of a work site stress management intervention designed to reduce stress-related symptoms. We hope to determine if a stress management intervention will reduce symptoms of stress and med-

ical utilization and if a self-help program works as well as a more intensive face-to-face one."

This page of the informed consent document went on to explain that all subjects would later be randomly assigned to one of three groups. One group, the full intervention group, would receive personalized feedback from their questionnaires at a wellness seminar, where results would be reviewed and questions could be asked. Members of this group would also be eligible to attend six face-to-face, small-group educational sessions to be held at their workplace. The partial intervention, or self-help, group would receive their personalized feedback by mail. Wait-list control subjects would receive no personalized feedback from their questionnaires until the end of the investigation. Both partial intervention and wait-list subjects would be invited to attend a wellness seminar immediately after the completion of the study, where feedback on their final set of questionnaires would be provided. Finally, informed consent also included permission to review participants' healthcare utilization records from their managed care organization over the year-quarter before the study as well as for the year of the investigation.

Measurements

The SCI was used to gather subjects' demographic information as well as their reports of stress and coping in their lives. The SCI combines existing questionnaires from the public domain with others that were newly developed for this instrument (18, 20, 21). SCI stress measures include demographic information, the Recent Life Changes Questionnaire, a measure of recent physical and psychological symptoms (including a depression scale), a negative responses to stress scale, and selected behaviors and emotions associated with heart disease and cancer risk (20). SCI coping scales included a measure of personal health habits (diet, exercise, smoking, and pace), a social support questionnaire, a positive responses to stress scale, and a measure of current life satisfaction in the areas of health, work, home and family, community, and finance. As reported elsewhere, reliability estimates for the major scales and subscales of the SCI are satisfactory to highly satisfactory, with 21 of 25 Cronbach's α values above 0.60, and 17 of 25 α values above 0.70 (20). The four scales with low Cronbach's α scores were dropped from our analyses. Test-retest correlation between the summary score for two administrations of the SCI, across a 6-month interval, was $r = .70$.

The State-Trait Anxiety Inventory (STAI), Trait Form, Y-2, was used to assess subjects' level of anxiety. Psychometric properties of the STAI have been reported previously (22). The SCI and STAI were completed at the beginning of the study (time 0), 6 months into the investigation (6 months), and at the end of the study year (12 months).

The Quarterly Health Report Questionnaire (QHRQ) was completed at time 0 and at 3 months, 6 months, 9 months, and 12 months across the study year. On this questionnaire subjects recorded any illnesses and/or injuries they had experienced, the number of days they were ill or disabled, the number of days they missed work due to illness or injury, and doctor visits, emergency room visits, and hospitalizations across the previous 3-month interval.

Objectively recorded physician visits were gathered by review of computerized medical records for subjects enrolled in a single large health maintenance organization (HMO) that provided us access to these data. Nearly one third of the participants were members of this HMO.

Interventions

Five hundred one volunteers were assigned, using a random numbers methodology, to the full intervention ($N = 171$), partial intervention ($N = 166$), or wait-list control group ($N = 164$). The majority of participants were recruited over a 4-month interval from April through July. The follow-up portion of the study began in the autumn and continued for 1 year.

Personalized feedback. Optically scanned data from the SCI were transferred to a database and then directed to an expert system that created a nine-page personalized feedback report with both text and tables. This feedback report was then interspersed among 27 workbook pages to create a 36-page personalized workbook.

Wellness seminar. All subjects assigned to the full intervention group attended a 90-minute seminar, where the feedback materials were distributed and discussed. The senior author conducted these seminars, which were held at the participants' workplaces. Small conference rooms were used, and approximately 30 persons were present at each seminar. At the end of the seminar, the small-group educational sessions were explained.

Small-group educational sessions. These sessions were conducted every other week over 3 months' time for persons in the full intervention group. All full intervention subjects were invited. The computer industry companies allowed 1 hour for these sessions and often requested that they be held during the lunch hour. The city government allowed 90 minutes for these sessions and allotted time from employees' normal work hours for their attendance.

Sessions were led by a team composed of a psychiatrist and a

nurse. Two such teams covered the three work sites. The approach to each of the six sessions was scripted in advance so that both teams covered the same materials. Attendance ranged from 4 to 24 individuals, with an average of 15. Topics were personal wellness goals (session one), stress and stress response (sessions two and three), and coping with stress (sessions four through six).

SCI and STAI Analyses

The two work sites (computer industry and city government) were analyzed separately because of differences in demographic characteristics of the subjects as well as in workplace atmosphere. For example, demographic differences between employees at these two sites were significant for age, ethnicity, education, and occupational level (Table 1). Also, sick leave policies, overtime work demands, and pace of work were very different.

Demographic characteristics of computer industry participants were compared with those of city government participants by analysis of variance (ANOVA) and χ^2 tests. Furthermore, demographic characteristics of subjects with complete data for all three SCI administrations ($N = 343$), labeled as study "completers," were compared with those of subjects with complete data for only one or two administrations of the SCI ($N = 158$), labeled "noncompleters," by ANOVA and χ^2 tests. For completers, 3×3 repeated-measure analyses of variance were performed on all stress, anxiety, and coping measures to determine the effects of three points in time by three group conditions, run by work site.

TABLE 1. Demographic Characteristics of the Sample by Work Site

Demographic Variable	Computer Industries ($N = 167$)				City Government ($N = 176$)			
	Full Intervention	Partial Intervention	Wait-List Control	Total	Full Intervention	Partial Intervention	Wait-List Control	Total
Age, mean (SD), y	40.9 (9.5)	42.9 (10.3)	40.7 (9.8)	41.5 (9.9) ^a	45.1 (8.6)	43.6 (9.6)	43.4 (9.3)	44.1 (9.1) ^a
Gender, %								
Male	50	55	42	49	41	39	48	43
Female	50	45	58	51	59	61	52	57
Ethnicity, %								
White	72	86	79	79	64	67	77	70 ^b
Asian	17	7	12	12	17	13	7	12
Hispanic	4	2	7	4	14	14	13	14
Black	0	2	0	1	2	4	3	3
Other	7	4	2	4	3	2	0	2
Education, %								
Less than high school	2	2	5	3 ^b	0	2	2	1 ^b
High school graduate	12	9	7	9	14	11	18	14
Post high school	15	18	20	18	34	33	23	30
College graduate	17	16	25	20	14	26	30	23
Post graduate	54	55	43	51	38	29	28	32
Marital status, %								
Married	68	50	49	56	56	60	67	61
Occupation, %								
Executive	48	52	42	47	9	14	17	13 ^c
High-level management	6	11	7	8	16	16	13	15
Mid-level management	27	18	18	21	12	28	20	20
Skilled or clerical	17	16	33	22	64	40	47	50
Semiskilled laborer	2	4	0	2	0	2	2	1
Student	0	0	0	0	0	0	2	1

^a $p < .05$ by ANOVA.

^b $p < .01$ by χ^2 .

^c $p < .001$ by χ^2 .

Illness and Doctor Visit Analyses

The QHRQ was completed for all four 3-month intervals by 281 subjects and for three of the four quarter-year intervals by another 85 subjects. For the 85 subjects with missing data for one quarter-year interval, an assignment of 0 illnesses was made for the missing quarter. Data from subjects with missing data for two or more 3-month intervals, 93% of whom were noncompleters, were not used.

These illness data proved to be highly skewed (skewness = 5.7) for both the computer industry and city government participants. Thus, nonparametric significance testing (ie, the Kruskal-Wallis ranking statistic and χ^2) was used for analysis.

The HMO subsample provided objectively measured doctor visits data across the study year (gained through review of computerized medical records). These data were not skewed (skewness = 0.96), allowing for analyses by ANOVA, groups by time, and χ^2 , separately for computer industry and city employees. Actual medical utilization data were available for 150 subjects. No other single HMO utilized by our total sample covered more than 40 participants.

Secondary Analyses

To examine for a possible dose-response relationship between small-group educational attendance and improvement in stress, anxiety, and coping scores, Pearson correlation coefficients and *t* tests were run. Differences between all full intervention subjects at baseline were controlled through analyses of covariance.

Potential predictors of higher vs. lower illness days, and doctor visits, were all demographic, stress, anxiety, and coping measures, plus the number of educational sessions attended by full intervention subjects. Outcome criteria were established by splitting the sample into those with a higher (6 or more) or lower (0–5) number of days of reported illness. For the HMO subsample, an outcome criterion was established by splitting the subsample into those having a higher (3 or more) or lower (0–2) number of doctor visits across the study year.

Univariate and multivariate analyses were run for all demographic, stress, anxiety, and coping variables, plus the number of educational sessions attended, leading to an illness or a healthy outcome. Multivariate analysis used relative operating curve (ROC) methodology to determine the probabilities of membership in an illness group or a healthy group of individuals based on variables making both a significant and unique contribution to the optimal predictor equation.

RESULTS

Demographic Characteristics

The total sample ($N = 501$) proved to be highly educated, with most participants holding middle- to upper-middle-class occupations. The largest minority group was Asian. These characteristics were typical of persons working in the Santa Clara County area. Participants with complete SCI and STAI data across the study year were compared with noncompleters. Those with complete data were slightly older (42.8 years vs. 40.6 years, $F(1,499) = 5.1$, $p = .02$), more likely to be female (56% vs. 43%, $\chi^2(1) = 5.4$, $p = .02$), and less

likely to be black (2% vs. 8%) or Hispanic (9% vs. 12%) ($\chi^2(4) = 12.9$, $p < .01$).

Table 1 compares demographic characteristics for participants with complete data, for the computer industry employees ($N = 167$) vs. city employees ($N = 176$), divided by work site. Subjects employed in the computer industry proved to be nearly 3 years younger ($F(1,341) = 6.2$, $p = .02$), were more likely to be white ($\chi^2(4) = 13.7$, $p < .01$), had higher educational achievements ($\chi^2(4) = 13.8$, $p < .01$), and were more frequently represented in management and upper-management occupational positions ($\chi^2(5) = 4.8$, $p < .001$). No significant between-groups differences were found for any of the demographic characteristics, at either work site (data not shown).

SCI and STAI Completers

Table 2 presents mean values and standard deviations for all stress measures. For participants in the computer industry, no significant between-groups differences were found at baseline. All groups showed significant decreases in stress and anxiety measures over time: number of recent life changes, $F(2,324) = 3.81$, $p = .023$; total symptoms, $F(2,322) = 19.45$, $p < .001$; depression scores, $F(2,328) = 9.18$, $p < .001$; negative responses to stress, $F(2,324) = 17.66$, $p < .001$; and STAI, $F(2,316) = 18.29$, $p < .001$. There was one significant group by time interaction for negative responses to stress. Full intervention subjects demonstrated a more robust improvement in negative responses, followed by partial intervention participants, with wait-list control participants showing the least improvement ($F(4,324) = 3.27$, $p = .012$).

For city government employees, a significant between-groups difference at baseline was seen for the STAI. Full intervention and partial intervention subjects had the highest mean scores, 39.1 (10.7) and 39.9 (9.8), respectively, and wait-list control subjects had the lowest, 35.4 (9.9). The results of ANOVA were $F(2,173) = 3.1$, $p = .046$. As in the computer industry, there were significant decreases in stress and anxiety scores across time for all groups: number of recent life changes, $F(2,344) = 8.04$, $p = .023$; total symptoms, $F(2,344) = 28.22$, $p < .001$; depression scores, $F(2,342) = 29.73$, $p < .001$; negative responses to stress, $F(2,342) = 21.89$, $p < .001$; and STAI, $F(2,326) = 35.18$, $p < .001$.

Table 3 presents mean values and standard deviations for the SCI coping measures. No significant between-groups differences in coping measures were found at baseline for both the computer industry and city government participants. With the exception of life satisfaction scores in the computer industry par-

TABLE 2. Means and Standard Deviations of Stress Measures by Treatment Group and Work Site

Stress Measures	Full Intervention						Partial Intervention						Wait-List Control					
	Time 0		6 Months		12 Months		Time 0		6 Months		12 Months		Time 0		6 Months		12 Months	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Computer industry employees (<i>N</i> = 167)																		
Recent life changes ^a	6.0	4.5	5.2	4.2	5.7	4.0	6.4	4.3	4.9	3.4	5.7	4.2	6.8	4.8	6.0	4.7	6.1	4.1
Symptom count ^b	11.2	9.2	9.3	8.5	7.6	7.1	10.6	6.9	9.3	6.9	7.9	6.4	11.4	8.2	10.6	7.4	9.0	7.5
Depression scale ^b	46.3	11.9	43.1	10.8	42.5	11.2	44.7	10.4	43.5	9.3	43.3	8.1	44.5	9.2	42.9	8.2	43.6	8.8
Negative responses ^{b,c}	12.6	6.2	9.9	5.4	10.4	5.2	11.6	4.9	10.1	4.2	9.5	3.8	11.0	5.0	10.8	5.3	10.3	5.0
STAI ^b	40.8	11.7	37.8	11.8	37.2	10.6	41.1	10.8	37.9	9.0	37.7	8.6	39.8	9.5	38.3	9.5	38.1	8.7
City government employees (<i>n</i> = 176)																		
Recent life changes ^{b,d}	4.2	3.9	3.1	2.8	2.9	5.1	5.5	5.1	5.7	4.6	4.7	3.8	5.4	4.4	4.5	3.9	3.7	3.6
Symptom count ^b	10.9	8.0	8.6	6.8	6.7	9.5	12.3	9.5	8.6	5.7	9.0	8.5	10.1	7.1	7.6	7.0	6.9	6.7
Depression scale ^b	45.2	11.3	40.8	8.6	40.9	10.6	44.2	10.6	39.8	9.1	40.2	9.3	41.9	9.4	39.8	9.7	39.8	9.2
Negative responses ^b	11.8	4.4	10.3	3.9	10.6	5.5	11.6	5.5	9.8	4.4	9.4	4.6	11.2	4.8	10.1	4.4	10.1	4.7
STAI ^b	39.1	10.7	34.9	8.7	34.2	9.8	39.9	9.8	35.1	8.7	35.8	8.7	35.4	9.9	33.4	10.0	33.0	9.3

^a Time effects: *p* < .05.
^b Time effects: *p* < .001.
^c Treatment × time effects: *p* < .05.
^d Treatment effects: *p* < .01.

TABLE 3. Means and Standard Deviations of Coping Measures by Treatment Group and Work Site

Coping Measures	Full Intervention						Partial Intervention						Wait-List Control					
	Time 0		6 Months		12 Months		Time 0		6 Months		12 Months		Time 0		6 Months		12 Months	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Computer industry employees (<i>N</i> = 167)																		
Health habits ^{a,b}	33.6	10.2	35.0	9.4	36.3	9.4	33.4	9.9	33.2	9.3	35.0	8.7	33.0	8.9	33.9	8.7	34.4	8.7
Social support ^{a,c}	31.0	10.9	32.6	9.4	33.4	8.8	31.7	7.6	33.6	7.9	33.5	6.7	31.9	8.8	33.6	8.5	33.9	7.5
Positive responses ^{a,d}	21.9	7.6	22.9	8.1	23.5	7.6	23.0	7.0	24.7	5.6	24.3	6.1	21.1	5.6	22.1	6.1	22.3	5.5
Life satisfaction ^e	37.9	9.7	37.9	9.9	38.5	10.0	35.4	10.7	36.2	10.0	36.4	9.9	36.7	9.3	36.4	9.0	37.2	9.5
City government employees (<i>N</i> = 176)																		
Health habits ^{a,b}	33.7	7.2	36.9	7.0	36.6	7.6	32.8	9.0	35.3	8.8	34.9	9.8	34.1	9.4	36.3	8.0	36.5	8.5
Social support ^{a,c}	34.4	9.5	36.1	9.1	35.6	8.8	35.2	7.6	37.7	8.0	36.8	8.0	35.0	7.8	36.2	8.4	37.5	8.6
Positive responses ^{a,d}	22.0	6.9	24.2	6.9	23.8	6.6	23.3	6.6	24.9	6.9	24.6	7.4	23.8	6.9	25.2	7.9	25.2	7.2
Life satisfaction ^{a,e}	37.8	9.5	40.2	8.2	39.4	6.9	36.2	9.7	39.1	10.2	38.8	10.0	38.7	10.8	40.1	10.1	41.4	10.4

^a Time effects: *p* < .001.
^b Computer industry, *F*(2,316) = 7.07, *p* < .001; city government, *F*(2,334) = 24.55, *p* < .001.
^c Computer industry, *F*(2,320) = 10.91, *p* < .001; city government, *F*(2,344) = 10.96, *p* < .001.
^d Computer industry, *F*(2,326) = 7.65, *p* < .001; city government, *F*(2,346) = 10.52, *p* < .001.
^e Computer industry, nonsignificant; city government, *F*(2,316) = 11.61, *p* < .001.

ticipants, significant changes over time were seen for all coping measures regardless of group. No group by time interactions, for either computer industry or city government subjects, were found for any of the coping measures.

Attendance at Educational Sessions

Attendance at educational sessions for full intervention subjects ranged from 0 to 6, with an average of 3.0 sessions for the computer industry employees and 4.0 sessions for city government employees. At baseline,

lower social support was significantly related to higher levels of participation in the intervention sessions for both the computer industry (*r* = .31, *p* = .01) and city government (*r* = .32, *p* = .02) employees. For city government participants, higher attendance was related to higher baseline scores on the STAI (*r* = .30, *p* = .02) and to lower baseline scores on positive responses to stress (*r* = .35, *p* = .006).

To better understand how session attendance related to outcome, attendance was compared with changes in stress, anxiety, and coping scores for subjects recorded at the end of the study (1 year), control-

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ling (by analysis of covariance) for variability in subjects' baseline values. For participants in the computer industry, those with higher attendance showed higher scores on the STAI ($r = .28, p = .047$), lower scores for health habits ($r = -.48, p < .001$), and lower scores for positive responses to stress ($r = -.28, p = .04$). No relationships were found between attendance and predictor scores for city government subjects.

Illness Reporting

For the 366 subjects who completed all four, or three of four, quarterly illness reports on the QHRQ, days reported ill across the follow-up year averaged 16 days, with a range of 0 to 362 days. Median (and range) data for city government participants, by treatment group, were as follows: full intervention, 5.5 (0–73); partial intervention, 6.0 (0–182); and wait-list control, 10.0 (0–180). Median (and range) data for computer industry employees, by treatment group, were as follows: full intervention, 5.0 (0–180); partial intervention, 6.0 (0–362); and wait-list control, 7.0 (0–50). Kruskal-Wallis results for city employees were close to being statistically significant ($\chi^2(2) = 5.4, p = .068$).

Effect size for illness days for the full intervention vs. wait-list control participants, for computer industry employees, was 0.44, and effect size for city government full intervention vs. wait-list control participants was 0.58. Effect sizes for partial intervention vs. wait-list control subjects, for both computer industry and city government employees, were 0.

HMO Subsample

The HMO subsample was divided into computer industry employees ($N = 49$) and city employees ($N = 101$). Doctor visits were summed across the follow-up year. These visits were recorded in the HMO's computerized medical records. Injuries, emergency room visits, and hospitalizations proved to be too few for reliable analyses.

Data for doctor visits over the 3-month interval before our study were available for everyone in the subsample. Mean doctor visits data for computer industry employees were as follows: full intervention, 0.76 visits; partial intervention, 0.89 visits; and wait-list control, 0.79 visits. Mean data for city government employees were as follows: full intervention, 0.73 visits; partial intervention, 1.19 visits; and wait-list control, 0.81 visits. No significant between-groups differences in mean number of doctor visits were present at either work site.

Mean, standard deviation, and range data for doctor visits over the study year for city employees were as

follows: full intervention, 2.8 (SD, 2.5; range, 0–12); partial intervention, 4.3 (SD, 3.1; range, 0–11); and wait-list control, 4.4 (SD, 2.8; range, 0–9). Differences in mean doctor visits were statistically significant ($F(2,91) = 3.29, p = .04$). Mean, standard deviation, and range data for doctor visits over the study year for computer industry participants were as follows: full intervention, 2.5 (SD, 2.6; range, 0–9); partial intervention, 3.7 (SD, 3.7; range, 0–15); and wait list control, 3.7 (SD, 2.9; 0–10). Between-groups differences for this relatively small number ($N = 47$) of participants were not significant. Mean number of doctor visits during the follow-up year, for the two work sites, are shown in Figure 1.

Univariate Analyses for Days Ill

Demographic measures, baseline scores for stress, anxiety, and coping, and number of educational sessions attended by full intervention subjects for subjects reporting 5 or fewer days of illness during the study year (defined as a low illness outcome) were compared with data for participants reporting 6 or more days ill (defined as a high illness outcome). In the computer industry, the single significant predictor of a high vs. a low illness outcome proved to be number of physical symptoms reported at baseline. Subjects with 0 to 5 days ill reported a mean of 5.5 symptoms, compared with 7.0 symptoms reported by those with 6 or more days ill ($t(178) = 2.1, p = .04$).

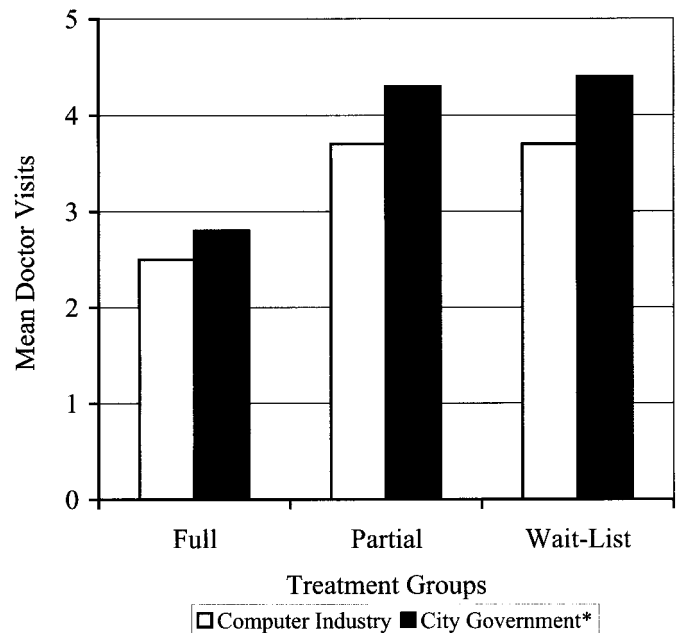


Fig. 1. Mean HMO doctor visits, by treatment group and work site, across the study year. *Changes in visits for city government subjects, $p < .04$.

City employees with a high illness outcome were significantly younger (42.4 vs. 45.2 years, $t(183) = -2.1$, $p = .03$), had significantly poorer health habits (32.1 vs. 35.6, $t(180) = -2.86$, $p = .005$), and registered significantly fewer life satisfactions (35.8 vs. 40.1, $t(179) = -3.1$, $p = .003$). Gender also played a role, as female city government employees had a significantly higher percentage of subjects with a high illness outcome than male city employees (65% vs. 35%, $\chi^2(1) = 6.7$, $p = .01$). Finally, middle management and clerical personnel had a significantly higher percentage of persons with a high illness outcome than upper management (82% vs. 43%, $\chi^2(5) = 150$, $p = .01$).

These same baseline measures were compared for HMO subjects reporting 0 to 2 doctor visits across the study year vs. those with 3 or more doctor visits. No differences were found between these two groups among computer industry employees. Among city employees, however, women were significantly more likely to have a high illness outcome than men (69% vs. 45%, $\chi^2(1) = 5.5$, $p = .02$).

Multivariate (ROC) Analyses

Days ill criterion for health. For the computer industry, persons reporting 4 or fewer life changes at baseline (38% of the sample) had a 61% chance of a low illness outcome vs. a 42% chance for those with 5 or more life changes (62% of the sample). A very small group of persons (8% of the sample) with 5 or more life changes at baseline had a 75% chance for a low illness outcome if, at baseline, they also had a positive responses to stress score of 19 or higher, 6 or fewer physical symptoms, and were older than 36 years of age.

City employees with a negative responses to stress score of 9 or less (36% of the sample) had a 61% chance of a low illness outcome vs. those with scores of 10 or higher, who had a 37% chance. Chances for a low illness outcome improved to 73% for those with few negative responses to stress who were also older than 40 years of age (25% of the sample).

Doctor visits criterion for health. For the computer industry, the single predictor of few doctor visits was 4 or fewer physical symptoms at baseline (38% of the sample had a 69% chance of a few doctor visits). The single predictor for few doctor visits for city employees was being a member of the full intervention group. Full intervention subjects (35% of the sample) had a 60% chance of a low doctor visits outcome, compared with a 31% chance for members of the other two groups.

DISCUSSION

The main findings from this study are that, contrary to our expectations, all groups improved on the stress, anxiety, and coping measures across the study, and there was only one significant between-groups difference. Nonetheless, even with relatively small sample sizes necessitated by analyzing work sites separately and using subsamples within the two sites, we found evidence of a nearly significant reduction in reported illnesses for full intervention participants and a significant reduction in objectively measured physician visits for the full intervention group compared with partial intervention and control groups.

The lack of significant between-groups differences across time for the SCI and STAI measures was surprising. The only significant between-groups difference was that computer industry employees in the full intervention group reported progressively fewer negative responses to stress across the study year. A possible explanation for the improved stress, anxiety, and coping scores seen for partial intervention and wait-list control subjects is that they received one or more phone calls every 3 months requesting their completion of the QHRQ. Furthermore, they received one or more calls when it was time for them to complete the SCI and STAI at 6 months and at 12 months. Such frequent telephone contacts may have led these persons to practice healthier lifestyles in response to a perceived investigator interest and concern (23–26).

Our hypothesis that face-to-face intervention would be superior to self-study was supported. A nearly significant reduction in reported illness for city employees and a significant reduction in doctor visits in the HMO subsample provided evidence.

We attempted to explain these findings by first looking at demographic, stress, anxiety, and coping as predictors of attendance at educational sessions. A pattern of higher attendance was seen among persons with higher anxiety scores (STAI) and lower coping resources (health habits, social support, and positive responses to stress) at baseline. Clearly those who most needed the educational sessions were more likely to attend.

In the HMO data, full intervention participants in city government showed significantly fewer ($p = .03$) doctor visits at 3 months into follow-up, 0.62 (0.86), compared with partial intervention subjects, 1.56 (1.95), and control subjects, 1.38 (1.50). A similar but nonsignificant trend was seen for computer industry participants at 3 months: full intervention, 0.50 (1.0); partial intervention, 0.94 (1.06); and control, 1.0 (1.08). Full intervention groups continued to maintain their reduced number of doctor visits across the study year,

whereas partial intervention and wait-list control subjects reported increased visits over the first 6 months of the study with a reduction in visits found between 6 and 12 months. This later reduction in doctor visits for the partial intervention and wait-list groups was consistent with their simultaneously reported increases in coping. Thus, full intervention participants showed an immediate and long-lasting reduction in doctor visits compared with a 6- to 12-month delayed effect seen in the other two groups.

Univariate analyses identified several predictors of our high illness outcome criterion: age (younger), gender (female), occupational status (lower), life changes (more), health habits (fewer), life satisfactions (fewer), and positive responses to stress (fewer). Results from these analyses highlighted the importance of demography and coping as buffers of life-change stress. The small group of subjects with a high number of recent life changes combined with one demographic dimension (older age) and two coping assets (high positive responses to stress and few physical symptoms) showed the same chance for a low illness outcome as persons with a low number of recent life changes.

Multivariate analyses that identified predictors of a low illness outcome varied by the criterion that was used. Predictors of 0 to 5 days ill across the study year included recent life changes (fewer), social support (higher), positive responses to stress (more), negative responses to stress (fewer), physical symptoms (fewer), and age (higher). Predictors for 0 to 2 yearly doctor visits were physical symptoms (fewer), STAI score (lower), and membership in the full intervention group. These significant univariate and multivariate predictors confirm observations seen in previous research and point out the value of using a multidimensional instrument such as the SCI (18, 20).

To achieve a single best estimate of reduction in healthcare utilization for HMO full intervention subjects, doctor visit data for computer industry and city government HMO participants were combined. Mean number of doctor visits for all full intervention subjects was 2.7 visits per person per year, compared with 4.1 visits per person per year for both partial intervention and wait-list control subjects. Full intervention HMO subjects, therefore, averaged 1.4 fewer doctor visits per person per year than did subjects in the other two groups. On a percentage basis, this amounted to a 34% (1.4 of 4.1) reduction in healthcare utilization by full intervention participants.

Present-day concerns about rising healthcare costs for companies make a program attaining a 10% reduction in costs noteworthy. Hence, to see a 34% reduction in healthcare utilization by all full intervention HMO participants was impressive. Based on expenses

for instructor salaries, questionnaires, educational materials, and travel, the per-person cost for full intervention subjects amounted to \$103. If medical personnel already employed at the workplace had been used instead of outside professionals, saving instructor salary and travel expenses, the average per-person costs would have been \$47.50. These low per-person costs would likely be offset by the one-third reduction in expenses for doctor visits.

We attempted to control for the effects of taking the SCI and the STAI, and receiving feedback in our small-group educational sessions, by having a partial intervention group. However, we did not control for the effects of the educational materials, the wellness seminar, and the six intervention sessions. To do so would have required collecting data from another large, randomly allocated group of individuals. This additional group (of nearly 250 persons) would match full intervention subjects' program but be exposed to a wellness seminar and educational sessions on topics other than stress and coping.

This study suggests that persons with normal levels of life stress, anxiety, and coping, vs. highly stressed individuals who show poor coping, can further improve their health through participating in a program such as ours (20). Consequently, company managers do not have to wait until they become aware of elevated levels of stress, anxiety, or illness in their employees before instituting a similar stress management program.

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