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Effects of Occupational Stress Management Intervention Programs: A Meta-Analysis

Katherine M. Richardson and Hannah R. Rothstein
Baruch College, City University of New York

A meta-analysis was conducted to determine the effectiveness of stress management interventions in occupational settings. Thirty-six experimental studies were included, representing 55 interventions. Total sample size was 2,847. Of the participants, 59% were female, mean age was 35.4, and average length of intervention was 7.4 weeks. The overall weighted effect size (Cohen's *d*) for all studies was 0.526 (95% confidence interval = 0.364, 0.687), a significant medium to large effect. Interventions were coded as cognitive–behavioral, relaxation, organizational, multimodal, or alternative. Analyses based on these subgroups suggested that intervention type played a moderating role. Cognitive–behavioral programs consistently produced larger effects than other types of interventions, but if additional treatment components were added the effect was reduced. Within the sample of studies, relaxation interventions were most frequently used, and organizational interventions continued to be scarce. Effects were based mainly on psychological outcome variables, as opposed to physiological or organizational measures. The examination of additional moderators such as treatment length, outcome variable, and occupation did not reveal significant variations in effect size by intervention type.

Keywords: stress management, meta-analysis, employee intervention

Employee stress has increasingly become a concern for many organizations. To paraphrase the "father of stress," Hans Selye, stress is an unavoidable consequence of life, and therefore an unavoidable consequence of organizations. Americans are working longer and harder, and job stress continues to increase. The average work year for prime-age working couples in the United States increased by nearly 700 hours in the past two decades (Murphy & Sauter, 2003; U.S. Department of Labor, 1999). From 1997 to 2001, the number of workers calling in sick because of stress tripled. The American Institute of Stress reported that stress is a major factor in up to 80% of all work-related injuries and 40% of workplace turnovers (Atkinson, 2004). This is not solely an American phenomenon. The Confederation of British Industry reported stress as the second highest cause of absenteeism among nonmanual workers in the United Kingdom, and the European Foundation for the Improvement of Living and Working Conditions reported that stress affects a third of the European working population (Giga, Cooper, & Faragher, 2003). In Australia, most states report an increasing number of annual workers' compensation claims resulting from workplace stress (Caulfield, Chang, Dollard, & Elshaug, 2004). Organizations provide a major portion of the total stress experienced by a person as a result of the amount of time spent on the job, the demands for performance, and the interaction with others in the workplace (DeFrank & Cooper, 1987).

Although it is not possible to eliminate stress entirely, people can learn to manage it. Many organizations have adopted stress management training programs to try and reduce the stress levels of their workforce. A stress management intervention (SMI) is any activity or program initiated by an organization that focuses on reducing the presence of work-related stressors or on assisting individuals to minimize the negative outcomes of exposure to these stressors (Ivancevich, Matteson, Freedman, & Phillips, 1990). Interest in strategies to reduce stress at work has increased steadily since the 1970s. According to the U.S. Department of Health and Human Services, national surveys conducted in 1985, 1992, and 1999 found the prevalence of stress management and counseling programs among private-sector worksites in those years was 27%, 37%, and 48%, respectively (Nigam, Murphy, & Swanson, 2003). The popularity

Katherine M. Richardson and Hannah R. Rothstein, Department of Management, Zicklin School of Business, Baruch College, City University of New York.

Correspondence concerning this article should be addressed to Katherine M. Richardson, Baruch College, City University of New York, One Bernard Baruch Way, New York, NY 10010. E-mail: katherine_mcpadden@baruch.cuny.edu

of worksite stress management programs has grown significantly abroad as well as in the United States.

Job Stress and Interventions

Newman and Beehr (1979, p.1) defined job stress as “a situation wherein job-related factors interact with the worker to change his or her psychological and/or physiological condition such that the person is forced to deviate from normal functioning.” Implicit in this definition is the belief that work-related factors are a cause of stress and that the individual outcomes may be psychological, physiological, or some combination of these. A SMI may attempt to change these work-related factors, assist employees in minimizing the negative effects of these stressors, or both. Ivancevich et al. (1990) developed a conceptual framework for the design, implementation, and evaluation of SMIs. According to the model, interventions can target three different points in the stress cycle: (a) the intensity of stressors in the workplace, (b) the employee’s appraisal of stressful situations, or (c) the employee’s ability to cope with the outcomes. The components of actual SMIs vary widely, encompassing a broad array of treatments that may focus on the individual, the organization, or some combination (DeFrank & Cooper, 1987; Giga, Noblet, Faragher, & Cooper, 2003).

Interventions may be classified as primary, secondary, or tertiary. Primary interventions attempt to alter the sources of stress at work (Murphy & Sauter, 2003). Examples of primary prevention programs include redesigning jobs to modify workplace stressors (cf. Bond & Bunce, 2000), increasing workers’ decision-making authority (cf. Jackson, 1983), or providing coworker support groups (cf. Carson et al., 1999; Cecil & Forman, 1990; Kolbell, 1995). In contrast, secondary interventions attempt to reduce the severity of stress symptoms before they lead to serious health problems (Murphy & Sauter, 2003). Tertiary interventions—such as employee assistance programs—are designed to treat the employee’s health condition via free and confidential access to qualified mental health professionals (Arthur, 2000). The most common SMIs are secondary prevention programs aimed at the individual and involve instruction in techniques to manage and cope with stress (Giga, Cooper, & Faragher et al., 2003). Examples are cognitive–behavioral skills training, meditation, relaxation, deep breathing, exercise, journaling, time management, and goal setting.

Cognitive–behavioral interventions are designed to educate employees about the role of their thoughts and emotions in managing stressful events and to provide them with the skills to modify their thoughts to facilitate adaptive coping (cf. Bond & Bunce, 2000). These interventions are intended to change individuals’ appraisal of stressful situations and their responses to them. For example, employees are taught to become aware of negative thoughts or irrational beliefs and to substitute positive or rational ideas (Bellarosa & Chen, 1997).

Meditation, relaxation, and deep-breathing interventions are designed to enable employees to reduce adverse reactions to stresses by bringing about a physical and/or mental state that is the physiological opposite of stress (cf. Benson, 1975). Typically, in meditation interventions, the employee is taught to focus on a single object or an idea and to keep all other thoughts from his or her mind, although some programs teach employees to observe everything that goes through their mind without getting involved with or attached to them. Meditation interventions often also include relaxation therapy and deep breathing exercises. Relaxation therapy focuses on the conscious and controlled release of muscle tension. Deep breathing exercises focus on increasing the intake of oxygen and the release of carbon dioxide, although muscle and mental relaxation is often an additional goal of slowing and deepening the breath.

Exercise programs generally focus on providing a physical release from the tension that builds up in stressful situations, increasing endorphin production, or both, although some have the goal of focusing the employee’s attention on physical activity (rather than on the stressors) or providing an outlet for anger or hostility (cf. Bruning & Frew, 1987).

Journaling interventions require the employee to keep a journal, log, or diary of the stressful events in his or her life (cf. Alford, Malouff, & Osland, 2005). The journal is used as a means of assisting the employee to monitor stress levels, to identify the recurring causes of stress, and to note his or her reactions. Journals are also used to formulate action plans for managing stress.

Time management and goal-setting interventions are designed to help people manage their time better, both on and off the job. Employees often operate under time pressure and are required to work on multiple tasks simultaneously. Working under such conditions can be particularly stressful. Time management interventions provide skills training in the areas of goal setting, scheduling and prioritizing tasks, self-monitoring, problem solving, delegating, negotiating, and conflict resolution (cf. Bruning & Frew, 1987; N. C. Higgins, 1986).

Electromyogram (EMG) biofeedback training provides participants with continuous feedback of muscle tension levels (cf. Murphy, 1984b). The objective is to consciously trigger the relaxation response and control involuntary stress responses from the autonomic nervous system. Through the use of electronic feedback measuring forehead muscle tension or hand temperature, patients receive feedback via audible tones or visual graphs on a computer screen. During the process they learn to monitor their physiological arousal levels and physically relax their bodies, actually changing their heart rate, brain waves, muscle contractions, and more.

SMIs may focus on any one particular strategy outlined above, such as relaxation training (cf. Fiedler, Vivona-Vaughan, & Gochfeld, 1989; R. K. Peters, Benson, & Porter, 1977), or combine multiple components to create a comprehensive training regimen that may include any of the following: cognitive–behavioral skills, meditation, assertiveness, social support, and so forth (cf. Bruning & Frew, 1986, 1987; de Jong & Emmelkamp, 2000; Zolnierczyk-Zreda, 2002). A trained instructor or counselor in either small group or one-on-one sessions generally teaches the methods, but techniques are sometimes self-taught with the aid of books and tapes (cf. Aderman & Tecklenberg, 1983; Murphy, 1984b; Vaughn, Cheatwood, Sirles, & Brown, 1989) and increasingly via computers (cf. Hoke, 2003; Shimazu, Kawakami, Irimajiri, Sakamoto, & Amano, 2005). Treatment programs are usually administered over several weeks and may take place at the worksite or at an outside location. Depending on the treatment method used, session length may vary from 15-min breaks to all-day seminars.

Which Interventions Are Most Effective?

The effectiveness of SMIs is measured in a variety of ways. Researchers may assess outcomes at the organizational level (e.g., absenteeism or productivity) or at the individual level, using psychological (e.g., stress, anxiety, or depression) or physiological (e.g., blood pressure or weight) measures. Given the wide array of stress management programs and outcome variables, there has been much debate in the literature as to which interventions, if any, are most effective (Briner & Reynolds, 1999; Bunce & Stephenson, 2000; Caulfield et al., 2004; DeFrank & Cooper, 1987; Giga, Noblet, Faragher, & Cooper, 2003; Ivancevich et al., 1990; Mimura & Griffiths, 2002; Murphy, 1984a; Newman & Beehr, 1979; Nicholson, Duncan, Hawkins, Belcastro, & Gold, 1988; van der Hek & Plomp, 1997). Some critics have claimed that studies in this area are inconclusive and based largely on anecdotes, testimonials, and methodologically weak research (Briner & Reynolds, 1999; Ivancevich et al., 1990).

Newman and Beehr (1979) were among the first researchers to perform a comprehensive narrative review of personal and organizational strategies for handling job stress, examining both medical and psychological literature. They reported a significant lack of empirical research in the domain and challenged industrial/organizational psychologists to bring their experience to the field of job stress–employee health (Newman & Beehr, 1979). During the 1980s, several researchers reviewed the SMI literature (DeFrank & Cooper, 1987; Murphy, 1984a; Nicholson et al., 1988). Murphy (1984a) performed a narrative review of 13 studies and concluded that they generally demonstrated acceptable positive effects, but noted that the "reports varied significantly in terms of the adequacy of the methodology used" (p. 2). DeFrank and Cooper (1987) criticized the methodological quality of the studies reviewed by Murphy. Three of the 13 studies from that review did not use control groups, and the majority had small sample sizes with low power and short follow-up time frames, making it difficult to assess the maintenance of gains.

Nicholson et al. (1988) expanded on Murphy's (1984a) work and identified 62 published evaluations of stress management programs from the medicine, public health, psychology, and education fields. These included case studies, preexperiments, quasi-experiments, and experimental studies (Nicholson et al., 1988). Of the 62 studies examined, only 18 provided adequate data to quantitatively summarize the results. Within these 18 studies, the average improvement in the treatment groups was equal to three quarters of one standard deviation in the control group scores, yielding "mildly encouraging results" (Nicholson et al., 1988). This translates into a Cohen's d of 0.75, which approaches a large effect (J. Cohen, 1988). However, only a third of the studies in Nicholson et al.'s review included participants from occupational settings. The remainder consisted of participants from a variety of groups, including schoolchildren, juvenile delinquents, college students, epilepsy patients, hypertension patients, and substance abusers.

Over the past two decades, intervention studies in occupational settings have proliferated, and researchers have conducted more focused reviews to examine their effectiveness (Briner & Reynolds, 1999; Bunce & Stephenson, 2000; Caulfield et al., 2004; Giga, Noblet, Faragher, & Cooper, 2003; Mimura & Griffiths, 2002; van der Hek & Plomp, 1997). Results have continued to be mixed. Briner and Reynolds conducted a narrative review of organization-level interventions (e.g., job redesign) and concluded that they often have little or no effect. Bunce and Stephenson examined interventions that focused on individual-level outcomes and reviewed 27 studies, assessing their levels of descriptive information and statistical power. They reported that "at present the quality of reporting and research design is such that it is difficult to form an impression of what type of SMI is appropriate to whom, and in what circumstances" (p. 198).

More recent narrative reviews have focused on particular job occupations, such as the nursing profession (Mimura & Griffiths, 2002) or mental health professionals (Edwards, Hannigan, Fothergill, & Burnard, 2002), or specific geographic regions, such as the United Kingdom (Giga, Noblet, Faragher, & Cooper, 2003) and Australia (Caulfield et al., 2004). A problem with such focused reviews, however, is that they result in a small number of studies, and each study may compare multiple intervention methods or outcomes. This makes it difficult to obtain precise estimates of the relative effectiveness of different interventions, or to assess generalizability of results.

The accumulation of stress management studies across a wide variety of occupational and geographic settings, assessing a multitude of intervention tactics, calls for a systematic review. In behavioral and medical research, as well as in other fields, meta-analysis has become the widely accepted technique for assessing the effectiveness of interventions. It has replaced the traditional narrative assessment of a body of research as a better way to accumulate data and synthesize them into generalizable knowledge (Eden, 2002). The primary goals of meta-analysis are to derive the best estimate of the population effect size and to determine whether there are any sources of variance around this effect (Rothstein, McDaniel, & Borenstein, 2002).

A study by van der Klink, Blonk, Schene, and van Dijk (2001) used meta-analytic techniques to examine the effectiveness of worksite stress interventions. The researchers meta-analyzed data from 48 interventions published in 45 articles between 1977 and 1996. A small but significant overall effect size was found ($d = 0.34$). When effects were broken down by intervention type, cognitive–behavioral interventions achieved the largest effect size ($d = 0.68$), followed by multimodal ($d = 0.51$), relaxation ($d = 0.35$), and organization-focused programs ($d = 0.08$). The present study seeks to update the van der Klink et al. meta-analysis. We believe that a new meta-analysis is appropriate for three reasons. First, although the van der Klink et al. review was published in 2001, it includes studies published only through 1996, and a considerable number of new, methodologically rigorous studies have been conducted since that time. There is a growing consensus that meta-analyses and systematic reviews, particularly those with health policy or practice implications, should be updated whenever a sizable number of new studies appear (cf. Chalmers & Haynes, 1994; Clark, Donovan, & Schoettker, 2006; J. P. T. Higgins & Green, 2005). This review expands the eligibility timeframe through early 2006.

Second, van der Klink et al. (2001) included studies of varying study designs and methodological quality. Nine of their included studies used quasi-experimental designs, and others did not include a no-treatment control or comparison group. In addition, the van der Klink et al. meta-analysis included seven randomized experiments that did not report sufficient statistics to calculate an effect size or that reported results of significant outcomes and not others. They did this by making assumptions about the probability values in these studies. As one of the consistent criticisms of studies of SMIs is that they are methodologically weak, our goal was to focus only on studies with methodologically strong designs. We therefore included only those interventions that were evaluated using a true experimental design, with random assignment of participants to treatment and control groups. This reduces the threat of selection bias and increases the internal validity of the included studies (Cook & Campbell, 1976) and, therefore, the validity of the meta-analytic results.

Finally, the van der Klink et al. (2001) review was based entirely on published journal articles and excluded dissertations, conference proceedings, book chapters, and the like. This exclusion of so-called "gray literature" has been shown to increase the threat that publication bias (a tendency toward preparation, submission, and publication of research findings that is based on the nature and direction of the research results rather than on the quality of the research; Dickersin, 2005) will affect the meta-analytic results. Publication bias affects the degree to which published literature is representative of all the available scientific evidence; when the research that is readily available differs in its results from the results of all the research that has been done in an area, we are in danger of drawing the wrong conclusion about that body of research (Rothstein, Sutton,

& Borenstein, 2005). In order to minimize the threat of publication bias, the current meta-analysis included experimental studies from both published and unpublished sources.

Our meta-analysis had two main goals. First, it was intended to bring together and synthesize experimental studies of SMIs that have been conducted (and reported) in a variety of disciplines (e.g., education, health care, organizational studies, and psychology) to identify what works, how well it works, and where or for whom it works. Second, we hoped to use our meta-analytic results to identify areas in the stress management literature where additional primary studies are needed.

To summarize, we intended our systematic review to improve on the van der Klink et al. (2001) meta-analysis by drawing from an additional decade of studies, by including only randomized experiments with sufficient statistical data to compute effect sizes without making additional assumptions about probability values, and by incorporating a more comprehensive literature search strategy. Rather than exclude the seven randomized experiments from the van der Klink et al. study for which they inferred *p* values, we performed a sensitivity analysis using the effect sizes for these studies that were imputed by van der Klink et al. to determine whether their inclusion changes our results. Our goals are to synthesize research from a variety of disciplines to assess what has been learned and also to identify areas in which additional primary studies are needed.

Method

Literature Search

Studies that assessed the effectiveness of a worksite SMI were collected from a variety of sources. Because our intent was to build on the van der Klink et al. (2001) meta-analysis, we began by obtaining all 45 studies used in that review. Second, we conducted an electronic search of six databases: Academic Search Premier, British Library Direct, Dissertations Abstracts, ERIC, ProQuest ABI Inform Global, and PsycARTICLES. These databases were chosen to obtain studies from different countries in a broad range of research fields, including social sciences, health care, and education. In addition, several of these databases include both published and unpublished studies. For the Academic Search Premier, British Library Direct, ERIC, and PsycARTICLES databases, we entered the following search terms on three lines: employee or work or management, AND stress or wellness, AND program* or intervention or prevention. This same procedure was followed for the Dissertations Abstract database, but it yielded no results. We therefore changed the search criteria to two lines: worksite and stress and management, AND program or intervention or prevention. For the ProQuest ABI Inform Global database, the same search terms were used but were entered on one line with classification codes, as follows: SU(employee or work or management) AND ((stress or wellness) w/2 (program* or intervention or prevention)) AND CC(9130 or 5400). The classification codes 9130 and 5400 indicate experimental and theoretical work, respectively. These electronic searches yielded 942 documents (Academic Search Premier = 377, British Library Direct = 255, ERIC = 122, PsycARTICLES = 99, Dissertation Abstracts = 31, and Proquest ABI Inform Global = 58).

Third, we performed a network search and e-mailed colleagues knowledgeable in the field to see if they recommended any studies. We also attended the American Psychological Association/National Institute for Occupational Safety and Health Work, Stress, and Health 2006 conference and reviewed the conference proceedings. Fourth, we performed a snowball search and reviewed the reference list of each article obtained to identify additional citations beyond the electronic search. Finally, we searched private and government-sponsored Web sites devoted to stress research to locate additional unpublished literature, including those for the American Institute for Stress (www.stress.org), the Canadian Institute of Stress (www.stresscanada.org), and the National Institute for Occupational Health and Safety (www.cdc.gov/niosh).

Criteria for Inclusion

A study had to meet the following criteria to be included in the meta-analysis: (a) be an experimental evaluation of a primary or secondary SMI (i.e., employee assistance programs were excluded); (b) include participants from the working population (i.e., studies involving students were excluded) who are not already diagnosed as having a major psychiatric disorder (e.g., depression or posttraumatic stress) or stress-related somatic disorder (e.g., hypertension); (c) use random assignment to treatment and control conditions; (d) report sample sizes, means, and standard deviations for both treatment and a no-treatment or waiting-list control group; if means and standard deviations were not reported, some other type of statistic that could be converted into a standardized mean effect size (Cohen's *d*) was necessary; and (e) be written in English after 1976. This date was chosen because it is the year the APA Task Force on Health Research published a report that exhorted psychologists, including industrial/organizational psychologists, to take a role in examining the health problems of Americans (Beehr & Newman, 1978).

Among the 45 articles used in the van der Klink et al. (2001) meta-analysis, 19 met the inclusion criteria outlined above and were included in our study. The remaining 26 articles were excluded for the following reasons: Nine used a quasi-experimental design without random assignment, 8 did not include a no-treatment comparison group, 7 did not report sufficient statistics to calculate an effect size, 1 used a student sample, and 1 did not include outcome variables related to stress or strain. We reviewed the abstracts of the 942 articles identified in the electronic search online to determine whether to obtain the studies for a full text review. Most studies were excluded on initial abstract review because they lacked a control group, did not include appropriate participants (e.g., used students or patients with clinically diagnosed disorders), assessed employee attitudes about interventions rather than the behavioral effects of the interventions, or had already been identified via the van der Klink et al. study. In total, 50 experimental studies were obtained for a full text review. Of these, 37 were excluded because they were quasi-experimental (17), did not use a control group (9), used a student or patient sample (7), or did not include the appropriate statistics (4). Thirteen studies met all the inclusion criteria and were included in the meta-analysis (9 peer-reviewed journal articles and 4 unpublished dissertations). In addition, 19 from the van der Klink et al. meta-analysis were included. During this process, we identified 19 other nonempirical review articles and also obtained them to examine the reference lists for additional studies.

The network search resulted in four usable studies (one journal article, two book chapters, and one unpublished dissertation). The snowball search resulted in 24 additional documents for review, and 2 of these were used in the study. The searches on the stress websites yielded no usable studies. In total, 38 articles were included in the current meta-analysis, representing 36 separate studies and 55 interventions.

Coding Procedure

We coded the reports at five levels: study, treatment–control contrast, sample, outcome, and effect size. Study-level coding recorded the article's full citation, publication type, number of treatment–control contrasts, and source of article (e.g., database). The treatment–control contrast level was created because several of the studies evaluated more than one type of treatment. Although some of these were totally independent evaluations, some had multiple treatment groups (each with nonoverlapping participants) that were compared with a single control group. We considered each of these treatment–control contrasts as a separate comparison for coding purposes. At this level of coding, we recorded information about the treatment and comparison groups, including program components (e.g., cognitive–behavioral skills training, meditation, exercise, etc.), where the treatment and comparison groups worked, where the program was delivered, who delivered the treatment, and the duration of the program. We used this information to code the intervention type as primary, secondary, or a combination. At the sample level, we coded the number of people in the sample (before attrition), the types of workers, and demographic information including country of participants. At the outcome level, we recorded each dependent variable and categorized them according to psychological measures (e.g., general mental health, anxiety, or depression), physiological measures (e.g., diastolic and systolic blood pressure or pulse), and organizational measures (e.g., productivity or absenteeism). We also coded the type of measurement scale (e.g., continuous) and the source of the data (e.g., self-report). For each outcome variable, we then coded the necessary information to calculate its effect size, including treatment and comparison group sample sizes, the statistical data, the direction of the effect size, and whether this difference was reported as statistically significant by the original investigator. We both coded the initial 10% of studies to assess intercoder reliability. Because there was close to 100% agreement, Katherine M. Richardson coded the remaining studies, reviewing unclear data when necessary with Hannah R. Rothstein until a consensus decision was reached.

Two of the studies that met our inclusion criteria used groups as the unit of random assignment to treatment or control conditions, rather than assigning individuals. This clustering of individuals within groups reduces the effective sample size of these studies. As we have no basis for estimating this effect, or for adjusting the weights of these two studies, we used the original sample sizes in our analyses. This should not have much of an impact on the overall effect size estimates or on the moderator analyses, but it will inflate the statistical significance levels of these two studies and underestimate the confidence intervals (CIs) for them.

Statistical Procedures

Comprehensive Meta Analysis Version 2 software (Borenstein, Hedges, Higgins, & Rothstein, 2005) was used to conduct the statistical analyses. The standardized mean difference (J. Cohen, 1992; Lipsey & Wilson, 2001) was calculated to represent the intervention effects reported in the eligible studies. This effect size statistic is defined as the difference between the treatment and control group means on an outcome variable divided by their pooled standard deviations. For this meta-analysis, the random effects model was most appropriate as heterogeneity was expected owing to the variety of intervention types and occupational settings. Our procedures were analogous to a Hunter–Schmidt (1990) bare-bones meta-analysis in that we made no corrections for statistical artifacts other than sampling error. Our decision was based on the lack of sufficient information in the retrieved studies to appropriately make such corrections (e.g., scale reliabilities). By not adjusting for artifacts, it is expected that the calculated mean effect sizes will underestimate their actual values (Hunter & Schmidt, 1990). We calculated effect sizes at the treatment–control contrast level. Our meta-analysis represents the combined effect of 55 independent interventions within 36 studies. For studies that reported multiple outcome variables, all applicable effect sizes that could be extracted were calculated and coded. However, we followed Lipsey and Wilson's (2001) advice that including multiple effect sizes from the same intervention violates the assumption of independent data points that is fundamental to most common forms of statistical analysis and inflates the sample size (*N* of effect sizes rather than *N* of interventions). They recommended either using the average of the outcomes at the treatment–control contrast level to get a combined effect or selecting the most representative outcome measure within each module. Owing to the wide range of outcome variables within our population of studies, we used the average of the outcomes at the intervention level for our overall analysis rather than introduce subjectivity into the analysis process by selecting what we felt would be most representative. We also looked at individual outcomes in a series of subgroup analyses. Each effect size was weighted by its precision, so that interventions with larger samples contributed more to the estimate of the population effect size.

Results

Demographics

Table 1 summarizes the studies selected for the meta-analysis. Thirty-eight articles were identified that met the inclusion criteria, representing 36 separate studies and 55 interventions. Total sample size was 2,847 before attrition and 2,376 after attrition. Individual sample sizes after attrition ranged from 14 to 219 participants, with a mean of 49 per intervention. The participants represented a wide range of occupations, including office workers, teachers, nurses and hospital staff, factory workers, maintenance personnel, and social services staff. Two thirds of the studies were conducted in the United States, and the remainder represented a diverse range of countries, including Australia, Canada, China (Taiwan and Hong Kong), Israel, Japan, the Netherlands, Poland, and the United Kingdom. Fifty-nine percent of the participants were female (based on 28 studies) and mean age was 35.4 (based on 18 studies). Average intervention length was 7.4 weeks. The mean number of treatment sessions was 7.5, each lasting an average of 1–2 hr.

Types of Interventions

The studies primarily assessed secondary intervention strategies to reduce the severity of an employee's stress symptoms. Only 8 studies included components that were considered primary intervention strategies, such as increasing workers' decision-making authority (e.g., participatory action research) or social support within the organization. All the intervention studies compared at least one treatment group to a no-treatment or waiting list control. Fourteen studies evaluated two treatment groups versus the same comparison group, and 2 studies evaluated three treatment groups versus the same control. Each treatment–control contrast was treated as a separate intervention for analysis purposes. The majority of studies ($k = 24$) evaluated interventions conducted in a group-training environment. Other modes of treatment included individual counseling sessions ($k = 3$); self-taught techniques using the Internet, tapes, or books ($k = 5$); or a combination of varying methods ($k = 4$). Twenty-five studies (69%) included relaxation and meditation techniques. Twenty studies (56%) included cognitive–behavioral skills training.

Table 1
Primary Studies Included in the Meta-Analysis

Author(s) and year	Treatment-control contrast	Sample size[a] and description[b]	Treatment components	Outcomes measured[c]	Length	Intervention type
Aderman & Tecklenberg (1983)	A	Various organizations (T = 21, C = 15)	General stress education seminar, plus meditation and relaxation training via audiotapes	Anxiety (Bendig, 1956)	12 weeks	Relaxation
	B	Various organizations (T = 19, C = 15)	General stress education seminar			Alternative
Alford, Malouff, & Osland (2005)	A	Child protective services officers, Australia (T = 31, C = 30)	Journal writing about recent stress reactions and emotions	General mental health (GHQ-12), positive affect, negative affect, job satisfaction (JIG)	3 days	Alternative
Bertoch, Nielson, Curley, & Borg (1989)	A	Teachers (T = 15, C = 15)	Holistic program: deep breathing, exercise, relaxation, social support, assertiveness, and nutrition	Stress (DSP), stress (OSI), stress (teacher stress measure), stress (structured clinical interview)	12 weeks	Multimodal
Bond & Bunce (2000)	A	Office workers (T = 24, C = 20)	"Acceptance commitment therapy": cognitive-behavioral skills to enhance emotional coping	General mental health (GHQ-12), depression (Beck), motivation, job satisfaction, propensity to innovate	14 weeks	Cognitive-behavioral
	B	Office workers (T = 21, C = 20)	"Innovation promotion" program: goal setting, participatory action, and planning to enhance problem-focused coping			Organizational
Bruning & Frew (1986, 1987)	A	Officer workers (T = 16, C = 16)	Management skills based on cognitive-behavioral techniques, goal setting, time management, communication, planning	Pulse, systolic & diastolic blood pressure, galvanics kin response	8 weeks	Multimodal
	B	Office workers (T = 15, C = 16)	Relaxation and meditation techniques			Relaxation
	C	Office workers (T = 15, C = 16)	Exercise program			Alternative

(*table continues*)

Table 1
(continued)

Author(s) and year	Treatment-control contrast	Sample size[a] and description[b]	Treatment components	Outcomes measured[c]	Length	Intervention type
Carson et al. (1999)	A	Nurses, United Kingdom (T = 27, C = 26)	Social support group to enhance coping abilities	Stress (DCL), social support (SOS), self-esteem (RSES), emotional exhaustion (MBI), general mental health (GHQ)	5 weeks	Organizational
Cecil & Forman (1990)	A	Teachers (T = 16, C = 19)	Stress inoculation training (Meichenbaum, 1977)	School stress, task-based stress, job satisfaction, role overload, social support (all SISS), coping skills	6 weeks	Cognitive-behavioral
	B	Teachers (T = 17, C = 19)	Coworker support group			Organizational
Chen (2006)	A	Office workers, Israel (T = 24 units, C = 13 units, *N* = 219 participants)	Active learning experience designed to increase participants' personal resources	Social support (House, 1981), perceived control (Karasek, 1979)	1 week	Alternative
Collins (2004)	A	Office workers (T = 9, C = 9)	Cognitive-behavioral skills, communication, relaxation techniques, time management	Stress (JSI), burnout (MBI), general physical health, anxiety (STAI)	5 weeks	Multimodal
	B	Office workers (T = 8, C = 9)	Cognitive-behavioral skills, relaxation techniques			Multimodal
de Jong & Emmelkamp (2000)	A	Various organizations, the Netherlands (T = 45, C = 41)	Muscle relaxation, cognitive-behavioral skills, problem solving, assertiveness training (taught by clinical psychologist)	Anxiety (Dutch STAI), general mental health (GHQ), general physical health, social support (SSI), role overload (OSQ), job dissatisfaction (OSQ)	8 weeks	Multimodal
	B	Various organizations, the Netherlands (T = 44, C = 41)	Muscle relaxation, cognitive-behavioral skills, problem solving, assertiveness training (taught by trained paraprofessionals)			Multimodal

(*table continues*)

Table 1
(*continued*)

Author(s) and year	Treatment-control contrast	Sample size[a] and description[b]	Treatment components	Outcomes measured[c]	Length	Intervention type
Fava et al. (1991)	A	Army officers (T = 20, C = 17)	Stress Type-A behavior reduction program, cognitive-behavioral skills, relaxation, self-esteem enhancement	Stress (global assessment of recent stress), stress (PSS), general mental health (Kellner's Symptom Q), exercise attitude	28 weeks	Multimodal
Fiedler, Vivona-Vaughan, & Gochfeld (1989)	A	Hazardous waste workers (T = 31, C = 30)	Progressive muscle relaxation, deep breathing	Systolic blood pressure, diastolic blood pressure, general severity index (SCL-90)	9 weeks	Relaxation
Ganster, Mayes, Sime, & Tharp (1982)	A	Office workers (T = 36, C = 34)	Cognitive-behavioral skills (Meichenbaum, 1975), progressive muscle relaxation	Anxiety, depression, irritation, general physical health, epinephrine, norepinephrine	8 weeks	Multimodal
Gildea (1988)	A	Foster care agency workers (T = 9, C = 8)	Stress/anger management training: cognitive-behavioral skills, journaling, relaxation, education, anger control	Systolic blood pressure, diastolic blood pressure, depression, general physical health, hostility, and anxiety (all SCL-90)	n/a	Multimodal
	B	Foster care agency workers (T = 8, C = 8)	Relaxation, journaling			Relaxation
N. C. Higgins (1986)	A	Office workers (T = 17, C = 18)	Relaxation, systematic desensitization	Emotional exhaustion (MBI), strain (PSQ), absenteeism	6 weeks	Relaxation
	B	Office workers, mixed (T = 18, C = 18)	Rational emotive therapy, time management, goal setting, assertiveness training			Multimodal
Hoke (2003)	A	Various organizations (T = 46, C = 53)	Twice weekly e-mails that teach deep breathing, exercise, hypnosis, journaling, meditation and relaxation, imagery	Stress (PSS), depression, anxiety, anger, daily hassles	12 weeks	Multimodal

(*table continues*)

Table 1
(*continued*)

Author(s) and year	Treatment-control contrast	Sample size[a] and description[b]	Treatment components	Outcomes measured[c]	Length	Intervention type
Jackson (1983)	A	Hospital workers (*N* = 66)	Introduction of staff meetings to increase staff participation	Role conflict, role ambiguity, social support, general mental health (GHQ), job satisfaction, absenteeism	24 weeks	Organizational
Kolbell (1995)	A	Child protective services workers (T = 13, C = 12)	Meditation and relaxation training via audiotapes	Emotional exhaustion (MBI), general physical health (BSI), absenteeism	4 weeks	Relaxation
	B	Child protective services workers (T = 13, C = 12)	Social support group			Organizational
Lee & Crockett (1994)	A	Hospital nurses, Taiwan, China (T = 29, C = 28)	Assertiveness training based on rational-emotive therapy (Ellis, 1962)	Assertiveness (RAS), stress (PSS)	2 weeks	Cognitive-behavioral
Maddi, Kahn, & Maddi (1998)	A	Office workers, mid-level managers (T = 18, C = 16)	"Hardiness training," based on cognitive-behavioral techniques	Hardiness, job satisfaction, strain, general physical health, social support	10 weeks	Cognitive-behavioral
	B	Office workers, mid-level managers (T = 12, C = 16)	Relaxation and meditation			Relaxation
Murphy (1984b)	A	Highway maintenance workers (T = 15, C = 8)	Electromyographic biofeedback	General physical health and anxiety (BSI); trait anxiety (STAI); job dissatisfaction.	10 days	Alternative
	B	Highway maintenance workers (T = 11, C = 8)	Muscle relaxation via cassette tapes			Relaxation
Peters, Benson, & Porter (1977); Peters, Benson, & Peters (1977)	A	Office workers, United Kingdom (T = 54, C = 36)	Daily 15-min breaks, taught specific relaxation technique with deep breathing	General physical health (Symptoms Index), productivity, social support, happiness, systolic & diastolic blood pressure	8 weeks	Relaxation
	B	Office workers, United Kingdom (T = 36, C = 36)	Daily 15-min breaks, no relaxation techniques taught			Relaxation

(*table continues*)

Table 1
(*continued*)

Author(s) and year	Treatment-control contrast	Sample size[a] and description[b]	Treatment components	Outcomes measured[c]	Length	Intervention type
Peters & Carlson (1999)	A	University maintenance workers (T = 21, C = 19)	Health education, cognitive-behavioral skills, goal setting, and relaxation	Anxiety, anger, and depression (STPI), health self-efficacy, job satisfaction, systolic/diastolic blood pressure, cholesterol	10 weeks	Multimodal
Pruitt (1992)	A	Army personnel (T = 31, C = 33)	Stress awareness education, assertiveness, time management, relaxation via audiotapes	Anxiety (STAI), anxiety (SCL-90), systolic & diastolic blood pressure	n/a	Multimodal
Shapiro, Astin, Bishop, & Cordova (2005)	A	Health care professionals (T = 18, C = 10)	Mindfulness-based stress reduction (meditation, deep breathing, yoga)	Burnout, general mental health (GSI), perceived stress	8 weeks	Relaxation
Sharp & Forman (1985)	A	Teachers (T = 30, C = 30)	Stress inoculation training (Meichenbaum, 1977)	Anxiety (TQ4), anxiety (STAI, state), anxiety (STAI, trait)	4 weeks	Cognitive-behavioral
	B	Teachers (T = 30, C = 30)	Classroom management skills training			Alternative
Shimazu, Kawakami, Irimajiri, Sakamoto, & Amano (2005)	A	Office workers in a construction machinery company, Japan (T = 100, C = 104)	Self-paced online intervention teaching cognitive-behavioral and coping techniques	Self-efficacy, stress (BJSQ), general physical health, job satisfaction	11 weeks	Cognitive-behavioral
Stanton (1991)	A	Administrative office workers, Australia (T = 15, C = 15)	"Ego-enhancement" relaxation techniques	Stress ("stress thermometer")	n/a	Relaxation
Thomason & Pond (1995)	A	Custodial staff (T = 14, C = 13)	Cognitive-behavioral skills, relaxation, imagery, and self-management skills	General mental health (SCL-90), anxiety (STAI), job satisfaction (JIG), blood pressure	6 weeks	Multimodal
	B	Custodial staff (T = 13, C = 13)	Cognitive-behavioral skills, relaxation, and imagery			Multimodal
	C	Custodial staff (T = 14, C = 13)	Personal development skills			Alternative

(*table continues*)

Table 1
(continued)

Author(s) and year	Treatment-control contrast	Sample size[a] and description[b]	Treatment components	Outcomes measured[c]	Length	Intervention type
Tsai & Crockett (1993)	A	Hospital nurses, Taiwan, China (T = 68, C = 69)	Relaxation training based on cognitive-behavioral model of relaxation (Smith, 1990)	General mental health (Chinese GHQ), stress (Chinese NSC)	5 weeks	Relaxation
Tunnecliffe, Leach, & Tunnecliffe (1986)	A	Teachers, Australia (T = 7, C = 7)	"Collaborative behavioral consultation" focused on problem-solving approach	Teacher stress (TOSQ)	5 weeks	Cognitive-behavioral
	B	Teachers, Australia (T = 7, C = 7)	Relaxation training			Relaxation
Vaughn, Cheatwood, Sirles, & Brown (1989)	A	Administrative workers (T = 8, C = 10)	Progressive muscle relaxation via audiotapes	Stress (SRI)	4 weeks	Relaxation
von Baeyer & Krause (1983-1984)	A	Nurses in a burn treatment unit, Canada (T = 7, C = 7)	Cognitive-behavioral skills, deep breathing, relaxation, and role playing	Anxiety (STAI, stait) anxiety (STAI, trait)	1 week	Multimodal
Wirth (1992)	A	Bakery employees (T = 28, C = 18)	Leader-facilitated SMI: cognitive-behavioral skills, emotional stress management, relaxation, health education	Locus of control, general physical health (PSC), absenteeism	4 weeks	Multimodal
	B	Bakery employees (T = 15, C = 18)	Self-taught SMI: cognitive-behavioral skills, relaxation, health education			Multimodal
Yung, Fung, Chan, & Lau (2004)	A	Administrative nursing staff, Hong Kong, China (T = 17, C = 30)	Relaxation using stretching and releasing of muscles	Anxiety (Chinese STAI, state), anxiety (Chinese STAI, trait), general mental health (Chinese GHQ)	4 weeks	Relaxation
	B	Administrative nursing staff, Hong Kong, China (T = 18, C = 30)	Relaxation using cognitive imagery			Relaxation

(*table continues*)

Table 1
(continued)

Author(s) and year	Treatment-control contrast	Sample size[a] and description[b]	Treatment components	Outcomes measured[c]	Length	Intervention type
Zolnierczyk-Zreda (2002)	A	Financial sector office workers, Poland (T = 40, C = 45)	Cognitive-behavioral skills, job control, social support, assertiveness, anger control	Problem-focused coping, emotional-focused coping, social support	10 weeks	Multimodal

Note. T = treatment; C = control; GHQ-12 = General Health Questionnaire 12; JIG = Job in General Scale; DSP = Derogatis Stress Profile; OSI = Occupational Stress Inventory; DCL = DeVilliers Carson Leary Scale; MBI = Maslach Burnout Inventory; SISS = Stress in the School Setting; JSI = Job Stress Index; STAI = State Trait Anxiety Inventory; SSI = Social Support Indicator; OSQ = Occupational Stress Questionnaire; PSS = Perceived Stress Scale; SCL-90 = Symptom Checklist 90; PSQ = Personal Strain Questionnaire; RAS = Rathus Assertiveness Scale; STPI = State-Trait Personality Inventory; TQ4 = Teacher Questionnaire 4; BJSQ = Brief Job Stress Questionnaire; NSC = Nurse Stress Checklist; TOSQ = Teacher Occupational Stress Questionnaire; SRI = Stress Response Index; SMI = stress management intervention; SOS = Significant Others Scale; RSES = Rosenberg Self-Esteem Scale.
[a] Based on posttreatment measures. [b] U.S. sample, unless otherwise noted. [c] Frequently used scales noted in parentheses.

Many of the interventions had multiple components (such as cognitive–behavioral skills training and meditation). Fourteen of the studies evaluated interventions with four or more treatment components. Table 1 provides a summary of the included studies.

Outcome Variables

Each study contained multiple outcome measures. We selected and coded all dependent variables that related to stress, including psychological, physiological, and organizational outcomes. This resulted in more than 60 different outcome variables, or an average of 3–4 outcomes per study. We averaged these outcomes at the treatment–control contrast level to calculate a combined effect size for each intervention. Psychological measures were used in 35 out of 36 studies. The most common among these were stress (k = 14), anxiety (k = 13), general mental health (k = 11), and job/work satisfaction (k = 10). Unfortunately, there was no uniform scale used for any construct. For example, stress was measured via 11 different scales, including the Job Stress Index (Sandman, 1992), Occupational Stress Inventory (Osipow & Spokane, 1983), Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983), Personal and Organizational Quality Assessment (Barrios-Choplin & Atkinson, 2000), and Teacher Stress Measure (Pettegrew & Wolf, 1982).

Physiological measures were used in a quarter of the studies, and the most common of these was systolic and diastolic blood pressure. Other physiological measures were epinephrine and norepinephrine levels, galvanic skin response, and cholesterol. Only six studies measured organizational-specific outcomes. Four studies assessed absenteeism, and two examined productivity.

Effect Sizes

A combined analysis, using the inverse-variance weighted average effect size from each individual intervention, yielded a significant effect size across all studies (d = 0.526, 95% CI = 0.364, 0.687). This is considered a medium to large effect size (J. Cohen, 1988). By comparison, van der Klink et al.'s (2001) meta-analysis yielded a small combined effect size (d = 0.34, 95% CI = 0.27, 0.41). We checked for heterogeneity of effects in two ways. First, we used the traditional chi-square statistic to test the hypothesis that all of the observed heterogeneity was due to sampling error variance. The Q value was highly significant ($Q = 202.6$, $p < .001$), indicating that there was more heterogeneity of effects than could be accounted for by sampling error. Second, we used the I^2 statistic: $I^2 = [(Q - df)/Q] \times 100\%$, where Q is the chi-square statistic and df is its degree of freedom (Higgins, Thompson, Deeks, & Altman, 2003). I^2 represents the amount of variability across studies that is attributable to between-study differences rather than to sampling error variability. In this case, the I^2 statistic suggests that 73% of the total variance is due to between-study variance, or heterogeneity, rather than to sampling error. Both statistics suggested the likely presence of moderators, so we proceeded to conduct subgroup analyses.

Intervention-Level Moderators

To search for moderators, we classified the interventions into more homogeneous subgroups and performed analyses on these groupings, again using the average outcome effect size for each intervention, when more than one outcome was assessed. First, we coded our interventions into the same categories used in the van der Klink et al. (2001) meta-analysis: cognitive–behavioral, relaxation, organizational, or multimodal (multiple component). Seven interventions could not be classified into these groupings. These studies evaluated interventions composed of exercise or EMG feedback, journaling, personal skills development, or classroom management training (for teachers). We therefore created an "alternative" intervention category, while recognizing that this grouping did not represent a specific type of intervention. Table 2 shows the average effect size for interventions in each of these categories.

The results in Table 2 show that the average effect sizes of both the cognitive–behavioral and the relaxation intervention categories were larger than the analogous average effects from the van der Klink et al. (2001) meta-analysis. Somewhat surprisingly, there was a great deal of heterogeneity of effects in the cognitive–behavioral intervention category ($I^2 = 89.5$, $Q = 57.0$, $p < .001$). The alternative intervention category had the second largest average effect size ($d = 0.909$, 95% CI = 0.318, 1.499), although it also had a wide confidence interval and, as would be expected, substantial heterogeneity ($I^2 = 85.3$, $Q = 40.8$, $p < .001$). Organizational interventions yielded virtually no effect, also consistent with the prior meta-analysis. Multimodal interventions, however, yielded a significant but small effect size in the present study ($d = .239$, 95% CI = 0.092, 0.386), which is lower than the van der Klink et al. study. The present meta-analysis included 15 studies (19 interventions) with multimodal programs, whereas the van der Klink et al. study included only 8 studies in this category. Within such multimodal programs, cognitive–behavioral, relaxation, and even organizational techniques can all be included as treatment components. Among the 19 multimodal interventions in our meta-analysis, 5 included cognitive–behavioral components, 3 included relaxation components, and 11 included both cognitive–behavioral and relaxation components. This makes it difficult to assess whether the specific components, the mixture of components, the number of components, or a combination of these factors is causing the intervention effect. Another way to categorize our studies is to look at the number of components per intervention. Table 3 shows the effect sizes based on these subgroups.

The results in Table 3 suggest that interventions that focus on a single component are more effective than those that focus on multiple components. The general trend is that as each component is added, the effect is reduced. However, there was significant heterogeneity among the one-component studies ($I^2 = 81.6$, $Q = 103.0$, $p < .001$), and the results in Table 3 are confounded by intervention type. For

Table 2
Cohen's d and Confidence Intervals on the Basis of Intervention Type

Intervention type	*k*	*N*	*d*	95% CI	*y*
Cognitive-behavioral	7	448	1.164**	0.456, 1.871	.68*
Relaxation	17	705	0.497***	0.309, 0.685	.35*
Organizational	5	221	0.144	−0.123, 0.411	.08
Multimodal	19	862	0.239**	0.092, 0.386	.51*
Alternative	7	455	0.909**	0.318, 1.499	N/A

Note. k = number of interventions; d = combined effect size; CI = confidence interval; y = Cohen's d from van der Klink et al. (2001).
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 3
Cohen's d and Confidence Intervals on the Basis of the Number of Treatment Components

No. of treatment components	k	N	d	95% CI
One	20	946	0.643***	0.309, 0.977
Two	18	970	0.607***	0.346, 0.868
Three	2	59	−0.104	−0.627, 0.418
Four or more	15	716	0.271**	0.102, 0.440

Note. k = number of interventions; d = combined effect size; CI = confidence interval.
** $p < .01$. *** $p < .001$.

example, the one-component interventions with the largest effects were cognitive–behavioral interventions ($k = 2$, $d = 1.230$, 95% CI = −0.968, 3.428). Four of the single-component interventions taught some form of personal development skills that specifically related to increasing personal resources or management skills that would assist employees in their jobs (e.g., classroom management training). These yielded a significant large effect ($d = 1.154$, 95% CI = 0.332, 1.975). Seven used relaxation as the treatment and obtained a significant medium effect ($d = 0.501$, 95% CI = 0.161, 0.841).

Among the studies with two treatment components, relaxation techniques were most likely to be the primary treatment component. This was the case with 10 interventions, yielding a significant medium effect size ($d = 0.502$, 95% CI = 0.265, 0.739). Seven interventions used cognitive–behavioral techniques as the primary treatment component, and these yielded a significant large effect size ($d = 0.913$, 95% CI = 0.320, 1.505). Among the studies with four or more treatment components, cognitive–behavioral skills training and relaxation were likely to be incorporated. Nine interventions included both cognitive–behavioral and relaxation components ($d = 0.296$, 95% CI = 0.086, 0.507), three included cognitive–behavioral components ($d = 0.201$, 95% CI = −0.119, 0.522), and three included relaxation components ($d = 0.215$, 95% CI = −0.069, 0.499).

We also examined whether treatment duration made a difference among the interventions. The average length was 7.4 weeks, but the range was 3 days to 7 months. We therefore grouped studies according to the length of the intervention period (three studies did not provide this information). Because treatment length may be confounded with type of intervention, we further classified the studies based on intervention type. Table 4 shows the effect sizes based on these subgroups. The "All studies" column suggests that shorter interventions are more effective than longer ones. However, when one examines the data by intervention type, the pattern does not hold as firmly. The majority of interventions fall under the relaxation and multimodal categories, but there are a limited number of studies in each cell. Relaxation interventions consistently produce medium-sized effects, regardless of length. Multimodal programs, in contrast, appear to lose effect as treatment length increases.

Outcome-Level Moderators

Another way to classify the data into subgroups is to examine the outcome measures used in the studies. Outcome measures could be psychological, physiological, or organizational in nature, and we coded them into 40 general categories. Some measures were used more frequently than others. To assess which measures produced larger effects and to examine whether outcome variables differed between intervention types, we performed a subgroup analysis of intervention type crossed with the outcomes we noted were used most frequently. Table 5 shows the effect sizes based on these subgroups.

Disaggregating the data by outcome variable and treatment type results in a small number of interventions in certain cells, but the analysis does illustrate several interesting findings. First, no studies that evaluated single-mode cognitive–behavioral or organizational interventions measured physiological outcomes. Thus, the large effect of the single-mode cognitive–behavioral programs is based solely on psychological and (less frequently) organizational measures. Likewise, the large effects of alternative interventions are also based primarily on psychological variables. A pattern thus emerges in which out-

Table 4
Cohen's d on the Basis of Length of Treatment and Intervention Type

Length of treatment	All studies	Treatment type				
		CB	Relax	Org	Multi	Alternative
1–4 weeks	0.804*** (15)	1.477** (2)	0.560* (5)	−0.097 (1)	0.274 (3)	1.217* (4)
5–8 weeks	0.396*** (22)	1.576 (2)	0.500*** (7)	−0.003 (2)	0.291* (9)	0.585* (2)
9–12 weeks	0.346* (10)	1.230 (2)	0.315 (3)	N/A	0.089 (4)	0.250 (1)
>12 weeks	0.401** (4)	0.323 (1)	N/A	0.328 (2)	0.718* (1)	N/A

Note. Numbers in parentheses represent total number of interventions. CB = cognitive-behavioral; Relax = relaxation; Org = organizational; Multi = multimodal.
* $p < .05$. ** $p < .01$. *** $p < .001$.

come variables are likely to be chosen on the basis of the type of intervention. For example, interventions that focus on the individual (e.g., cognitive–behavioral, journaling, and stress education) use psychological measures, and those that focus on organizational changes generally include organizational measures. The result is that we are left with gaps in the body of research. We are unable to assess whether alternative treatment programs (e.g., journaling, exercise, and personal coping skills)—which have a large effect on psychological and physiological outcomes—produce similar results using organizational measures. Regarding specific organizational outcomes, measures of productivity appear to produce larger effects than absenteeism, but there is a general lack of studies that use such measures. In general, there are no uniform outcome measures used to assess the effectiveness of stress management programs. Only one third of the interventions reported using an actual measure of "stress," and among these there was significant variation in the scales chosen.

To obtain a more pure assessment of whether type of outcome measure played a moderating role, we selected only those studies for which psychological outcomes were provided in combination with either physiological or organizational measures. In other words, the same samples of participants were being measured using both types of outcomes. All of the psychological measures were based on self-report, continuous scales. This may affect the reliability of the outcomes. The physiological measures, in contrast, were more likely to be administered by an

Table 5
Cohen's d on the Basis of Outcome Variables and Intervention Type

Outcome variable	All studies	Treatment type				
		CB	Relax	Org	Multi	Alternative
Psychological						
All combined	0.535*** (52)	1.154** (7)	0.507*** (16)	0.134 (5)	0.258** (18)	0.905** (6)
Stress	0.727*** (18)	1.007** (5)	0.834** (5)	−0.314 (2)	0.595** (5)	1.367*** (1)
Anxiety	0.678*** (22)	2.390*** (1)	0.611*** (5)	N/A	0.418** (12)	0.841 (4)
Mental health	0.441*** (16)	0.708* (1)	0.405* (5)	0.167 (3)	0.518 (5)	0.616* (2)
Work-related outcomes[a]	0.183 (23)	0.682 (4)	−0.381 (4)	0.243 (4)	−0.115 (7)	0.794 (4)
Physiological						
All combined	0.292* (14)	N/A	0.312 (5)	N/A	0.166 (7)	0.714** (2)
Organizational						
All combined	0.267 (11)	0.606 (1)	0.534*** (4)	0.247 (3)	−0.122 (3)	N/A
Productivity	0.703*** (4)	0.606 (1)	0.661*** (2)	0.989** (1)	N/A	N/A
Absenteeism	−0.059 (7)	N/A	0.213 (2)	−0.159 (2)	−0.122 (3)	N/A

Note. Numbers in parentheses represent total number of interventions. CB = cognitive-behavioral; Relax = relaxation; Org = organizational; Multi = multimodal.
[a] Includes job/work satisfaction, motivation, social support, daily hassles, role ambiguity, role overload, and perceived control.
* $p < .05$. ** $p < .01$. *** $p < .001$.

independent, trained examiner or via a medical device (e.g., blood pressure monitor). The organizational measures were based on company records (e.g., absenteeism) and self-report data (e.g., productivity or propensity to innovate). Table 6 shows the effect sizes based on these subgroups.

The data in Table 6 are based on a small number of studies and should therefore be interpreted cautiously. Even so, it appears that intervention type continues to confound outcome effects. The results for all studies combined suggest that psychological and physiological outcome variables produce comparable effect sizes. However, this depends on type of intervention. For example, for the alternative subgroup, the physiological measures produced larger effect sizes. When studies measured both psychological and organizational variables, psychological outcomes produced larger effects than organizational outcomes. But this may also depend on treatment type, as the relationship is reversed for the relaxation and organizational subgroups. Table 6 does alert us to the overreliance on self-report measures in intervention studies. Among the 55 interventions, only 11 measured both psychological and physiological outcomes, and 11 measured both psychological and organizational outcomes.

Sample-Level Moderators

The final moderator analysis we performed was based on industry sector. Many early intervention studies were performed in the health care or education fields. We classified studies into subgroups on the basis of three industry sectors: office, health care, and education. We further grouped the results by intervention type. Table 7 shows the effect sizes based on these subgroups. Results depict effect sizes in the general direction of prior analyses, with cognitive–behavioral producing the largest effects. However, what may be more interesting is to examine the distribution of intervention type by industry. For example, multimodal interventions appear more likely to be used in office settings, perhaps because there has been no solid empirical evidence as to the most effective treatment in this particular setting, and therefore a "potpourri" approach is used. In contrast, relaxation interventions appear more often within health care settings, and cognitive–behavioral interventions in education settings. However, disaggregating the data produces small numbers of studies in each cell, so these interpretations may be unstable.

Outlier Analysis

We performed outlier analyses by examining forest plots of the effect sizes and confidence intervals, for all studies combined and at the subgroup levels. One alternative intervention was identified as a possible outlier because of its very large effect size and the fact that its confidence interval did not fall into the range of similar interventions for that subgroup. We therefore excluded this study (which represented two alternative interventions: exercise only and listening to music; Taylor, 1991) from the analysis. However, based on a sensitivity analysis, we note that if we included this study in our calculations, the combined overall effect size would increase slightly (d = 0.618, 95% CI = 0.432, 0.903).

Table 6
Cohen's d on the Basis of Outcome Variable and Intervention Type for Selected Studies

Outcome variable	All studies	Treatment type				
		CB	Relax	Org	Multi	Alternative
Psychological vs. physiological						
Psychological	0.227* (11)	N/A	0.303* (4)	N/A	0.151 (6)	0.250 (1)
Physiological	0.219 (11)	N/A	0.282 (4)	N/A	0.115 (6)	0.601 (1)
Psychological vs. organizational						
Psychological	0.285** (11)	0.253 (1)	0.376* (4)	0.187 (3)	0.197 (3)	N/A
Organizational	0.267 (11)	0.606 (1)	0.534*** (4)	0.247 (3)	−0.122 (3)	N/A

Note. Numbers in parentheses represent total number of interventions. CB = cognitive-behavioral; Relax = relaxation; Org = organizational; Multi = multimodal.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 7
Cohen's d Based on Industry Sector and Intervention Type

Industry	All studies	Treatment type				
		CB	Relax	Org	Multi	Alternative
Office	0.680*** (19)	0.872 (3)	0.619*** (7)	0.162 (1)	0.395* (6)	1.337** (2)
Health care	0.492*** (8)	0.988*** (1)	0.462*** (4)	0.208 (2)	1.307* (1)	N/A
Education	1.255** (7)	1.662* (3)	1.523* (1)	0.056 (1)	0.524 (1)	2.037*** (1)

Note. Numbers in parentheses represent total number of interventions. CB = cognitive-behavioral; Relax = relaxation; Org = organizational; Multi = multimodal.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Sensitivity Analysis

We performed a sensitivity analysis to examine whether including seven additional studies from the van der Klink et al. (2001) meta-analysis would change our overall results. These particular studies did not meet our inclusion criteria because, according to our review, they did not report sufficient statistics to calculate an effect size.[1] They were included in the van der Klink et al. study on the basis of assumptions made by those authors. However, rather than exclude these interventions entirely, we used the reported effect sizes from the van der Klink et al. study and added them to our meta-analysis. This slightly reduced our combined overall effect size (d = 0.469, 95% CI = 0.328, 0.609) but still yielded a medium effect.

Publication Bias

We performed an analysis to examine whether the combined effect size from published studies differed from that of unpublished studies. The current meta-analysis included five unpublished dissertations, representing eight interventions. The combined effect size from these eight interventions, using the average effect size across outcomes, yielded a significant medium to large effect (d = 0.553, 95% CI = −0.126, 1.232, p = .110). In comparison, the combined effect from published studies was .509 (95% CI = 0.356, 0.661, $p < .001$). In this case, it appears that including unpublished studies slightly increased the size of our overall average effect, whereas the general concern is that omission of unpublished work upwardly biases the effect size. We have no unambiguous explanation for the direction of difference in our particular case. There were no apparent differences in methodological quality between the two groups of studies.

Another way to detect publication bias in a meta-analysis is the "trim-and-fill" technique, developed by Duval and Tweedie (2000). "Trim and fill" is a nonparametric method designed to estimate and adjust a funnel plot for the number and outcomes of missing studies (Duval, 2005). We used this method on the overall effect size distributions and estimated the number of missing studies at six, all to the right of the mean. This suggests that the combined effect of 0.526 is understated and that the potential impact of including the proposed "missing" studies would increase the effect to 0.595. However, one limitation of the trim-and-fill method is that if the data are heterogeneous, the technique may impute studies that are not really "missing." Study-related factors may distort the appearance of the funnel plot (Duval, 2005). To adjust for heterogeneity, we performed additional trim-and-fill analyses at the subgroup level, examining intervention type crossed with outcome. We were able to use the method only if there was a minimum of three interventions in the subgroup. On the basis of the analyses, multimodal interventions was the only category that produced greater than one "missing" study. On the basis of the psychological outcome measures, it appeared that three studies were missing on the left side of the mean, which would suggest an overstated effect and would decrease the overall effect for multimodal interventions (d = 0.190). We stress that the main goal of the trim-and-fill method is as a sensitivity

[1] For example, one study contained three distinct treatment modules but combined the participants of each into one group and compared it with the control. Two studies reported results of only the statistically significant findings, and several others failed to report all required statistics (e.g., means with no standard deviations). In such cases, van der Klink et al. (2001) used p values, making assumptions when no such value was reported (e.g., nonsignificant findings).

analysis to assess the impact of missing studies on the overall effect, rather than actually adjusting the end results (Duval, 2005).

Discussion

In the present study, we used meta-analysis procedures to evaluate the effects of SMIs in workplace settings. We updated a previous systematic review performed by van der Klink et al. (2001). Thirty-eight articles met our inclusion criteria, representing 36 studies and 55 interventions. A combined analysis, using the weighted average effect size from each individual intervention, yielded a significant effect size ($d = 0.526$, 95% CI = 0.364, 0.687). However, this overall analysis may be misleading as there is significant heterogeneity within the studies. Further analysis was required to determine what moderators were present.

We classified interventions into more homogeneous subgroups and performed analyses on these groupings to identify moderators. First, to be consistent with the van der Klink et al. (2001) study, we coded interventions on the basis of their treatment components and categorized them into five subgroups: cognitive–behavioral, relaxation, organizational, multimodal, and alternative interventions. Although we found larger effects in each of the four subgroups that we had in common with van der Klink et al., the relative effectiveness of the four groups was the same in both meta-analyses, and van der Klink et al.'s average effect size value for each category was well within the 95% confidence intervals around our mean effects. Thus, our research both supports the results of the van der Klink et al. meta-analysis and extends it by ruling out the threat that weak study design in some of the included studies was responsible for the observed effects. In fact, we show that higher average effects were obtained when only true experiments were included.

In the current meta-analysis, cognitive–behavioral interventions ($d = 1.164$) and alternative interventions ($d = 0.909$) yielded the largest effect sizes. On the basis of the I^2 statistic and Q values, however, there was substantial heterogeneity within each of these subgroups. We therefore performed additional subgroup analyses, and cognitive–behavioral interventions consistently produced larger effects than other types of interventions. Our findings are in accord with other research that has shown cognitive–behavioral interventions to be among the more effective methods for managing stress in other settings and with other populations, including HIV-positive gay men (Lutgendorf et al., 1998), women with early stage breast cancer (Antoni et al., 1991), and students (Stein et al., 2003). Similarly, cognitive therapy has proved to be an effective treatment for a variety of psychological, psychosomatic, and somatic disorders, including depression and anxiety (Lipsey & Wilson, 1993), chronic pain (Morley, Eccleston, & Williams, 1999), chronic fatigue syndrome (Whiting et al., 2001), and insomnia (Rybarczyk et al., 2005).

In an attempt to understand why cognitive–behavioral interventions might produce stronger effects than other popular techniques such as relaxation or meditation, we compared the goals of the methods. Relaxation and meditation aim to refocus attention away from the source of stress, to increase the person's awareness of the tension in his or her body and mind, and to reduce this tension by "letting go." Although they may reduce or eliminate troubling thoughts or feelings, they do not direct the individual to confront dysfunctional ideas, emotions, or behaviors. Thus, these are basically passive techniques. Cognitive–behavioral interventions, on the other hand, are more active. These interventions encourage individuals to take charge of their negative thoughts, feelings, and resulting behavior by changing their cognitions and emotions to more adaptive ones and by identifying and practicing more functional behavioral responses. In other words, cognitive–behavioral interventions promote the development of proactive as well as reactive responses to stress. This may account for the relative magnitude of the two types of treatments, but other differences, such as variations in the length of the intervention and the mode of instruction, will need to be ruled out by future research.

Despite the stronger effects of cognitive–behavioral interventions, the most popular treatment components among the 55 interventions were relaxation and meditation techniques. They were used in 69% of the studies. On the basis of the subgroup analyses, these programs consistently produced medium effects. A likely reason for the popularity of this treatment is its simplicity. A survey of subject matter experts rated relaxation as the most practical intervention, because it is the least expensive and easiest to implement (Bellarosa & Chen, 1997). Often these techniques are self-taught via audiotapes. Cognitive–behavioral interventions, in contrast, are generally taught by a trained professional in a group session, and therefore require a greater investment of organizational resources.

A somewhat surprising finding from the current study is that the more components added to a cognitive–behavioral intervention, the less effective it becomes. Single-mode cognitive–behavioral interventions yielded a *d* of 1.230, but cognitive–behavioral interventions with four or more components (e.g., including relaxation, assertiveness, time management, etc.) yielded a *d* of 0.233. This finding contradicts Murphy's (1996) narrative review, in which he concluded that "the most positive results were obtained with a combination of two or more techniques" (p. 112). Multimodal interventions are quite common and are more likely to be of a longer duration. However, longer treatment programs were generally not associated with larger effect sizes. Organizational researchers may be tempted to institute a combination of treatments in hopes of producing more effective stress management. We suggest that when single components are resource intensive and relatively multifaceted at the outset, as is the case with cognitive–behavioral skills training, the organization's ability to implement additional components effectively may decrease and work to the detriment of the more complex individual components. Simpler interventions may not suffer from being bundled with other components. For example, the effect of relaxation training varied less dramatically whether it was delivered on its own ($d = 0.497$) or as part of a package four or more components ($d = 0.246$). On the basis of our meta-analysis, we suggest that cognitive–behavioral programs should not generally be combined with other treatments, but relaxation and meditation can be used as part of a larger set of treatment components. As one anonymous reviewer noted, however, shorter programs—which are likely to be more cost-effective and practical to implement—appear to be sufficient and perhaps even better than programs of longer duration.

The alternative interventions yielded a large average effect, and several of these are worth noting. Three studies (Chen, 2006; Sharp & Forman, 1985; Thomason & Pond, 1995) incorporated an intervention designed to increase employees' personal resources or management/job skills, and they produced a combined significant large effect ($d = 1.414$, CI = 0.587, 2.241). We made the decision to code these interventions as alternative rather than organizational because they were designed to provide employees with individual tools to assist them with the more stressful aspects of their work rather than to make structural changes in their jobs. For example, Chen (2006) designed an intervention to increase participants' personal resources during the introduction of a new information technology system, and Sharp and Forman (1985) provided classroom management training to teachers. As these interventions may be thought to address organizational issues, we conducted a reanalysis by putting them in the organizational subgroup. This increased the average effect of organizational interventions from 0.144 ($k = 5$, CI = −0.123, 0.411) to 0.595 ($k = 8$, CI = −0.044, 1.233). This sensitivity analysis both illustrates that the small number of studies in particular categories affects the stability of the results for that subgroup and provides evidence that programs that increase the employee's job-related skills and abilities may be an effective way to reduce employee stress. We suggest that new primary studies are needed for this category of intervention.

Our examination of outcome measures by intervention type revealed several other gaps in the literature. As noted in earlier reviews (Murphy & Sauter, 2003; van der Klink et al., 2001), there remains a lack of studies that assess organizational-level outcomes. We suggest that future primary studies attend to this level of outcome. We further suggest that we will learn more about the mechanisms by which interventions reduce stress and be able to more meaningfully compare interventions by incorporating each of the three types of outcome measures in each evaluation. Currently, researchers tend to choose outcome measures that are highly aligned with the intervention. Thus, exercise interventions will almost always use physiological measures, cognitive–behavioral and relaxation programs will use psychological measures, and organizational interventions will include at least one organizational outcome. Matching intervention to outcome type makes sense but also creates confounds between intervention and type of outcome. For example, in our sample of studies, no single-mode cognitive–behavioral intervention used physiological outcome measures. These interventions achieved some of the largest effects on the basis of psychological variables, but how would they have compared with exercise interventions if they had measured cardiovascular functioning? New primary research comparing different interventions on similar outcomes would contribute to both theoretical and applied literatures on worksite stress management.

Limitations

A limitation of this meta-analysis is that there is limited information to assess the effects of organizational-level interventions or organizational-level outcomes. The majority of studies reported only psychological-level outcome measures, and there were very few studies with organizational-level outcomes (e.g., absenteeism and performance). Of the 36 studies, only 5 assessed the impact of an organizational intervention. One reason for this is because of the strict inclusion criteria we applied to our literature search. We limited the type of studies to only those experiments with random assignment to treatment and control groups, and it is likely to be difficult to conduct true experiments on organizational interventions. On the other hand, this may reflect the true state of the research literature, as reviews with less stringent inclusion criteria also lament the lack of evaluation of organizational interventions (Giga, Noblet, Faragher, & Cooper, 2003; Murphy & Sauter, 2003).

Another limitation of this meta-analysis is that the moderators we examined are confounded by the type of participants in each study, and with each other. Our overall effect size is an average of several heterogeneous effects, which may have been produced by differences in the characteristics of the sample participants as well as in the intervention type. The wide variety of intervention types and outcome variables makes for a multitude of effect combinations. We have attempted to classify the interventions into the most meaningful subgroups while keeping in mind that subgrouping leads to decreased power and precision.

A final limitation is that we cannot account for the varying organizational stress levels before the intervention and how they may have influenced the size and variability of treatment effects. Some studies in our sample did prescreen employees and selected participants who, although not clinically diagnosed with a stress-related illness, scored moderate to high on initial stress screenings. Other studies simply recruited employees through public notice. We cannot make the assumption that pretreatment stress levels among our sample studies were uniformly high simply because the organizations were willing to participate in an intervention. An anonymous reviewer noted that often the organizations with the most stressful environments are the ones whose management does not see the value in investing in training.

Future Research

The overall significant medium to large effect size indicates that there is value to SMI programs. These results show that individual employees can be taught techniques to reduce their stress levels and alleviate symptoms of strain. In addition, nearly all of the subcategories of interventions produced meaningful effects. Some of these, such as cognitive–behavioral interventions and meditation, have been the focus of a relatively large number of studies, but not all of the potentially effective treatments have been studied very often. Specifically, single-mode treatment programs that provide employees with personal job-related skills and abilities (e.g., resource enhancement and goal setting) need more attention by researchers.

Our moderator analyses, even for popular interventions, are based on small numbers of studies. Furthermore, it was not possible to remove potential confounds such as the one between type of intervention and outcome type. Thus, future research that systematically disentangles the confounding in the current body of literature would contribute to our knowledge of the effectiveness of different types of programs.

Little is known about the long-term effects of SMIs. In all of the studies in this meta-analysis, the posttreatment measures were taken either immediately after training or within several weeks. Only a quarter of the interventions ($k = 15$) included follow-up measures subsequent to the posttreatment evaluation. It would be useful to know how long these effects last. Recent research on time away from work (i.e., respites) has found empirical evidence to suggest a direct relationship between occupational stress and strain. Studies have found that time away from work will alleviate stress symptoms, but no matter how long the respite—whether a weekend or year-long sabbatical—employees ultimately return to prerespite stress levels (Eden, 2001). We need additional primary studies to assess whether a similar pattern develops with SMIs.

Finally, the present meta-analysis illustrates that after 30 years of work, there are a large number of methodologically rigorous intervention studies in the stress management literature. We hope the results encourage future researchers to strive to design quality experiments that incorporate random assignment to treatment and control groups and report the results of all outcomes, not just the statistically significant ones. In addition, we promote the continued use of meta-analytic procedures to synthesize the research. As more primary studies are conducted, it is important to update systematic reviews and continue to reassess the results.

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*Indicates study was used in the meta-analysis.

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