1998

A review of the health impact of smoking control at the workplace

Michael Eriksen
Georgia State University, meriksen@gsu.edu

Nell H. Gottlieb
University of Texas at Austin, nell.gottlieb@gmail.com

Review: Smoking Control

A Review of the Health Impact of Smoking Control at the Workplace

Michael P. Eriksen, Nell H. Gottlieb

Abstract

Purpose. *To summarize and provide a critical review of worksite health promotion program evaluations published between 1968 and 1994 that addressed the health impact of worksite smoking cessation programs and smoking policies.*

Methods. *A comprehensive literature search conducted under the auspices of the Centers for Disease Control and Prevention identified 53 smoking cessation program evaluation reports, of which 41 covered worksite single-topic cessation programs. Nine additional reports were located through manual search of citations from published reports and reviews. These 50 reports covered 52 original data-based studies of cessation programs. The search produced 19 reports for tobacco policy evaluations, of which 12 addressed health impact. An additional 17 reports were located by the authors. These 29 reports covered 29 studies of policy impact.*

Summary of Important Findings. *Smoking cessation group programs were found to be more effective than minimal treatment programs, although less intensive treatment, when combined with high participation rates, can influence the total population. Tobacco policies were found to reduce cigarette consumption at work and worksite environmental tobacco smoke (ETS) exposure.*

Conclusions. *The literature is rated suggestive for group and incentive interventions; indicative for minimal interventions, competitions, and medical interventions; and acceptable for the testing of incremental effects. Because of the lack of experimental control, the smoking policy literature is rated as weak, although there is strong consistency in results for reduced cigarette consumption and decreased exposure to ETS at work. (Am J Health Promot 1998;13[2]:83–104.)*

Key Words: Smoking Cessation Programs, Tobacco Policy, Worksite Health Promotion, Review

INTRODUCTION

Tobacco use, particularly cigarette smoking, continues to be the single greatest cause of preventable death in our society.[1] The Centers for Disease Control and Prevention (CDC) estimate that, as a result of cigarette smoking, over 400,000 Americans die prematurely each year, equivalent to the annual loss of 5 million years of life.[2] Not only does smoking result in a massive health burden, but it also has a significant and adverse effect on health care expenditures. A recent study estimates that $50 billion is spent on treating smoking-related diseases each year, about 7% of all medical expenditures, with nearly half being paid for by public funds.[3] Approximately $2 in medical expenses is associated with every pack of cigarettes sold in this country.[3]

Nowhere is the concern about the health and economic impact of smoking greater than it is in the workplace. In fact, over the last 15 years, the greatest advances in controlling tobacco use and in protecting the nonsmoker from the adverse effects of secondhand smoke have occurred in the workplace. Growing from an early concern with safety and productivity in the 1970s to a concern with litigation and need to comply with state and local ordinances in the 1990s, the workplace is widely recognized as an innovator in limiting the direct and indirect adverse effects of tobacco.[4] Today, most workplaces have in place restrictive smoking policies, many creating completely smoke-free environments. As these policies have been implemented, they have become increasingly restrictive, and most companies have

Michael P. Eriksen, ScD, is Director, Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia. Nell H. Gottlieb, PhD, is Professor, Department of Kinesiology and Health Education, The University of Texas at Austin.

Send reprint requests to Nell H. Gottlieb, PhD, Department of Kinesiology and Health Education, The University of Texas at Austin, Austin, TX 78712.

This manuscript was submitted June 28, 1996; revisions were requested August 21, 1996; the manuscript was accepted for publication July 20, 1998.

Health Promot 1998;13(2):83–104.

0890-1171/98/$5.00 + 0

introduced new or stronger policies over the last 10 years. The progress in establishing policies to control workplace smoking has been so great that the federal government's Healthy People 2000 objective for restricting smoking was achieved by 1994.[5]

Given companies' interest in limiting smoking in the workplace, the issue quickly becomes one of determining the relative effectiveness of different workplace smoking control interventions. Corporate decision makers need to be able to reasonably anticipate the types of outcomes that will result from specific tobacco control interventions. The purpose of this paper is to begin to answer this question by analyzing the published literature on worksite smoking control and determining if general conclusions can be made that will be of value to the business community.

Efforts to control workplace smoking usually take one of two general approaches. The objective of the first approach is to assist smoking employees (and, in some instances, family members) in modifying their smoking behavior, with the goal of achieving permanent smoking cessation. The goal of the second approach is to protect the health of nonsmoking employees by reducing or eliminating exposure to environmental tobacco smoke. This second approach typically involves the establishment of some type of restrictive smoking policy, with an increasing frequency of smoke-free policies or bans. Often, these two general approaches are combined as part of a total tobacco control program, with the hope that one approach will reinforce or complement the other. Thus, many tobacco control programs are based on the belief that a nonsmoking environment will make it easier for smoking employees to quit or that efforts to help employees stop smoking will increase the acceptance and aid in the implementation of a restrictive smoking policy.

Tobacco control is also a key component of a comprehensive worksite health promotion program. These multicomponent programs have the advantage of providing a behavior change support system to use for a variety of risk and wellness behaviors and of including programs that are mutually supportive (for example, stress management, fitness, and smoking cessation to reduce smoking) and hold the interest of participants more than single-component programs.[6,7]

Nine literature reviews on worksite smoking cessation programs were published between 1985 and 1994,[8–16] of which one included a review of the effects of smoking policies.[16] These reviews have pointed out the great potential of worksite smoking control for long-term cessation, including the mobilization of peer support; ease of recruitment; use of environmental cues, incentives, competitions, and policies; and convenience in conducting outcome evaluations. However, the difficulties of conducting research in this setting, including reduced experimental control, volunteer bias in recruitment, especially if time off for attendance is not provided, potential employee relations problems, and problems with staff turnover for follow-up, were also discussed. Weaknesses noted in the research articles reviewed included use of self-report, relatively short follow-up periods, weak research designs, lack of consistency between units of assignment and units of analysis, small sample sizes, lack of definition of the study population, recruitment and treatment procedures, failure to report attrition rates, and lack of complete outcome measures following the recommendations of the 1985 Surgeon General's Report.[17] For smoking policy evaluations, issues were noted with the research designs, limited power to detect small changes in cessation rates, and the predominance of studies in health care settings, which limited external validity.[16]

Fisher et al.[18] conducted a meta-analysis of 20 controlled studies of worksite cessation that had 34 comparisons of long-term (over 12 months) quit rates. They found an overall mean effect size of .21 ± .07, indicating a modest but significant overall effect. The weighted average follow-up quit rate from all interventions was 13%. Interventions in small worksites that lasted 2 to 6 hours and contained heavy smokers showed the largest effect sizes.

The current review article updates the literature from these articles and provides a systematic review and assessment of the quality of each research report. Smoking control programs within multicomponent programs have already been considered in this review series.[19] Included are research projects or program evaluations that address smoking cessation programs and tobacco control policies, as well as, in some cases, programs that combine both cessation efforts and worksite policies. Unfortunately, there is no published literature that assesses the independent and combined effects of these two approaches. Despite this limitation, this review will summarize the literature for each of the two approaches and suggest implications for comprehensive tobacco control efforts. Following a summary of the extant research and findings, the methodological issues confronting workplace smoking control research will be discussed and recommendations for future research put forward.

METHODS

This review on the health impacts of workplace smoking control programs is part of a larger review on the health impact of workplace health promotion programs sponsored by the U.S. CDC. The CDC conducted the initial search for studies with the goal of identifying all the published studies between 1968 and 1994 reporting the health impact of worksite health promotion programs. This search is described in detail in the introductory article to these reviews.[20] The CDC search for worksite smoking cessation programs produced 53 reports, of which 41 covered worksite single-topic cessation programs. Nine additional reports were located through manual search of citations from published reports and reviews. These 50 reports covered the 52 original data-based studies that are included in Table 1.[21–70] Three of these studies did not focus on cessation rates, but they contribute to our understanding of increasing program participation[53,55] and of

the immediate impact of the Great American Smokeout.[56] Smoking cessation interventions that are components of comprehensive health promotion programs are reviewed by Heaney and Goetzel.[19]

The CDC search for tobacco policy evaluations produced 19 reports, of which 12 were reviewed. An additional 17 reports were found by the authors through a manual search of citations from published reports and reviews and their own files, yielding the 29 studies in Table 4.[71–99] Policy implementation studies were not considered for this review.

Each table provides information about the purpose of the evaluation, description and rating of the research design, whether a comparison group was used, sample size and description, outcome measures, evaluation period, and findings. For the smoking cessation studies, participation rate and intervention components are also included. The research design methodological rating scale is presented as a footnote to the tables and ranges from "1" for anecdotal findings to "5" for randomized trials. Table entries are arranged within different groupings according to the methodological design rating and year of publication and alphabetically within year. When multiple reports of one study are included, they are listed by the first published report. When multiple trials are reported in one report, they are listed individually.

REVIEW OF THE LITERATURE

Smoking Cessation Evaluations

Of the 52 smoking cessation program evaluations reviewed in Table 1,[21–70] 44.2% used randomized designs and 19.2%, quasiexperimental designs. Five types of studies were identified: evaluations that looked at group programs (19.6%), minimal treatment programs (21.6%), incentives (7.8%), competitions (11.8%), medical interventions (9.8%), and tests of the relative effectiveness or incremental effects of specific treatment components (29.4%). In addition, one study reviewed was a randomized trial of strategies to recruit participants to a cessation group trial.[53] The majority of the evaluations for incentive (75%) and group (60%) programs were observational; 50% of the competition evaluations used quasiexperimental designs; 54.5% of the minimal intervention evaluations used experimental designs, as did 80% of those for medical interventions. The testing of treatment component effects was primarily done using randomized (66.7%) or quasiexperimental (26.7%) designs. The latter category included four studies of the effects of social support over group or self-help interventions,[22–24,27,29,51,52] four of competition over group or minimal interventions,[34,36,37,44] and three of environmental supports over group programs.[30–32]

Table 2 displays the research design ratings of evaluations conducted in 5-year periods. In general, the number of studies and the rigor of the research designs increased over time. The highest proportion of studies overall and of rigorous studies within a time period were conducted from 1985 to 1989; six of these studies were small-scale experimental trials of minimal interventions by the same research team.[50,65] The nature of the research has changed over time. While evaluations of group interventions have continued, concern with low participation rates led to research on incentives and competitions. The clinic evaluations also became more methodologically sound with the study of treatment components using randomized designs. Most recently, worksite-wide programming for health promotion interventions has been undertaken using the worksite as the unit of randomization and analysis. Our review includes three such studies,[21,22–24,60] and these have shown much smaller effect sizes.

Of the 25 studies that examined the 6- to 24-month quit rates of 37 cessation groups (see Table 1), the range was 0% to 91%, and the median cessation rate was 23%.[21–46] Of the four more rigorous studies that had no-treatment comparison or control groups, Shipley et al.[35] and Sorensen et al.[21] found markedly lower (5% and 3%, respectively)—and Scott et al.[38] and Jason et al.[33] similar (25% and 20%, respectively)—net differences in rates between the intervention and comparison/control groups.

The 19 studies that examined minimal treatment interventions included a telephone help line,[57] a computerized nicotine fading intervention,[48] the Great American Smokeout,[56] short videos,[50,54] and a televised cessation program,[22–24] in addition to the more common self-help manual-based interventions.[25,39,47,49,51,52,55,58,59] The quit rates ranged from 1.1% for a self-help manual for firefighters[47] to 21.4% for computerized daily assessment plus a contest,[49] and the median quit rate across all studies was 10.1%. The five studies of minimal video interventions with control groups found from −.05% to 14% (median, 0.5%) net differences between groups.[50,54] Lowe et al. studied recruitment mode to a self-help program, finding that subjects receiving telephone calls were more likely to schedule and keep appointments than those who received a letter.[53]

The effect of competitions on recruitment to group or minimal treatment cessation programs was reported in seven studies[34,36,37,44,55] and the effect on cessation rates in six studies.[34,36,37,44] Participation rates ranged from 2% to 88%, with a median of 47%. Cessation rates ranged from 12% to 91%, with a median of 65%. It should be noted that three of the studies (from the same report) represented competitions in small worksites, did not have comparison groups, and reported high cessation rates (80% to 90%).[44] In the more rigorously designed studies, the net effects for cessation rate of competition plus group cessation program over group program alone were found to be 1%,[36] 4%,[37] and 25%.[34] For participation, the net effects of competition were 35%,[37] 1.4%,[34] and 26%[55] of smokers to programs and 53% of all employees for the Great American Smokeout.[55]

Among the group and minimal cessation program evaluations, four randomized trials of treatment components examined the addition of social support. One of these studies found a significant incremental effect of social support (14.4% vs. 5.8%),[51,52] while two found no difference.[27,29] Ja-

Table 1

Characteristics of Evaluations of Worksite Smoking Cessation Programs

Study	Purpose of Evaluation	Research Design Rating	Comparison Group	Sample Size	Participation Rate	Sample Description	Research Design
Cessation groups†							
Sorensen et al. (1993)[21]	Determine the effectiveness of a short-term comprehensive smoking cessation program with coworker support training	*****	Yes	All smokers in eight companies	12% of smokers; 3.7% of nonsmokers	Eight worksites with mean of 42% blue-collar workers in suburban Bloomington, Minnesota, an intervention community for the Minnesota Heart Health Program	Worksites randomized to two groups (intervention/no intervention) with one pre- and two posttests; 89% completed 1 month and 96%, a 6-month survey of smokers identified at baseline (80% all employee response rate); no attrition rate reported
Jason et al. (1987, 1989)[22–24]	Determine the incremental benefit of worksite self-help support groups with a lottery incentive in conjunction with media and self-help smoking cessation activities	***** (Worksites)	Yes	43 volunteer companies from a random selection of 100 companies	Not reported	43 companies affiliated with PruCare health maintenance organization	Randomized two-group (self-help plus group plus lottery plus media vs. self-help plus lottery plus media) pretest/posttest design; company is unit of randomization and analysis; data are from volunteer employees who completed registration forms and received a manual (n = 235 in group and 192 in no-group condition); lacked no-treatment control group; response rates to posttests were 47% and 33% and reported conservatively; treatment completion was not reported
Omenn et al. (1988)[25]	Determine the relative effectiveness of a group multicomponent cessation program, a group relapse prevention program, and a self-help program	***** (Random assignment within preference for group or self-help format)	Yes	402 smokers	11%	Primarily male employees of the Department of Energy in Washington state	Three-group (multicomponent program [MCP] vs. group relapse prevention [RPP] vs. minimal treatment [MTP]) pre- and three posttests; lacked no-treatment control; 80% of Ss completed MCP compared to 57% of those in RPP, 31% for group-help MTP, and 40% for self-help MTP
Frank et al. (1986)[26]	Determine the effects of various amounts of hypnosis and hypnosis plus behavioral sessions	*****	Yes	63 smokers	Not reported	Employees of the University of Missouri	Subjects in initial sample of 48 were blocked on pack years of smoking and scores on the Creative Imagery Scale and randomly assigned to three conditions: two 1-hour sessions of hypnosis; four 1-hour sessions of hypnosis plus a booster session 3 weeks later; two 1-hour sessions of hypnosis plus two 1-hour sessions of behavioral self-management training plus a booster session 3 weeks later; all sessions were done every 2 weeks; 15 additional subjects received four 1-hour sessions of hypnosis (two times/week) plus a booster session 3 weeks later; pre- and two posttests; 6% attrition; lacked a no-treatment control
lasgow et al. (1986)[27]	Determine the incremental effect of social support on a smoking cessation program	*****	Yes	29 smokers	Not reported	Maintenance, clerical, and lower level professional staff; site not specified	Subjects assigned to groups of three to seven based on schedules; groups assigned to two conditions: basic program and basic program plus social support; pre- and two posttests; 7% attrition with no difference by condition; lacked a no-treatment control
Glasgow et al. (1984)[28]	Determine the relative effectiveness of three versions of a controlled smoking program on nicotine consumption	*****	Yes	36 employees and spouses	Not reported	Employees of a telephone company	Three groups (abrupt reduction vs. gradual reduction vs. gradual reduction with feedback), pre- and two posttests; lacked a no-treatment control; 8% attrition
Malott et al. (1984)[29]	Determine the incremental effect of a coworker social support component on a controlled smoking program	*****	Yes	24 employees	Not reported	Volunteers from a telephone company (8) and medical clinic (16)	Two groups (support plus program vs. program) with pre- and two posttests; lacked a no-treatment control; all Ss completed groups; one moved before 6 months follow-up
Dawley et al. (1993)[30]	Determine the incremental effectiveness of an environmental component over smoking cessation alone	****	Yes	97 smokers	22%, 13% in environmental sites; 7% in cessation-only site	Employees from three chemical plants in Louisiana	Quasiexperimental, two groups (environmental/group vs. cessation alone) with pre- and two posttests; no attrition rate reported
Hymowitz et al. (1991)[31]	Determine the effect an "enriched milieu" (environmental approach) would have on the impact of a group quit smoking program	****	Yes	252 employees in six work sites	Not reported; "a small portion"	White-collar worksites ranging from 950 to 3300 employees	Two groups (group plus physician counseling plus worksite health promotion vs. group cessation program), pre- and two posttests; lacked a no-treatment control; worksites randomized but individual unit of analysis; 23.4% dropped out and were included in the denominator
Dawley et al. (1991)[32]	Determine the relative effectiveness of an environmental approach to worksite smoking control compared to a smoking cessation program alone	****	Yes	30 smokers (14 in environmental site; 16 in comparison site)	Not reported	Primarily male Louisiana oil refinery workers	Quasiexperimental design with two groups, pre- and two posttests; attrition not reported
Jason et al. (1990)[33]	Evaluate the effectiveness of a multicomponent smoking cessation program including social support, incentives, and competition	****	Yes	95 smokers (53 in intervention group and 42 in comparison group)	81% in intervention group; 84% in comparison group	Mid-size companies with no other description	Quasiexperimental two-group (intervention vs. no intervention) pretest-posttest design; 11.4% for intervention and 11.9% for comparison left company and are not included in analyses, although smoking status was reported

Table 1

Extended

Intervention Components	Outcome Measures	Evaluation Period	Findings
Three 1-hour behavioral cessation classes, 1-hour class for nonsmokers on coworker support of cessation, 90-minute consultation with optional follow-up on ways to implement policy for employers	Self-reported smoking cessation and quit attempts with data on coworker support and workplace norms; saliva continine collected for 52% of sample but not analyzed	6 months	At 6 months, 12% of intervention group reported cessation compared to 9% of control groups, with cessation predicted by coworker requests not to smoke
20-day television affiliate news quit smoking segments; at worksites, program schedules, cessation manual, and (in group condition) six 45-minute employee-led support groups during 3 weeks TV programs along with 12-hour-long monthly meetings; also, two $50 lotteries were held each month for group members abstinent since last meeting and for family/coworkers who had been named as helpful	Self-reported cessation, daily cigarette consumption, and tar, nicotine, and CO content of cigarette brands smoked; biochemical and/or coworker or relative confirmation of quitting at 12 months	12 months	The addition of support groups to the basic intervention appeared to nearly double the quit rate at 3 months (22% vs. 12%). At the 12-month follow-up, there was no difference in abstinence (21%) or in continuous abstinence (7% in group vs. 3% in no group). At the 12-month follow-up, cessation rates were 26% in the group (G) condition and 12% in the no-group (NG) condition, with 11% continuous abstinence in the G and 3% in the NG conditions. The company-wide reductions in smoking for Gs and NGs at immediate post (10% vs. 3%), at 6 months (6% vs. 2%), and at 12 months (5 vs. 2%) were significantly different. No differences were found in number of cigarettes and tar, nicotine, and CO levels of cigarettes smoked between the groups at any posttest.
Multicomponent program (MCP) used behavioral skills training, aversive stimuli, imagery, and stress management offered in group and self-help format over 3 weeks; relapse prevention program (RPP) focused on coping skills to prevent relapse and met eight weekly 2-hour sessions or in self-help format; minimal treatment program (MTP) used self-help booklet with cessation tips	Self-reported cessation with saliva continine verification at 12-month follow-up	12 months	There was no difference in self-reported quit rates among the three group-help preference programs (25.5% MCP, 24.6% RPP, and 23.5% MTP) or in the three self-help preference formats (15.8% MTP, 19.5% RPP, and 16.5% MTP), but all group formats were higher than self-help formats. Verified quit rates were for the group-help preference, 15.7% MCP, 17.5% RPP, and 7.8% MTP; for the self-help preference, 9.2% MCP, 11.0% RPP, and 7.0% MTP.
Hypnotic treatment was mutual group hypnosis procedure including group problem solving, self-hypnosis as a coping strategy, personalized suggestion for motivation to quit, and maintenance; cognitive behavioral treatment included self-monitoring, alternative behaviors, stimulus control, environmental management, self-reinforcement, target reduction, and problem solving. $35 deposit could be earned back by attendance and abstinence	Self-reported cessation with saliva thiocyanate confirmation and daily cigarette consumption	6 months	Of the initial three conditions, there were no significant differences between groups in the number of cigarettes smoked or the number of quitters. 31% were abstinent at the end of treatment, with 17% abstinent at the 6-month follow-up. In the fourth condition, 60% were abstinent at the end of treatment and 20%, at 6 months.
Six cognitive behavioral program (Glasgow et al. [1984])[28]; social support condition included subject selection of a partner to attend two group meetings on support and to receive biweekly partner support manuals and two telephone calls for encouragement and consultation	Self-reported cessation and cigarette consumption with CO and saliva thiocyanate validation, examination and weighing of saved cigarette butts	6 months	No difference between groups was found at 6 months, with 25% of cessation group only and 23% of group plus social support condition showing validated abstinence. End of treatment abstinence was 54% in the cessation group-only condition and 40% in the group plus social support condition (ns). The frequency of negative or nonsupportive interactions with partners was inversely associated with success, while there was no relationship between the frequency of supportive interactions and success.
Seven weekly meetings with goals of 50% reduction per week in abrupt group; 25% per week in gradual group; 25% per week with graphs of daily nicotine intake for gradual/feedback group	Self-report of smoking status and consumption with CO validation and cigarette butt weight	6 months	At 6 months, one-third of the subjects in the gradual condition were abstinent compared to no subjects in the abrupt condition.
Controlled smoking had six weekly 50-minute group meetings focused on sequentially reducing nicotine content, daily cigarette consumption, and percentage of each cigarette smoked, cessation, and relapse prevention. The social support component included pairing with coworker partners in the program, with discussion at least once a day and monitoring of partner support	Self-reports of smoking with biochemical (CO) confirmation; self-reports of smoking topography; self-monitoring of smoking, examination and weighing of cigarette butts	6 months	Both treatment groups had 17% cessation rates at the end of treatment and at 6 months, and no significant differences between groups were found in the nicotine content of brand, cigarettes/day, percentage of cigarette smoked, and CO level.
The environmental intervention included signage for smoking and no-smoking areas; humorous antismoking posters, bumper stickers, banners, and buttons. Cessation programs were six 1-hour sessions over 2 weeks including self-help manual, photographed public declarations of quitting, and cinnamon "cigarette" sticks	Self-reported smoking behavior with saliva cotinine validation among cessation program participants; unobtrusive observation of smokers at plants	4 months	Participation rates of smokers were 32% and 13% at environmental/group sites and 7% at cessation-only site. Quit rates were 54% and 48% at environmental/group sites, compared to 36% at cessation only sites. Unobtrusively observed smoking in smoking areas decreased in environmental/group sites (142 to 112) but not in the cessation-only site (52 vs. 53).
Behavioral group program had eight 2-hour weekly sessions with brief maintenance sessions. Enriched milieu consisted of systematic worksite physician counseling of smokers, smoking awareness through newsletters and worksite health promotion, and the implementation of restrictive smoking policies	Self-reported smoking status with CO confirmation	12 months	No differences were found between employees in the enriched (full) program and the group-only worksites. Immediate quit rates were 35% in the full and 47% in the group-only conditions; at 12 months, 18% of the full and 22% of the group-only worksites had quit.
Both sites had restrictive smoking policies and had six 1-hour behavioral group sessions; comprehensive group had large banners at the worksite entrance with antismoking posters	Self-reported abstinence with urinary cotinine validation	5 months	At 5 months, the abstinence rate was twice that at the comprehensive site vs. the cessation-only site (43% vs. 21%).
Three-week cessation program with 6 months of follow-up meetings; incentives for attending meeting and daily and monthly abstinence; a three-person competition for most days abstinent; comparison group had CO measurement only	Self-reported cessation with CO confirmation	12 months	The multicomponent program resulted in higher 6-month (42% vs. 13%) and 1-year (36% vs. 16%) cessation rates than the comparison condition. Extremely high levels (80%) of participation were found in both conditions.

Table 1

Continued

Study	Purpose of Evaluation	Research Design Rating	Comparison Group	Sample Size	Participation Rate	Sample Description	Research Design
Maheu et al. (1989)[34]	Determine the effectiveness of competition in conjunction with a multicomponent smoking cessation program	****	Yes	56 volunteer smokers	2% competition; 0.6% no competition	Predominantly male blue-collar aerodynamic employees from two San Diego worksites	Quasiexperimental two-group design with pre- and two posttests; no attrition rate reported
Shipley et al. (1988)[35]	Determine the effect of a comprehensive smoking cessation program compared to a health screening on employee smoking	****	Yes	Seven companies with over 2000 employees (four intervention and three comparison)	20.7% attended cessation clinic	Employees of Johnson & Johnson manufacturing plants	Quasiexperimental two-group design (screening plus cessation program vs. screening), pre- and posttests; lacked a no-treatment control
Klesges et al. (1987)[36]	Evaluate the incremental effectiveness of competition and relapse prevention training in the context of a multicomponent cessation program	****	Yes	136 smokers from eight worksites	Not reported; estimated 28% across all sites	Employees in four worksites in Fargo, North Dakota, and four worksites in Eugene, Oregon	Two (competition/no competition) by two (relapse prevention training/no relapse prevention training) design with pre- and two posttests; worksites randomized but individuals the unit of analysis. The treatment attrition rate was 7% overall, with no difference across conditions.
esges et al. (1986)[37]	Determine the incremental effect of competition on a smoking cessation program	****	Yes	107 smokers	88% with competition; 53% without ($p < 0.05$)	Employees of five financial institutions in North Dakota	Quasiexperimental, two groups, pre- and two posttests; four sites in the competition group and one site in the no-competition group; 91% completed program with no difference in intervention and comparison groups
Scott et al. (1986)[38]	Determine the effect of a nicotine fading and abstinence training intervention for nurses	****	Yes	29 smokers	Not reported	Nurses from four general medical units at a Veterans Administration Medical Center	Quasiexperimental, two groups, pre- and five posttests; three units in intervention group and one waiting list control unit; 15.8% (three) and 10% (one) terminated employment and left the group and were not included in analysis
Bertera et al. (1990)[39]	Determine the relative effectiveness of a self-help vs. group approach to smoking cessation	***	No	70 smokers	Not reported	Employees in a large office complex	Smokers self-selected into self-help or group program; pre- and posttest; no attrition rate reported
en et al. 1990, 1991)[40,41]	Determine the impact of a multiple option smoking cessation program	***	No	1113 smokers (participants); 1204 smokers (nonparticipants)	Not reported; estimated at 50%	Employees of Dow Chemical Texas Operations	One group with pre- and two posttests; 27.2% failed to submit 3-month contracts
Digrusto (1987)[42]	Determine the effectiveness of a worksite smoking cessation program	***	No	28 employees	82%	Employees of a small factory in Sydney, Australia	One group, pretest–posttest design; attrition not reported
Dawley et al. (1984)[43]	Determine the effectiveness of a smoking cessation program	***	No	19 hospital employees and 4 patients	Not reported	Employees and patients of a hospital	One group, pre- and two posttests; 26% attrition
Stachnik and Stoffelmayr (1983)[44]	Determine the effectiveness of a smoking cessation program	***	No	Not reported	70%	Clerks, tellers, and middle managers of a bank	One group, posttest only; attrition not reported
Stachnik and Stoffelmayr (1983)[44]	Determine the effectiveness of a smoking cessation program	***	No	Not reported	70%	Clerical and professional staff of a professional organization that provides services to hospitals	One group, posttest only; attrition not reported
Stachnik and Stoffelmayr (1983)[44]	Determine the effectiveness of a smoking cessation program	***	No	Not reported	47%	Office personnel and factory foremen of an automotive parts manufacturing company	One group, posttest only; attrition not reported
Mossman (1978)[45]	Determine the effectiveness of a company no-smoking clinic	***	No	118 employees	Not reported	Employees of Sandia Laboratories in New Mexico	One group, posttest only

Table 1

Extended

Intervention Components	Outcome Measures	Evaluation Period	Findings
Multicomponent program included behavioral strategies, nicotine gum, a buddy system, and stress management and met nine times for 2 hours the first 4 weeks and 1 hour/week for 9 weeks; team competition for cash pool and raffle for individual participants at 3 months	Self-reported cessation confirmed by CO	12 months	Recruitment was significantly higher at the competition site than at the comparison site (2% vs. 0.6% of smokers), but it was low. The 1-year abstinence rates were 50% in the competition site and 25% in the comparison site, but the difference was not statistically significant.
3-hour lifestyle seminar followed by multicomponent behavioral smoking cessation clinic with opportunity to attend other *Live for Life* health promotion programs; comparison companies had health screening only	Self-reported smoking status with partial thiocyanate verification; daily cigarette consumption	2 years	The comprehensive program resulted in a 2-year quit rate of 22.6% compared to 17.4% in the comparison companies. No differences between conditions were seen in the number of cigarettes smoked by continuing smokers.
Multicomponent cognitive behavioral program for six weekly sessions; within-site competition with weekly feedback on a visible barometer and monetary prizes at program completion and at 6 months; relapse prevention booster sessions were held at 1- and 2-month intervals following the program	Self-reported smoking cessation with CO and saliva thiocyanate validation	6 months	At the immediate posttest, the competition intervention resulted in significantly higher quit rates (39% vs. 16%), but these differences decayed at 6 months (12% vs. 11%). The 6 months' differences for relapse prevention were in the expected direction but not significant (15% vs. 8%).
Six[illegible] cognitive behavioral program.[28] Intersite competition between four banks using buttons and smoking barometers with cash prizes (immediate and 6 months post) and a catered meal (6 months)	Self-reported cessation with CO and saliva thiocyanate verification	6 months	The competition condition achieved higher participation rates (88% vs. 53%). At 6 months, the quit rates were not different (18% vs. 14%). However, 16% of all smokers in the competition worksites quit vs. 7% of all smokers in the no-competition site.
Self-help manual emphasized nicotine fading and abstinence training with daily therapist visits on the unit to discuss progress and problems, measure and feedback CO levels with public posting of large graph in unit; daily contacts maintained for 3 months after abstinence and faded to weekly and monthly visits	Self-reported cessation with CO validation	12 months	At 3 months, 56% of intervention subjects were abstinent, decreasing to 25% at 6, 9, and 12 months.
Choice of American Lung Association's *Freedom from Smoking* clinic and *Freedom from Smoking in 20 Days* self-help kit	Self-reported smoking behavior	18 months	The combined quit rate was 17%, with 20.9% of clinic participants abstinent and 11.1% of the self-help group abstinent.
M[illegible]rogram options included quitting on own, b[illegible]dy program, nicotine gum, American Lung Association (ALA) self-help materials, ALA 7-week group clinic, quarterly prize incentives	Self-reported quitting validated by CO at 6 months[40] and saliva cotinine at 5 years[41]	6 months[40]; 5 years[41]	The 6 months' continuous quit rate was 23.8%. After 5 years, program participants were 2.3 times more likely to be nonusers than the nonparticipants (10.2% vs. 4.4%).
Seven group meetings 30 to 60 minutes in length, three meetings/week. Included behavioral techniques, obtaining social support, rapid smoking, a lottery for cash prizes, and a booster rapid smoking session	Self-reported cessation with cotinine confirmation	18 months	25% biochemically verified smoking cessation rate at 18 months
Ten 1-hour group cognitive behavioral cessations, with contact maintained with the group during the 6 months follow-up and certificate from hospital director for abstinence over 6 months	Self-reported cessation	6 months	Of participants who could be followed up, 15/17 (88%) were not smoking at the end of treatment, 10/16 (68%) at the 4-month follow-up, and 7/14 (50%) at the 6-month follow-up. Thus, at the 6-month follow-up, 7 of the 23 initial program participants were not smoking (30%).
Wor[illegible]e-wide recruitment. Twenty 1-hour group [illegible]gs over a 7-month period on cessation pro[illegible]ures, health aspects of smoking, lifestyle, and social support. No-smoking team contest with management contribution of $75 per team member and employee contribution of $25; $20 lottery at each meeting for abstinence since previous meeting; contracts not to smoke mailed to family and friends	Self-reported smoking status with corroboration by family and friends	6 months	91% of participants were abstinent after 6 months. The net reduction in worksite smokers was 65%.
Worksite-wide recruitment. Twenty 1-hour group meetings over a 7-month period on cessation procedures, health aspects of smoking, lifestyle, and social support. No-smoking team contest with management contribution of $75 per team member and employee contribution of $25; $20 lottery at each meeting for abstinence since previous meeting; contracts not to smoke mailed to family and friends	Self-reported smoking status with corroboration by family and friends	6 months	80% of participants were abstinent after 6 months. The net reduction in worksite smokers was 37%.
Worksite-wide recruitment. Twenty 1-hour group meetings over a 7-month period on cessation procedures, health aspects of smoking, lifestyle, and social support. No-smoking team contest with management contribution of $75 per team member and employee contribution of $25; $20 lottery at each meeting for abstinence since previous meeting; contracts not to smoke mailed to family and friends	Self-reported smoking status with corroboration by family and friends	6 months	85% of participants were abstinent after 6 months. The net reduction in worksite smokers was 46%.
Five 1.5-hour sessions for 1 week, with weekly 1-hour sessions for 6 weeks; cue avoidance, coworker support, films on adverse consequences of smok-	Self-reported cessation	12 months	25% quit rate reported after 1 year

Table 1

Continued

Study	Purpose of Evaluation	Research Design Rating	Comparison Group	Sample Size	Participation Rate	Sample Description	Research Design
Kanzler et al. (1976)[46]	Determine the effectiveness of a smoking cessation program	***	No	30 smokers	4%	Employees of New York State Psychiatric Institute (9) and family members and others (21)	One group, pre- and three posttests, with comparison to similar groups in community; 33% of treatment group dropped out and were counted as failures
Minimum treatment interventions†							
O'Hara et al. (1993)[47]	Determine the effectiveness of a tailored self-help cessation guide for firefighters compared to a nationally available self-help guide	*****	Yes	105 smokers	Not reported	Firefighters and paramedics in Dade County, Florida	Randomized two-group (tailored vs. standard self-help guide) pretest–posttest design; 26.2% filled out at least some of the self-help guide
Burling et al. (1989)[48]	Determine the effectiveness of a computer-delivered smoking cessation program	*****	Yes	58 volunteer smokers	Not reported	VA Medical Center employees	Randomized two-group (computerized nicotine fading/contest vs. contest) pretest–posttest design; lacked no-treatment control group; no attrition rate reported for program
Jeffery et al. (1988)[49]	Evaluate the impact of reduction vs. cessation goals in a smoking cessation program that included financial contracting	*****	Yes	59 volunteer smokers	2%	Faculty and staff of the University of Minnesota	Two-group (reduction vs. cessation goals) posttest only with random assignment; lacked a no-treatment control group; 30% dropped out and were treated as smokers
Sutton and Hallett (1988)[50]	To determine the effectiveness of a fear-arousing cessation videotape	*****	Yes	77 in videotape conditions	58% of respondents to survey (78% response rate)	Company A with occupational health program near London	Randomized into cessation motivation vs. seat belt videotape groups; comparison with nonparticipants; pre- and two posttests; response rates were 97% at 3 months and 89% at 1 year
Sutton and Hallett (1988)[50]	To determine the effectiveness of a cessation motivation videotape and a confidence booster session	*****	Yes	150 smokers in videotape conditions	29% of smoking respondents to survey (83% response rate)	Company B with occupational health program near London	Randomized into cessation motivation vs. cessation motivation plus confidence boosting vs. political aspects of tobacco videotape groups; comparison with nonparticipants; pre- and two posttests; response rates were 96% at 3 months and 94% at 1 year
Sutton and Hallett (1988)[50]	To determine the effectiveness of a cessation motivation videotape and the tape minus a gory sequence	*****	Yes	197 smokers in videotape conditions	47% of smoking respondents to survey (81% response rate)	Company C with occupational health program near London	Randomized into cessation motivation vs. cessation motivation—a gory sequence vs.advertising aspects of tobacco videotape groups; comparison with nonparticipants; pre- and two posttests; response rates were 89% at 3 months and 85% at 1 year
tton and Hallett (1988)[50]	To determine the effectiveness of cessation motivation videotapes	*****	Yes	179 smokers in videotape conditions	33% of smoking respondents to survey (88% response rate)	Company D with occupational health program near London	Randomized into cessation motivation vs. another cessation motivation vs. advertising aspects of tobacco videotape groups; comparison with nonparticipants; pre- and two posttests; response rates were 96% at 3 months and 99% at 1 year
Windsor et al. (1988)[51]; Windsor and Lowe (1989)[52]	Determine the Incremental effectiveness of a skill training/social support enhancement and monetary incentives to a self-help manual	*****	Yes	387 smokers	19.7%	Employees of the University of Alabama at Birmingham	Randomized into four groups in two by two factorial pretest–posttest control group design; lacked no-treatment control group; 9.6% didn't complete program and were included as smokers
Lowe et al. (1987)[53]	Determine the effectiveness of impersonal vs. interpersonal recruitment strategies used in a worksite smoking cessation program[51,52]	*****	Yes	90 smokers who had expressed interest in participating in a cessation program	Not applicable	Employees of the University of Alabama at Birmingham	Randomized two-group (phone calls/letter) pretest–posttest design
Sutton and Eiser (1984)[54]	Determine the effectiveness of a fear-arousing videotape on smoking	*****	Yes	138 employees (43 smokers) in Study 1; 157 employees (29 smokers) in Study 2	Not reported	Volunteer employees of the London Post Office and London Transport	Study 1 had two groups: OFF video vs. an alcoholism video; Study 2 had two groups: OFF video vs. a seat belt video; pre- and two posttests
Gottlieb and Nelson (1990)[55]	Determine the role of competition in recruiting employees to participate in the Great American Smokeout	****	Yes	12 worksites (site size from 74 to 195) for competition	70% competition; 17% no competition for GASO; 28% vs. 2% for self-help group	Employees in three metropolitan regions of the Texas Department of Human Resources	Quasiexperimental two-group (competition vs. no competition) design with pre- and posttest
Hantula et al. (1992)[56]	Determine the impact of the Great American Smokeout on smoking behavior	***	No	Not applicable	Not applicable	Adults (employees and visitors) in a large urban hospital cafeteria	One group, 18 observations over a 3-month period (pre, during, and post Smokeout)
Kinne et al. (1991)[57]	Determine response to a telephone smoking information program	***	No	385 callers, with 61 from worksites	1.6% mean across four worksites	Callers from four predominately male blue-collar worksites and the general population of Seattle, Washington	One group, posttest only

Table 1

Extended

Intervention Components	Outcome Measures	Evaluation Period	Findings
Subsidized enrollment in on site Smokenders program	Self-reported cessation	12 months	Two-thirds of the 30 participants graduated; at 1 year, 60% of these reported abstinence.
Firefighters' guide uses fire service terms and symbols. Nontailored guide was the ALA's *Freedom from Smoking for You and Your Family*	Self-reported smoking behavior and quit attempts	3 weeks	No difference in quitting behavior between tailored and standard self-help material (1.1% cessation; 24.1% quit attempts), although screening and physical examination of smokers seemed to be associated with increased rates of cessation (11.5%)
Computerized nicotine fading treatment and daily assessment plus 2-week stop-smoking contest with a lottery for $300 worth of prizes; contest only	Biochemically confirmed abstinence rates; self-reported daily cigarette consumption; nicotine and CO of cigarette brands smoked	6 months	Although not statistically significant, computer-delivered group had a 6-month quit rate nearly double that of the contest-only group (21.4% vs. 11.5%) and statistically different daily cigarette consumption (14 vs. 17 at 6 months), nicotine levels (0.64 vs. 0.79 at 6 months) and carbon monoxide levels (29 vs. 37 at 6 months) of brands smoked.
Self-help manual; optional education/counseling; financial contracts of $5 to $25 biweekly	Program dropout rate; self-reported cessation rate immediately post-treatment and at 6 months, biochemically validated at both points	12 months	Both treatment groups achieved approximately the same effect: 30% dropout rate; 50% cessation at 6 months and 12% at 1 year.
25-minute videos *Dying for a Fag?* plus a cessation booklet or a booklet on seat belt use plus a leaflet on seat belt use; viewed in groups of 18 to 23	Self-reported smoking cessation with carbon monoxide validation	12 months	There was no difference in validated abstinence among the video groups and nonparticipant groups (3%, 0%, and 5%, respectively).
25-minute videos *Dying for a Fag?* (DFF) and *License to Kill* (LTC) (politics of tobacco); DFF with an additional 5-minute sequence to boost confidence; cessation booklets included in the DFF groups; viewed in groups of 18 to 23	Self-reported smoking cessation with carbon monoxide validation	12 months	The DFF group (11%) had a significantly higher quit rate than the DFF plus C group (8%) but not the LTK group (9%); nonparticipants (4%) had significantly lower quit rates than participants.
25-minute videos, DFF, DFF without bins of lungs, and *The Tobacco War* (TW) (tobacco advertising); cessation booklets included with DFF groups; viewed in groups of 18 to 23	Self-reported smoking cessation with carbon monoxide validation	12 months	There were no differences between the video and nonparticipant groups in long-term abstinence (4%, 3%, 4%, and 2%).
25-minute videos, DFF, *Smokers' Luck* (SL) (a motivational video), and TW; cessation booklets included with DFF groups; viewed in groups of 18 to 23	Self-reported smoking cessation with carbon monoxide validation	12 months	There were no differences between the video and nonparticipant groups in long-term abstinence (3%, 2%, 5%, and 3%).
Self-help manuals were the ALA's *Freedom from Smoking in 20 Days* and *A Lifetime of Freedom from Smoking*; skill training/social support was 20 to 30 minutes of individual counseling with skill instructions including deep breathing, keeping a diary, contracting to quit, and developing a buddy system; monetary incentives ($25) after 6 weeks and 6 months of cessation	Self-reported smoking status at 6 weeks, 6 months, and 1 year, with saliva thiocyanate validation	12 months	The self-help approach combined with skills training and social support achieved a 1-year continuous session rate of 14.4% compared to a 5.8% rate in the self-help groups. Monetary incentives appeared to have no effect on quit rates. The cost-to-benefit ratio for the most effective methods was approximately 2 to 1.
Two modes of recruitment invitation: telephone call or letter	Whether appointments were scheduled and kept	Not applicable	Subjects receiving phone calls inviting participation were more likely to schedule appointments (51%) and keep appointments (16%) than those receiving a letter (0%).
DFF and videos on alcoholism and seat belts were viewed in groups of 20 to 30	Self-reported cessation	3 months	At the 3-month follow-up, 14% of those in the smoking video condition reported stopping smoking compared to none in the control condition; 86% of smoking video condition indicated they tried to stop or cut down, compared with 33% of those in the control condition.
Cold-turkey buffet incentive for worksite	Participation rates and penetration into the smoking population	At completion of contest on GASO	Competition increased the recruitment of all employees to the Great American Smokeout (70% vs. 17%) and of smokers to a self-help program (28% vs. 6%).
Posters, banners, announcements in internal publications, and loudspeaker announcements for the Great American Smokeout of the American Cancer Society	Observations of number of people sitting in the smoking section of the cafeteria, number of people smoking, and mean expired CO of volunteers stopping by an information table	2 months	During the day of the Great American Smokeout, there was a reduction in number of people observed smoking (8 vs. 16.5), sitting in the smoking session but not smoking (36 vs. 55) and mean expired CO levels of volunteers (11.6 vs. 18.1), but these differences disappeared the day after the Smokeout.
Free confidential smoking information delivered by phone	Self-reported smoking cessation	6 months	11.5% of callers quit at an average cost of $63.50 per caller and $607.78 per quitter. The average participation rate of smokers across worksites was 1.6%.

Table 1

Continued

Study	Purpose of Evaluation	Research Design Rating	Comparison Group	Sample Size	Participation Rate	Sample Description	Research Design
Gottlieb and Nelson (1990)[56]	Evaluate the impact of a self-help cessation program	***	No	43 smokers	28% competition, 6% no-competition sites	Employees in three metropolitan regions of the Texas Department of Human Resources	One group, pretest–posttest design; nine (12.3%) missing cases at follow-up counted as smokers
Gritz et al. (1988)[55]	Determine the effectiveness of a self-help smoking cessation program for registered nurses	***	No	149 smokers	Not reported	Registered nurses from 15 hospitals in the Los Angeles area	One group pretest–posttest design; 52% of nurses used self-help manual and 20% used maintenance manual; response rates at 1 month, 96.6%, and 89.3% at 6 and 12 months with noncontacted treated as smokers
Nepps (1984)[59]	Determine the effectiveness of a minimal contact broad-spectrum smoking cessation program	***	No	36 employees	Not reported	White-collar employees of Johnson & Johnson in New Jersey	One group, pre- and three posttests; 47.2% received only one of nine modules but all included in denominator
Incentives							
Glasgow et al. (1993)[60]	Determine the effectiveness of an incentive-based worksite smoking cessation program	***** (Worksites)	Yes	19 worksites and approximately 1100 smokers	23% in incentive condition	Mid-size Oregon state agencies	Worksites randomized (9 intervention, 10 control) to two groups, pre- and two posttests; 22% of cohorts left worksite
Rand et al. (1989)[61]	Determine the relative contribution of contingent payment and worksite carbon monoxide monitoring to the long-term maintenance of smoking abstinence	*****	Yes	47 subjects assigned to three experimental conditions	Not reported	Hospital workers who had abstained from smoking for 5 days	Three groups: (1) contingent payment with frequent monitoring, (2) noncontingent payment with frequent monitoring, and (3) noncontingent payment with infrequent monitoring; monitored twice a week for 6 months. 92% completed the abstinence week and made up the sample
Glasgow et al. (1991)[62]	Describe the implementation and 1-year impact of an incentive-based smoking cessation program	***	No	Nine worksites and approximately 700 smokers	29%	Mid-size Oregon state agencies	One group with monthly measures; attrition not reported
Sloan et al. (1990)[63]	Determine the effect of a year-long multiple lottery contest on cessation and relapse rates	***	No	73 smokers	10%	Primarily male employees of the Volvo aircraft engine manufacturing company in Sweden	One group with pre- and three posttests; attrition not reported
Rosen and Lichtenstein (1977)[64]	Determine the impact of a $5/month nonsmoking salary bonus on smoking cessation and total and work daily cigarette consumption	***	No	31 company employees (both smokers and nonsmokers)	87%	Employees of an ambulance-medical rental company	One group, pre- and two posttests; attrition not reported
Clinical/nicotine replacement							
Sutton and Hallett (1988)[50]	Determine the effectiveness of nicotine gum in minimal treatment programs	*****	Yes	161 smokers (79 invited to participate; 82 control)		Employees from Company D (see above) who were still smoking at the 3-month videotape intervention follow-up	Randomized into nicotine gum plus four consultations with occupational health nurses vs. no treatment; pre- and posttests
Sutton and Hallett (1987)[65]	Determine the effectiveness of a brief nicotine gum intervention	*****	Yes	334 volunteer smokers who expressed interest in participating	49% expressed interest; 64% of the 270 assigned to treatment attended	Employees of a large retailing company in London	Randomized two-group pretest–posttest design
Li et al. (1984)[66]	Determine the incremental effect of physician-administered 3 to 5 minutes of behavioral counseling over a simple warning	*****	Yes	871 initially (576 at 11 months) naval shipyard workers	84.6%	Male asbestos-exposed naval shipyard workers	Two groups (3 to 5 minutes of behavioral counseling by physician with cessation pamphlet vs. warning to quit with cessation pamphlet); pre- and two posttests; physicians did not maintain protocol, and subjects were reclassified according to the intervention they received; lacked a no-treatment control; 76.1% follow-up at 3 months; 86% at 11 months
Rose and Hamilton (1987)[67]; Rose et al. (1982)[68]	Determine the effectiveness of antismoking advice among high CVD risk smokers	*****	Yes	1445 male smokers (714 intervention; 731 control)	Not reported	British civil servants	Two groups (recall for physician advice, support, and encouragement with average of four follow-up visits vs. normal care with screening findings sent to their general practitioners); pre- and three posttests on tobacco consumption and smoking status; follow-up symptoms and physical findings (at 1 and 3 years) and mortality (at 10 years); response rates among survivors 84% at 1 year, 70% at 3 years, and 83% at 9 years
Whitney and Harris (1994)[69]	Determine the impact of a smoking cessation program using nicotine replacement therapy as part of a larger wellness program	***	No	293 military retirees, 83 of whom responded to a mailed survey	Not reported	Air Force retirees	One group, posttest only; 28% response rate

Table 1

Extended

Intervention Components	Outcome Measures	Evaluation Period	Findings
Group orientation with video, self-help manual, and refunds of fees to quitters for cessation	Self-reported cessation confirmed by saliva continine	6 months	The self-reported quit rate at end of program was 28% and the validated quit rate among program participants was 7% at 6 months.
ALA's *Freedom from Smoking in 20 Days* and *A Lifetime of Freedom from Smoking*, with three manuals targeted specifically to smoking on weight control, break times at work, and use of buddy support	Self-reported smoking behavior, with validation through two confederate reports and saliva thiocyanate and cotinine	12 months	The 1-year quit rate was 19.5% and the continuous abstinence rate, 12.7%. Low program use during the 12 months following enrollment was found, with 52% of nurses using the ALA cessation manual, 20%, the maintenance manual, and from 22% to 24%, the specially designed nurse-focused materials.
Nine-module self-help manual, including behavioral techniques, smoke holding, and relapse prevention; CO assessment and feedback to participants by consultant done weekly	Self-reported cessation	6 months	The abstinence rate after 6 months was 11.1%. Half of the smokers who had quit at the end of treatment remained abstinent at 6 months. All eight posttreatment quitters had completed eight or nine modules.
Video orientation describing incentives; $10 for abstinence and entry into an ex-smoker of the month monthly lottery, monthly lottery for nonsmoking coworker buddies, and grand prize lotteries during final month	Self-reported smoking cessation with biochemical (CO and cotinine) validation	24 months from program initiation	There was no difference in self-reported cessation rates at 1 year (12.9% for incentives vs. 12.0% for control) or 2 years (18.0% for incentives vs. 15.5% for controls). Biochemically validated cessations were at 1 year (10.8% vs. 11.6%) and at 2 years (14.2% vs. 11.5%). Both worksite and individuals were used as the unit of analysis.
Payment of up to $200; CO monitoring twice weekly monthly	Quit rate confirmed by CO	6 months	Contingent payment delayed but did no prevent relapse to smoking. Monitoring CO levels had no effect on relapse rates.
Video orientation describing incentives; $10 for abstinence and entry into an ex-smoker of the month monthly lottery, monthly lottery for nonsmoking coworker buddies, and grand prize lotteries during final month	Self-reported cessation verified by CO	12 months of intervention	The incentives program resulted in high participation rates (29%) but modest cessation rates (approximately 20%). Worksites varied greatly on both participation and cessation rates.
Cash lotteries at 1, 6, and 12 months after the contest	Self-reported smoking cessation with saliva cotinine and CO verification	12 months	Recruited approximately 10% of company's smokers and achieved a 32.8% one-year continuous abstinence rate
$ th bonus for not smoking, to be matched at tmas, with individual rule violation to result in of a month's bonus for all participating employees	Self-reported smoking status	12 months	After 1 year, 33% of smokers were abstinent.
Ss had watched a videotape 3 months earlier; personal invitation for occupational physician to attend four-session treatment program using 2 mg Nicorette gum	Self-reported smoking cessation validated with CO measure	12 months	22% of those invited who attended were abstinent at 1 year, compared to 2% of those invited who did not attend and 2% of the control group.
Two consultations 2 weeks apart with CO measurement, a prescription for 2 mg Nicorette gum, and recommendations for use	Self-reported smoking with validation using carbon monoxide	12 months	The 1-year continuous abstinence rates were 12% among participants, 1% among those invited but not attending, and 2% among control group.
Following mandated screening by physicians, workers were given their results and received either a minimal warning not to smoke and a pamphlet with a plan for quitting or 3 to 5 minutes of behavioral counseling to secure commitment to the plan in the pamphlet	Self-report of smoking status and consumption with CO validation at 11 months	11 months	At 11 months, smokers with behavioral counseling were more likely to remain abstinent (8.4%) than those with a minimal warning (3.6%). Prolonged abstinence rates did not differ among subjects with abnormal lung function tests (3.7%) and normals (5.9%). The group with normal lung function test who received behavioral counseling had the highest level of abstinence (9.5%).
Personalized letter of invitation to see a physician to discuss screening results; cessation booklet, individual advice, support and encouragement of cessation by physician in 15-minute initial visit, with an average of four follow-up visits over 12 months; no other health advice, except for calorie restriction for weight gain; normal care group had results of health screening sent to their family physicians	Self-reported cessation and daily cigarette consumption, reported nasal obstruction, cough, phlegm, and dyspnea; blood pressure and weight, decline of ventilatory funding, mortality from death certificates	9 years	Respondents not reporting smoking were 51% at 1 year, 57% at 3 years, and 55% at 9 years. About one-third of those giving up cigarettes continued to smoke a pipe or cigars. At 1 year, 32% of the intervention group and 8% of the comparison group reported not smoking any form of tobacco. The intervention group reported a lower prevalence of nasal obstruction, cough, phlegm, and dyspnea, no change in blood pressure, a slower decline in ventilatory function, and an increase in weight over controls. Over 10 years, deaths in the intervention group from CHD were 18% lower than controls, and deaths from lung cancer were 23% lower. Deaths from nonlung cancers were higher in the intervention group but were not related to changes in smoking and were suggested to have been due to chance.
Nicotine replacement gum with voluntary weekly 1-hour meetings that included discussion of addiction, the physiopathology of smoking diseases, and instructions for using the gum	Self-reported smoking status, number of nonsmoking months	Not specified	Of the 83 respondents, 57.8% had quit immediately and relapsed, 21.7% had relapsed but were now nonsmoking, and 20.5% were current smokers. 74% of respondents' months since entering the program were smoke-free.

Table 1

Continued

Study	Purpose of Evaluation	Research Design Rating	Comparison Group	Sample Size	Participation Rate	Sample Description	Research Design
Kilburn and Warshaw (1990)[70]	Determine the effectiveness of personalized feedback related to health effects of smoking by health providers during physical examination and in a follow-up letter to asbestos-exposed workers	***	No	605 questionnaire/interview respondents representing 2627 smokers	Not reported	Construction trades and shipbuilding union workers exposed to asbestos for at least 5 years	One group, pre- and posttest; used yearly quit rates of 736 ex-smokers as historical control; 19% response rate to follow-up survey (n = 504) with a telephone interview of 101 nonresponders

† Three studies (Jason et al.,[22–24] Omenn et al.,[25] and Bertera et al.[39]) included both group and minimal intervention conditions.
***** Properly conducted experimental study with randomized control group.
**** Properly conducted study with comparison group but no random assignment.
*** Evaluation without comparison or control group.
** No intervention but might include long-term or dramatic results from dissemination of information or a medical agent into a population.
* Descriptive, anecdotal, or authoritative.

son et al. reported a significant incremental effect at 3 months (22% vs. 12%) but not at 6 months.[22–24] Three studies examined the incremental effectiveness of a worksite-wide awareness/cessation program over a cessation group alone; two found a significant effect (43% vs. 21%; 54% and 48% vs. 36%),[30,32] but one[31] did not.

We found five studies[60–64] of incentives with quit rates ranging from 6% to 33%, with a median of 20%. Participation rates were reported in four of these studies[60,62–64] and ranged from 10% to 87%, with a median of 26%. Glasgow et al.[60] conducted a randomized trial of incentives using companies as the unit of analysis and worksite-wide cessation rates. They found no difference in biochemically validated cessation rates at 1 year (10.8% vs. 11.6%) or at 2 years (14.2% vs. 11.5%) between sites with an incentive program based on contingent payment of $10 for monthly abstinence checks and a chance to win a monthly lottery and no intervention control sites. The participation rate for the incentive sites was 23%.

Three studies examined the effect of physician advice for high risk workers to quit smoking, with two using an experimental design. Rose et al. found a net cessation rate of 24% among British workers at high risk for cardiovascular disease.[67,68] Li et al. found cessation rates of 8.4% for short behavioral counseling and 1.6% for a simple warning among asbestos-exposed shipyard workers.[66] Kilburn and Warshaw, using a one-group–only design, found a cessation rate of 29.8% among asbestos-exposed workers who received personalized feedback from their physicians.[70] The three studies of nicotine replacement therapy with brief voluntary counseling reported quit rates from 10.1% to 21.7%, with a median of 12%.[50,65,69] The two controlled studies found net cessation rates of 10% and 8.1%.[50,65]

Rating for the Cessation Literature

Table 3 displays the ratings of methodology of studies reviewed within the categories of cessation programs and policy interventions. As discussed earlier, the cessation literature includes several program type subsets that varied in overall methodological rigor. Therefore, the cessation literature is rated suggestive for group and incentive interventions; indicative for minimal interventions, competitions, and medical interventions; and acceptable for the testing of treatment components. Conclusions that can be drawn are that group programs are more effective than minimal treatment programs. Less intensive treatment, however, when combined with high participation rates can have an impact on the total population of smokers at a worksite. Competitions have the potential to increase recruitment to smoking cessation programs and possibly to increase cessation rates. The evidence is less strong that incentives will increase participation or quit rates.

Across the 52 studies, there were 14 no-treatment control or comparison groups.[21,33,35,38,50,54,60,61,65,67,68] For the five video experiments, the median net quit rate was 0.5% and the range, −0.5% to 14%.[50,54] For the two incentive trials, the median quit rate was 4.5% and the range, 3% to 6%.[60,61] The net quit rates for the three group interventions ranged from 3% to 25%, with a median of 12.5%.[21,33,35,38] The range of quit rates for the three clinical interventions was from 8.1% to 24%, and the median was 10%.[50,65,67,68] Because of the small number of trials with no-treatment intervention or comparison groups, we cannot be certain what the absolute intervention effect is for most worksite interventions.

The majority of the studies used biochemical confirmation of quitting (65%), and over half (54.9%) followed subjects for at least 1 year. Attrition rates were not uniformly reported. Treatment attrition was reported by 17 studies and ranged from 4% to 74%, with a median of 16%. Only five of these studies treated those who did not complete treatment and were not followed up as smokers. Twelve studies reported attrition from follow-up with 17 rates ranging from 3% to 81%, with a median of 12.3%. Three studies with five rates counted these subjects as smokers. No attrition rates were re-

Table 1

Extended

Intervention Components	Outcome Measures	Evaluation Period	Findings
Personalized health provider feedback of effects of cigarette smoking on symptoms, x-ray and lung function tests, and physical exam findings and risk of dying from lung cancer during exam and in a follow-up letter	Self-reported cessation and reduction of smoking	Follow-up questionnaire administered from 6 to 25 months after intervention	Among mailed questionnaire respondents, 29.8% reported quitting and 35.9% reducing smoking from a mean of 28 to 13 cigarettes. Among telephone-interviewed nonrespondents, 17% reported quitting and 53%, reducing consumption. This was compared to the historical quit rate of 2.5% to 5.5% over past 20 years (4.7% the previous year).

Table 2

Research Design Ratings for Smoking Cessation Program Evaluations over Time

Year	Research Design Rating ***	****	*****	n Total
Before 1980	75.0% (3)	—	25.0% (1)	(4)
1980–84	55.6% (5)	—	44.4% (4)	(9)
1985–89	9.1% (2)	22.7% (5)	68.2% (15)	(22)
1990–94	52.9% (9)	29.4% (5)	17.6% (3)	(17)
Total	36.5% (19)	19.2% (10)	44.2% (23)	52

***** Properly conducted experimental study with randomized control group.
**** Properly conducted study with comparison group but no random assignment.
*** Evaluation without comparison or control group.

Table 3

Research Design Ratings for Worksite Tobacco Control Evaluations

Tobacco Control Component	*** #	*** %	**** #	**** %	***** #	***** %	Total	Rating
Cessation program	19	36.5	10	19.2	23	44.2	52	Suggestive to acceptable
Policy intervention	26	89.7	3	10.3	—		29	Weak
Total	45	63.4	13	18.3	23	32.4	71	

***** Properly conducted experimental study with randomized control group.
**** Properly conducted study with comparison group but no random assignment.
*** Evaluation without comparison or control group.

ported by the remaining 15 studies for which they were applicable. In addition, several observational studies compared the quit rates of volunteer participants and nonparticipants.

Smoking Policy Studies

Included in Table 4 are the 29 studies that have examined the health impact of tobacco policy,[71–99] including six population studies of individuals.[94–99] Eleven studies used a pre–post cross-sectional design, and eight, a one or two posttest cross-sectional design with no baseline. Three quasiexperimental designs employed a matched worksite without a policy.[71–73] One study used the worksite as the unit of analysis in a study of the relationship of policy restrictiveness to smoking sites.[75] Six studies used population surveys to assess the relationship between worksite policy restrictiveness and tobacco use[95–99] and reported environmental tobacco smoke (ETS) exposure.[94] The earliest study was published in 1983,[93] when smoking policies were an innovation and there were few community or state laws and ordinances restricting smoking.

Smoking bans have two health-related outcomes: the cessation or reduction in smoking by smokers and the reduction of ETS exposure of employees. The majority of studies have focused on smoker behavior, under the assumption that policies create clear cues and reinforcements for not smoking. Following the Environmental Protection Agency report labeling ETS a carcinogen,[100] however, interest has shifted to include the outcome of ETS exposure.

There is consistent evidence that policies effect a reduction in cigarette consumption at work, with a median reduction of 3.4 cigarettes/day reported in the nine studies that examined this variable.[71–73,76,81,86–88,98] Three other studies reported the percentage of workers who indicated they had reduced or stopped smoking at work, with a range of 12% to 39%.[84,85,89] Two population studies found that workers under policies banning smoking smoked about five cigarettes fewer on workdays compared to nonworkdays; for worksites with no policy, there was one cigarette per day difference.[95,99] The findings are less consistent as to whether overall consumption is decreased. Of the 29 studies, 12 reported some indicator of a decrease[75–77,80,83,86,88,91–93,96,97] and 3, no decrease or a slight increase.[73,84,90] Of the six studies that re-

Table 4

Characteristics of Evaluations of Worksite Smoking Policy Interventions

Study	Purpose of Evaluation	Research Design Rating	Sample Size	Sample Description	Research Design
Worksite samples					
Brigham et al. (1994)[71]	Determine the biological, subjective, and behavioral impact of a restrictive worksite smoking policy on individual smokers, with no report of cessation programs	****	67 smoking employees (34 interventional group, 33 comparison group)	Volunteer smoking employees of Francis Scott Key Medical Center, Baltimore, Maryland (intervention) and volunteer smokers recruited from neighboring hospitals without a policy (comparison); could not be seeking treatment to quit	Quasiexperimental, four pretests and four posttests; volunteers
Stave and Jackson (1991)[72]	Evaluate the impact of a smoking ban, with smoking cessation and health education programs begun in 1995	****	800 (400 per site) at 3 months post; 152 (80, 72 per site) at 15 months postimplementation	Employees of Duke University Medical Center (intervention) and University Campus (comparison)	Quasiexperimental, two posttests; 91% response rate of random samples at 3 months; 97% response rate of smokers and recent ex-smokers from first posttest at second posttest; telephone interviews
Biener et al. (1989)[73]	Evaluate the effect of a restrictive smoking policy, with self-help smoking cessation programs offered at both policy and comparison hospitals	****	165 employees at 1 month prepolicy; 156 at 6 months post; 214 at 12 months post	Two hospitals in Rhode Island	Quasiexperimental, two groups (policy vs. none), pre- and two posttests; response rates were 97%, 92%, and 29% (computed) of the three random samples
Brenner and Fleischle (1994)[74]	Describe the relationship of smoking regulations within a worksite to current and retrospective smoking behavior; policies by work area were no restrictions for outdoor work and single offices; ban for operational rooms with sensitive equipment, cars, and in clients' homes (in place prior to 1983), and agreement in which smoking was allowed contingent on agreement of all employees sharing an office (implemented in 1983)	***	966 employees	Employees of a telecommunication office in Rottweil, Germany	One group, posttest; 91.8% of all employees
Jeffery et al. (1994)[75]	To compare smoking prevalence and consumption in companies with and without smoking restrictions and to determine the relative effect of policy and worksite health promotion programming; half had smoking and nutrition health promotion interventions as part of a randomized trial	***	32 worksites	Worksites in the Minneapolis–St. Paul area participating in a randomized trial of a smoking cessation/weight control intervention	Pre- and post-test observational study of effects of changes in workplace smoking policy among companies participating in a larger project with randomized sites; 32 worksites at each point; worksite data points from a random sample of 200 employees at each time point, with average of 75% response at each point
Daughton et al. (1992)[76]	Evaluate the effect of a smoking ban, with partially subsidized cessation programs	***	1083 at 5 months post; 88 smokers at 17 months postpolicy implementation	Employees of a hospital in Omaha, Nebraska	One group, two posttests; approximately one-third (*sic*) at first posttest; 47% (computed) of smokers at second posttest
Goldstein et al. (1992)[77]	Evaluate the effect of a smoking ban in five hospitals on employees and patients; free smoking cessation classes offered in all hospitals, at no cost in four	***	1997 employees (187 to 640 per hospital)	Employees of five hospitals in Augusta, Georgia, who had jointly gone smoke-free	One group, posttest only; 75% response rate overall, 66% to 85% across hospitals to random proportional sample
Marcus et al. (1992)[78]	Examine the relationship between smoking policy, household smoking status, ETS exposure, and salivary cotinine	***	Study 1: 106 volunteers; Study 2: 881 nonsmokers and ex-smokers	Study 1: Nonsmoker and ex-smoker employees from nine Rhode Island worksites; Study 2: Employees of five Rhode Island workplaces	One group, posttest; for Study 2, 45% completed survey only and 26%, both survey and saliva testing
Offord et al. (1992)[79]	Evaluate the effect of a smoking ban, with no-cost nicotine dependence treatment	***	10,579 employees	Employees of the Mayo Medical Center in Rochester, Minnesota	One group, posttest; 66.3% of all employee sample
Baile et al. (1991)[80]	Evaluate the impact of a smoking ban, with no report of cessation programs	***	349 employees, including 83 smokers	Employees of H. Lee Moffitt Cancer Center and Research Institute, Tampa, Florida	One group, posttest only; 70% of all employees

Table 4

Extended

Comparison Group	Outcome Measures	Evaluation Period	Findings
Comparison	Self-reported cigarette consumption during specified time periods, cigarette butt length and weight, saliva nicotine and cotinine, and withdrawal symptoms	1 month prepolicy to 1 month postpolicy	Mean verified consumption among intervention subjects decreased from 7.6 to 3.6 among intervention Ss, compared to 10.0 to 9.5 among comparison subjects. No change was found for cigarette consumption during nonwork hours (12.6 vs. 11.4 in intervention group; 12.0 vs. 11.1 in comparison group). Increases in ratings of common withdrawal symptoms were found among intervention Ss.
Comparison	Self-reported current and retrospective smoking status with carbon monoxide validated quit rates and cigarette consumption per day, at work and during nonwork hours	3 and 9 months postsmoking ban; policy announced 6 months before implementation	At 3 months, self-reported quit rates were not significantly different (12.6% intervention vs. 6.9% comparison), but carbon monoxide validated quit rates were significant (9.2% vs. 1.4%) as were 9 months quit rates (22.5% vs. 6.9%) and validated rates of 10.8% vs. 2.9%. Mean cigarette consumption at work decreased from 8.1/day to 4.3/day in the intervention site, with no change in the comparison site (9.3 to 8.7) at 6 mos. No change was found for cigarette consumption during nonwork hours.
Comparison	Self-reported smoking status and cigarette daily consumption; nonsmokers' self-report of being bothered by smoke in offices, staff lounges, and lavatories	1 month prior and 6 and 12 months postimplementation; policy announced 1 month prior to implementation	7% of smokers in the policy hospital and 11% of smokers in the comparison hospital reported quitting by 12 months. Mean cigarettes at work decreased from 8.4 to 4.5 at 12 months in the policy hospital, compared to 7.6 to 6.9 in the control hospital and consumption at home from 12.8 to 10.6 in the policy hospital and 13.3 to 9.2 in the comparison hospital. At 12 months postpolicy, significant differences were found between the policy and comparison hospitals in the percentage of nonsmokers bothered by smoke in offices (5% vs. 25%), comparable (*sic*) in staff lounges, and not significant for lavatories (18% vs. 16%).
None	Self-reported smoking status and cigarette consumption (current and 8-year retrospective)	8 years following policy implementation	Current smoking and average cigarettes per day varied by type of work area policy: no restriction (31.4%, 20.5 cigs.), agreement (24.8%, 14.1 cigs.), ban (28.2%, 13.2 cigs). In the 8 years, 27.1% of no-restriction group, 24.6% of smoking ban group, and 35.6% of the agreement group reported quitting smoking.
	Self-reported employee smoking prevalence and cigarette consumption confirmed by expired air carbon monoxide	At beginning of randomized trial and 2 years later	Smoking prevalence at baseline was lower in sites with restrictive policies (22.2% vs. 26.1%). No differences were found by policy type (restrictive, changed from nonrestrictive to restrictive, and nonrestrictive throughout) in smoking prevalence or recent quit attempts. Smokers in sites that changed from nonrestrictive to restrictive decreased consumption from 20.6 to 18.3, with no change in sites that maintained the same policy type. No interaction effect was found between smoking cessation treatment group and smoking policy.
None	Self-reported smoking status, cigarette consumption during work hours, on workdays, and on nonworkdays; smoking cessation program participation	5 months postban; 17 months postban; policy announced 7 months before ban	At first posttest, 8% of smokers reported quitting during the past year, compared to 7% of ex-smokers who reported quitting the year before. Cigarette consumption at work declined from 7.3 to 4.2 during work hours, 15.6 to 12.7 during workdays, and 19.6 to 18.6 during nonworkdays. 39% reported trying to quit, and 11% enrolled in a subsidized program. At the second follow-up, 41% reported trying to quit during the second year, and 8% reported being smoke-free for at least 3 months. 21% of smokers signed up for an agency-sponsored cessation program.
None	Self-reported "quit because of policy" rate, smoking cessation program participation	4 months postban	9% of previous smokers reported they had quit smoking in response to the ban, and 57% of current smokers indicated they had reduced their daily consumption. 32 employees (estimated as 7.3% of smokers) participated in a hospital cessation program.
None	Salivary cotinine concentration	Not reported	Study 1: Detectable cotinine concentrations were found in a higher proportion of nonsmokers from workplaces with least restrictive policies (63%) than with moderately (29%) or most restrictive (25%) policies. Having smokers in the home was not associated with cotinine concentration. Study 2: Significant differences in cotinene were detected in 27% of volunteers from workplaces with least restrictive policies, 12%, with moderately restrictive policies, and 11% from most restrictive policies. The presence of smokers in the home was also associated with significantly higher rates of cotinine detection.
None	Self-reported smoking status	2.5 years	Cessation rate of 22.5%. Overall prevalence dropped from 16.7% at pretest to 13.8% at follow-up.
None	Self-reported smoking history, changes in pattern of use since initiation of smoking ban, nicotine dependency	4 months following ban; date of announcement not reported	5.7% of smokers reported they had quit; 31.3% reported no decrease in number of cigarettes smoked and 54.2%, a decrease in total consumption. 43.8% reported increasing their cigarette use before or after work. 83% reported none or only one withdrawal symptom, and 53% denied experiencing withdrawal symptoms.

Table 4

Continued

Study	Purpose of Evaluation	Research Design Rating	Sample Size	Sample Description	Research Design
Hocking et al. (1991)[81]	Evaluate the impact of a smoking ban, with policy of time off to attend approved smoking cessation programs and publicity on quitting	***	1088 prior, 646 at 6 months post and 1424 at 18 months postpolicy	Employees of Telecom Australia (indoor workers)	One group, pre- and two posttests; over 80% (*sic*) of all eligible employees responded to pretest and second posttest; 59% (computed) of pretest respondents responded to first posttest
Sorensen et al. (1991)[82]	Evaluate the impact of a restrictive smoking policy, with free onsite smoking cessation classes offered	***	1192 employees	Employees of the New England Telephone Company	One group, posttest only; 74.5% response rate for stratified random sample
Borland et al. (1990)[83]	Evaluate the impact of a smoking ban, with availability of smoking control programs	***	2113 employees matched pre and post	Employees of the Australian Public Service from six departments in 44 locations who completed initial survey and could be matched for follow-up	One group, pre- and posttest; 79% response to initial survey with 62% of these able to be matched; 83% of matched sample completed both surveys
Gottlieb et al. (1990)[84]	Evaluate the impact of a restrictive smoking policy, with availability of smoking cessation programs.	***	1764 employees 3 months prior; 1395 at 1 month post; 1158 at 6 months postimplementation	Employees of the Texas Department of Human Services, a large decentralized state agency	One group, pre- and two posttests; 82%, 70%, and 53% of the three systematic samples responded; mail distribution
Hudzinski and Frohlich (1990)[85]	Evaluate the effect of a smoking ban, with no report of cessation programs	***	1946 at 6 months prior; 1608 at 6 months post; 684 at 12 months postimplementation	Employees of Ochsner Medical Institutions	One group, pre- and two posttests; response rates of all employees were 46%, 38%, and 16%; mail distribution
Mayo et al. (1990)[86]	Evaluate the effect of a smoking ban, with no report of cessation programs	***	1032 at 1 month prior; 762 at 3 months post; 745 at 12 months postimplementation	Employees of Colorado State Hospital, a psychiatric hospital in Pueblo, Colorado	One group, pre- and two posttests; response rates of all employees were 74%, 54%, and 53%
Mullooly et al. (1990)[87]	Evaluate the effect of a smoking ban, with no mention of cessation programs	***	For 1985 ban sites, 409 in 1976 to 1074 in 1987; for 1986 ban sites, 820 in 1976 to 1219 in 1987	Employees of the Western region of Kaiser-Permanente Medical Program	One group, eight cross-sectional surveys pre- and postban; response rates exceeding 70%, except in 1980 (60%) and 1982 (67%)
Stillman et al. (1990)[88]	Evaluate the effect of a smoking ban, with availability of smoking cessation programs	***	6050 at 6 months prior; 3423 at 6 months postpolicy	Employees of the Johns Hopkins Medical Institutions	One group, pre- and posttest; 69% of all employees to pretest; 74% of those with complete smoking information on pretest responded to the posttest
Becker et al. (1989)[89]	Evaluate the impact of a smoking ban, with promotion of self-help materials	***	762 employees at 6 months before ban and 704 at 6 months after ban	Full- and part-time employees of the Johns Hopkins Children's Center	One group, pre- and posttest; 79% and 74% response of all employees; distributed directly to units
Scott and Gerberich (1989)[90]	Evaluate the effect of a restrictive smoking policy	***	452 employees	Employees of a Midwestern insurance company who had been working prior to the policy	One group, posttest only; 92% response rate
Petersen et al. (1988)[91]	Evaluate the impact of a restrictive smoking policy, with promotion of subsidized cessation clinic, a buddy system, and educational campaign	***	1210 employees	Employees of a Connecticut insurance company	One group, posttest only; 81% response of convenience sample of 2137-employee population; distributed in lunch area
Rosenstock et al. (1986)[92]	Evaluate the impact of a smoke-free smoking policy, with promotion of self-help and smoking cessation classes	***	447 employees	Employees of Group Health Cooperative of Puget Sound, a 35-facility health maintenance organization	One group, posttest only; systematic probability sample with 65% response rate; mailed survey
Andrews (1983)[93]	Evaluate the impact of restrictive smoking policy, with smoking cessation classes and individual counseling	***	892 employees and patients prepolicy; 965 employees postpolicy	Employees and patients of New England Deaconess Hospital	One group, pre- and posttest; convenience sample representing 36% of employees at posttest
Population surveys					
Pierce et al. (1994)[94]	Assess relationship between local smoking ordinances, worksite policy, and ETS exposure	***	12,802	Respondents to 1990–91 California Tobacco Survey above 18 years of age who were employed indoors	Cross-sectional population survey, 75.1% for screening interview and 78% for extended interview

Table 4

Extended

Comparison Group	Outcome Measures	Evaluation Period	Findings
None	Self-reported smoking status and workday cigarette consumption	Prior (time not specified) and 6 and 18 months following ban; policy introduced with 6 months grace period of no disciplinary steps	There were no differences in smoking prevalence before and at 6 months, but there was a reduction of about 5% at 18 months. Workday cigarette consumption declined between three and four cigarettes/day at 6 months and was maintained at 18 months.
None	Self-reported current and retrospective smoking status; self-reported effect on air quality	20 months postpolicy implementation; announcement 2 months before implementation	Smoking prevalence decreased 21% from the time workers became aware of the policy to 20 months postpolicy, of which 42% was attributed by the subjects to the policy. 28% indicated receiving some type of cessation assistance. 55.7% of current smokers, 71.7% of former smokers, and 76.0% of current smokers indicated improved air quality in work areas, and 33.7% of current smokers, 50.7% of former smokers, and 55.5% of never smokers reported worsened air quality in nonwork areas.
None	Self-reported smoking status and cigarette consumption during seven time periods across 24 hours	2 to 4 weeks prior and 5 to 6 months following smoking ban; policy announced 1 year prior to implementation	No differences in smoking prevalence (23.3% pre vs. 22.3% post). Moderate smokers reduced an average of 5.8 cigarettes/day and heavy smokers, 7.9 cigarettes/day.
	Self-reported smoking status, daily cigarette consumption, and daily cigarette consumption at work; self-report of being bothered by coworkers' and clients' smoke and level of satisfaction with air quality in work area	3 months prior and 1 and 6 months following implementation; policy announced 5 months prior to implementation	No differences in smoking prevalence (22.9% pre vs. 21.6% and 19.5% post). No difference in percent of smokers consuming 15 or more cigarettes daily (51.3% vs. 44.2% vs. 52.5%). The percentage of smokers consuming 15 or more cigarettes daily at work declined from 16.9% prior to 7.5% after 1 month and 4.9% after 6 months. Nonsmokers reported an increase in air quality (2.5 vs. 3.1 vs. 3.1), and smokers reported lower perceived air quality (3.1 vs. 2.9 vs. 2.9). The percentage of employees never bothered by coworker smoke increased from 41.3 to 70.2 to 80.1%, and by clients' smoke, from 66.2 to 79.2 to 85.0%.
None	Self-reported smoking status, daily cigarette consumption	6 months prior; 6 and 12 months following ban; date of announcement not reported	Smoking prevalence decreased from 20% to 14% at 1 year, approximately 25% at 6 months, and at 12 months indicated they no longer smoked at work; 35% indicated they smoked more after work hours.
None	Self-reported smoking status, daily cigarette consumption	1 month prior; 3 and 12 months following ban; date of announcement not reported	Reported smoking prevalence varied from 29% pre to 24% at 6 months and 25% at 12 months post. In a cohort of 73 volunteer smokers, average cigarette consumption declined from 16.3 (pre) to 14.5 at 12 months; work consumption from 7.7 (pre) to 4.2 at 12 months; afterwork consumption increased from 8.3 to 10.3 at 12 months.
None	Self-reported smoking status, daily cigarette consumption at work, attempts to quit; perception of being bothered by someone else's smoke at work	Approximately 1.5 and 7 years after ban	Substantial ban-related reduction in percentage of responders reporting that smoke was present in their work environments. No ban effect on smoking prevalence or reported attempts to quit smoking. Reduction of 1.4 cigarettes at work per day at 1986 ban sites ($p < 0.05$) and less than 0.1 cigarettes in the 1985 ban sites (ns). In ban sites, percent reporting being bothered by someone else's smoke decreased from 60% to 29% of nonsmokers being bothered at least occasionally and from 14% to 6% among smokers.
None	Self-reported smoking status and daily cigarette consumption; count of cigarette butts in public areas; observations of smoking; environmental nicotine vapor concentrations	8 months prior and 6 months following ban; policy announced 6 months before implementation	Smoking prevalence declined from 21.7% to 16.2%; average daily consumption decreased from 16.4 to 13.1, with work consumption from 7.8 to 3.8/day. There was a corresponding decline in observed smoking by staff and visitors and environmental nicotine level (one to two orders of magnitude).
	Self-reported smoking status and daily cigarette consumption; count of cigarette butts in public areas; observations of smoking; environmental nicotine vapor concentrations	6 months prior and 6 months following smoking ban; policy announced 6 months prior to implementation	No differences were found in smoking prevalence (15% pre vs. 13.8% post) or average daily consumption (15 ± 11 pre to 15 ± 9 post). Percentage of smokers smoking at work declined from 82% to 43%, with a corresponding decline in observed smoking by staff and visitors and environmental nicotine level.
None	Self-reported smoking status and daily cigarette consumption	1 year postimplementation	11% of smokers reported quitting, 22.5% decreasing consumption, 59% remaining the same, and 7.5% increasing consumption.
None	Self-reported smoking status and daily cigarette consumption including retrospective 1 year and 1 month prior to policy measures	3 months postban; policy announced 5 months prior to implementation	No change in smoking prevalence (25.2% vs. 23.6% vs. 22.0%). Consumption decreased from 0.95 and 0.99 to 0.67 packs/day, with 44% of smokers indicating decreased consumption.
None	Self-reported smoking status and daily cigarette consumption	4 months postban; policy announced 1 year before policy implementation	29% of current smokers indicated they were smoking an average of two cigarettes less than prior to the policy; three ex-smokers indicated they quit.
None	Self-reported smoking status	20 months postpolicy	26% at posttest indicated they had quit, though few credited the policy alone; 33% of smokers indicated they were smoking less.
Not applicable	Self-reported exposure (during past 2 weeks) to smoke in work area and worksite policy restrictiveness; strength of ordinance from zip codes	Not applicable	The level of ETS exposure is more strongly related to strength of worksite policy than to ordinance level. Exposure is low in worksites with a ban even with no ordinance. In worksites with a work area ban (but not total ban), the existence of a strong ordinance appeared to reduce the exposure of nonsmokers to ETS (14.4%), compared to areas with weak (28.1%) or no ordinances (26.5%).

Table 4

Continued

Study	Purpose of Evaluation	Research Design Rating	Sample Size	Sample Description	Research Design
Kinne et al. (1993)[95]	Assess relationship between worksite smoking policies and cigarette consumption	***	596 men and 632 women	General population from Washington state who were employed but not self-employed	Cross-sectional population telephone survey with response rate of 53% men and 65% women
Pederson et al. (1993)[96]	Determine the effect of a City of Toronto bylaw that required all employers to implement a smoking policy	***	1543 at just prior to; 1430 at 8 to 9 months postpassage of city bylaw	General population from metropolitan Toronto analyzed in terms of being a city worker, other location worker, or nonworker	One group, pre- and posttest; random-digit dialing telephone survey with 68.4% and 62.5% response rates
Woodruff et al. (1993)[97]	Assess relationship between workplace smoking policies and smoking prevalence and cigarette consumption	***	11,704	Respondents to the 1990 California Tobacco Survey above 18 years who were employed indoors	Cross-sectional population survey; 75.1% for screening interview and 75.3% for in-depth interview
Paulozzi et al. (1992)[98]	Assess impact of Vermont worksite smoking law on smoking behavior and reported exposure to ETS	***	407 employees and 279 employers	Vermont residents who work and their employers	Cross-section population telephone survey; employee response rate was 66.8% and employer, 68.6%
Wakefield et al. (1992)[99]	Assess relationship between worksite smoking policies and cigarette consumption	***	1120	Respondents to a 1989 survey of South Australians above 15 years who were employed	Cross-sectional population survey, with response rate of 89%; interviews in respondents' homes

***** Properly conducted experimental study with randomized control group.
**** Properly conducted study with comparison group but no random assignment.
*** Evaluation without comparison or control group.
** No intervention, but might include long-term or dramatic results from dissemination of information or a medical agent into a population.
* Descriptive, anecdotal, or authoritative.

ted decreased numbers of cigarettes,[75,76,83,86,88,91] the median amount was 2.8 cigarettes/day.

There is less evidence that smoking prevalence is decreased with policy interventions, with 7 of 14 studies reporting no change[74,75,83,84,87,89,91]; six reported decreases in prevalence ranging from 2.9% to 6%, with a median of 5%[79,81,85,86,88,98] and one current population survey found a 6.8% difference in prevalence among workers employed in worksites with bans vs. no restrictions.[97] Six of seven studies showed estimates of cessation rates ranging from 5.7% to 26%, with a median of 12%.[72,79,80,89,90,93] A net decrease in cessation rates of 4% was found in a comparison of two hospitals, one with a policy and one without a policy, using a quasiexperimental design.[73] Corroborating the negative finding, Brenner and Fleischle[74] found no difference in cessation rates across sites with varying restrictiveness of policy in a telecommunications company, and Pederson et al.[96] found no difference in agreement that "a lot of smokers had quit" between workers covered by a city bylaw on worksite smoking and those outside the city's jurisdiction, although 5% more of the city workers agreed that a lot of smokers had tried to quit.

Two studies reported environmental nicotine vapor levels,[88,89] and one measured cotinine levels of nonsmokers.[78] Each showed lower levels of nicotine and cotinine in worksites with bans than in those with restricted smoking and with no policy. In addition, five studies reported perceptions of decreased exposure to smoke or increased air quality.[73,82,84,87,94] These are consistent with the findings of reduced smoking at work, which also follows a dose-response relationship with policy restrictiveness.

Rating for the Smoking Policy Literature

As seen in Table 3, because of the lack of quasiexperimental or experimental designs, the body of smoking policy literature literature is rated as weak. However, there is strong consistency in the findings for reduced cigarette consumption at work and decreased exposure to ETS at the worksite and slightly less consistency in results for overall consumption. The findings for a reduction in prevalence, by contrast, are not consistent.

Observational studies dominate the literature in smoking policy because the intervention is throughout the worksite and is not under the investigator's control. The lack of comparison groups limits the conclusions that can be drawn from the data. The use of posttest-only designs and of retrospective measures of smoking as a prepolicy smoking indicator also limit internal validity. Biochemical validation of quit rates was used in only three studies.[71,72,75] An important confounding variable has been that policy implementation included optional smoking cessation classes in two-thirds of the worksite studies. The external validity for the 23 policy intervention studies is limited, as 60.9% are from hospital and health maintenance organizations, 13% from telecommunications companies,

Table 4

Extended

Comparison Group	Outcome Measures	Evaluation Period	Findings
Not applicable	Self reported policy type, smoking status, daily cigarette consumption	Not applicable	Most employees (81% of men and 91% of women) reported a smoking policy at their worksite. For men, mean workday consumption was 23.0 (no policy), 14.0 (restrictions), and 16.0 (no smoking) (not significant), ($p < 0.001$); for women, it was 11.0 (no policy) 11.8 (restrictions), and 10.4 (no smoking) (not significant). Mean nonworkday consumption was, for men, 24.1 (no policy), 16.4 (restrictions), and 21.2 (no smoking) ($p < 0.01$); for women, it was 12.5 (no policy), 15.7 (restrictions), and 16.7 (no smoking) (not significant). Among men, 47.2% with restrictions perceived they smoke less at work vs. 70.4% with a ban ($p < 0.05$); among women, 75.1% with restrictions perceived they smoked less at work vs. 90.0%, with a ban (ns).
Not applicable	Perception of smokers' behavior	Prior to and 8 to 9 months following implementation of workplace smoking restriction bylaw	Workers affected by the law were more likely to report that smokers had cut down the number of cigarettes smoked. No differences were seen in perceptions that smokers had quit.
Not applicable	Self-reported smoking status and cigarette consumption, stage of change	Not applicable	Prevalence of regular smoking in smoke-free workplaces was 13.7%, compared to 20.6% in those with no restrictions, with regular smokers in smoke-free sites consuming 296 packs/year compared with 341 packs/year in workplaces with no restrictions. A higher proportion of smokers in smoke-free worksites were in the preparation stage for quitting.
[illegible]pplicable	Self-reported policy, daily work consumption, daily home consumption, perception of smoking less at work and at home	16 months after policy	Mean number of cigarettes smoked at work declined from 11.3% pre to 7.8% post and at home, from 14.2 to 11.0. Reported prevalence at work decreased from 27% to 22% and at home, from 29.9% to 24.9%.
Not applicable	Self-reported leisure day and workday cigarette consumption	Not applicable	Adjusted (for sex and cigarettes per leisure day) mean differences in workday and leisure day consumption were 5.2 for total ban, 4.9 for partial ban, and 0.1 for no ban. Significant differences were found between work and leisure day consumption among those with either total or partial ban and by type of workplace restriction.

and 8.7% each for public service, insurance, and not specified.

[illegible]e opportunity for conducting no-treatment comparisons of smoking policy is fading, as communities and states pass ordinances requiring worksites to have tobacco policies. Observational studies with worksites as the unit (e.g., Jeffery et al.[75]), preferable since the worksite is the unit of the intervention but more difficult to carry out because data on aggregate employee smoking behavi[illegible]ust be obtained from each site, and population surveys of employed residents (e.g., Pierce et al.,[94] Kinne et al.,[95] Pederson et al.,[96] Woodruff et al.,[97] Paulozzi et al.,[98] and Wakefield et al.[99]) enable researchers to test the relationship between policy restrictiveness and patterns of cigarette use and exposure to ETS. Such studies may also be used to test the effect of large-scale policy initiatives, such as the Vermont worksite smoking law[98] or the City of Toronto worksite smoking by law.[96]

DISCUSSION

[illegible] we have seen, there continue to be a number of weaknesses in the worksite smoking cessation and control literature. From 1990 to 1994, over half of the smoking cessation studies used a preexperimental design, in marked contrast to the 5 preceding years but similar to the period one decade earlier. During this same period, however, evaluations of 19 multicomponent programs were published, 12 of which used designs with comparison or control groups.[19] Most of these studies used smoking or health risk score as an outcome variable. This body of research should also be considered when assessing the outcomes of smoking cessation interventions at worksites.

Experimental designs in the sole-purpose cessation programs we have reviewed were increasingly used to focus on the independent effects of various program components, as called for by earlier reviewers.[9,17] However, this was at the expense of understanding the effect of the basic program over the background quit rate, as very few studies employed a no-treatment control group.

In comparison to earlier reviews,[9,12–14] we found a higher proportion of studies with biochemical verification of smoking, reports of participation rates, and follow-up rates of a year or more, although there is still room for improvement. Although almost half of the studies reported the participation rate, there was little discussion of the issue of volunteer bias in the recruitment. This would tend to inflate the cessation rates, and it is likely that future programs at the same site would find fewer smokers motivated to quit.

There continues to be a lack of reporting of attrition, including that for treatment and follow-up. Studies that did report these rates typically reported them for one or the other indicator. Both are important. In the majority of cases, however, the attrition cases were not included in the denominator and counted as smokers, so the cessation rates are likely lower than reported. Measurement of outcomes remains a problem, with some studies using point prevalence of not smoking and others, continuous abstinence. Recommendations for measurement were included in the 1985 Surgeon General's Report on workplace smoking[17] but have not been widely adopted in the studies we reviewed.

Another methodological issue was the specification of treatments. Treatments often included multiple types of intervention, e.g., self-help and financial contracting with optional education,[49] making it difficult to categorize and compare them. Information was rarely given regarding the environmental cues and policies present at the worksite. Also, a description of the fidelity of implementation of treatments was rarely provided. In one study, just under half of the subjects had received only one of nine modules[59]; in another, only 26.7% of subjects completed at least some of the self-help guide.[47] The low success rates from such studies could be due to failure of implementation or motivation, rather than the intervention itself.

The issue of volunteer bias in traditional cessation programs continues to be a problem. These are the smokers most motivated to quit, in the ready for action or action stage.[101] Participation rates among smokers were not routinely reported and were considered generally only for evaluations of competition and incentive interventions that were directed worksite wide. Rarely were cessation rates reported for smokers in the worksite as a whole. This contrasts to the evaluations for the multicomponent programs, which considered risk behaviors and risk scores of the entire worksite population.[19] The importance of involving smokers at all stages of readiness to quit with tailored programming has been recognized by researchers[10] but is not reflected in the studies reviewed here.

The use of worksite as both unit of assignment and unit of analysis, recommended in the 1985 Surgeon General's Report[17] and elsewhere,[14] is key to studying cessation programming within its social context and for addressing the worksite as a whole as the intervention population. This can be accomplished by using the worksite as the unit of analysis with enough worksites to achieve power to detect differences between intervention and comparison sites or by using hierarchical or nested designs.[17] Of the 52 cessation studies we reviewed, only three used this design feature. Other less costly options include matching worksites at pretest on smoking prevalence and other key organizational characteristics, conducting multiple baseline designs, and reporting both treatment groups or work areas and the individual as the unit of analysis.[14]

For smoking policy evaluations, most of the studies were preexperimental, and slightly fewer than half did not use a pretest–posttest design. The six population studies were cross-sectional and were not designed to capture the effects of change in policy. In addition, smoking policies were almost always accompanied by cessation opportunities. These design issues greatly affect our ability to make causal statements about the effects of smoking policy on cessation and exposure to ETS.

Others have pointed to the importance of knowing the context of the worksite, including the demography and smoking status of the workforce, degree of management support for the program, history of health promotion efforts at the site, and organizational climate and size.[17] These characteristics could affect program outcome and participation rate. Context is also an important component used to assess external validity. For example, the physician-delivered interventions that work with asbestos-exposed shipyard workers might not work with another group, such as telephone operators or bank employees. Often, the sites are not described in detail, limiting the extent to which subject/treatment fit and potential for generalization can be understood.

The smoking cessation interventions we reviewed were carried out in a variety of settings, including blue-collar, white-collar, government agency, and health care sites. By contrast, the policy intervention studies were predominantly health care sites. This is consistent with a nationwide smoking ban in hospitals announced in

SO WHAT? Implications for Health Promotion Practitioners and Researchers

This review indicates that smoking cessation group programs are more effective than minimal treatment programs, although less intensive treatment, when combined with high participation rates, can influence the total worksite population of smokers. Competitions have the potential to increase program participation. There is consistent evidence that tobacco policies decrease workday cigarette consumption by smokers and exposure to ETS at work.

Weaknesses in research methodology found in the evaluation of cessation programs include weak designs, lack of no-treatment control groups, lack of reporting of participation and attrition rates, volunteer bias, infrequent specification of treatments and treatment fidelity, and lack of attention to the unit of analysis or use of nested designs. The policy evaluations were mostly observational, rarely used biochemical measures to validate cessation, were confounded by the presence of cessation programs during the policy change period, and, except for the population studies, had poor external validity.

Based on these findings, practitioners should select interventions that have strong empirical evidence of effectiveness, work to increase participation in cessation programs, and combine policies with programming for a coherent program of worksite smoking control. Also, they should consider the pros and cons of conducting cessation programs as part of a multicomponent health promotion program within the context of their site and of targeting all smokers in the workforce with appropriate interventions.

The worksite remains an important setting for studying smoking cessation and control. This review has pointed to a number of deficiencies in methodology that should be addressed so that firm conclusions can be drawn regarding intervention effectiveness. Researchers should build on the best evidence to date to design innovative theory-based programs that address the needs of all smokers in the employee population and evaluate them using rigorous designs and methodology.

November 1991 and successfully implemented by December 1993[102] and with the fact that many tobacco researchers had easy access to hospitals for study. However, the generality of the findings from hospitals is questionable, given that not smoking directly addresses the primary health mission of the organization.

Future research should focus on the evaluation of worksite-wide interventions that include components for smokers at all stages of change. This becomes more important as nonsmoking becomes established as the norm at work with bans on smoking and as smoking becomes less normative in the community as well. Individuals who continue to smoke will be less likely to volunteer for standalone worksite cessation programs and will also require more intensive cessation approaches. Multicomponent health promotion programs offer participants skills for behavior change, opportunities to increase self-efficacy for behavior change in one area that could be transferred to another, and a climate supportive of health. Another opportunity lies in the linkage between a company's managed care providers and its worksite health promotion program. Assessment, counseling, and appropriate referral by their health care providers will reach smokers who may not participate in worksite-based programming.

The time for studying the changes in worksite tobacco policy in the United States has passed, and it will not be possible to conduct controlled experiments. Future research should focus on population studies that examine the relative effect of worksite policies on self-reported smoking and exposure to smoke. For these studies to be useful, variables that measure other influences on tobacco use and exposure will need to be included for use as control variables. Surveillance of policy coverage among worksites should be continued. International work, however, should focus on well-controlled studies of policy interventions, along with surveillance of worksites for policy prevalence and general population surveys.

References

1. McGinnis JM, Foege WH. Actual causes of death in the United States. JAMA 1993;270: 2209–12.
2. Centers for Disease Control. Cigarette smoking-attributable mortality and years of potential life lost—United States, 1990. MMWR 1993;42:645–9.
3. Centers for Disease Control. Medical-care expenditures attributable to cigarette smoking—United States. MMWR 1994;43:469–72.
4. Eriksen MP. Workplace smoking control: rationale and rapproaches. Adv Health Educ Health Promot 1986;1A:65:103.
5. National Center for Health Statistics. Healthy People 2000 Review, 1994. Hyattsville, Maryland: Public Health Service, 1995.
6. O'Donnell MP. Employers' financial perspective on health promotion. In: O'Donnell MP, Harris JS, editors. Health Promotion in the Workplace. Albany, New York: Delmar, 1994: 41–65.
7. O'Donnell MP. Designing workplace health promotion programs. In: O'Donnell MP, Harris JS, editors. Health Promotion in the Workplace. Albany, New York: Delmar, 1994: 69–88.
8. Danaher BG. Smoking cessation programs in occupational settings. Public Health Rep 1980;95(2):149–57.
9. Orleans CS, Shipley RH. Worksite smoking cessation initiatives: review and recommendations. Addict Behav 1982;7:1–16.
10. Windsor RA, Bartlett EE. Employee self-help smoking cessation programs: a review of the literature. Health Educ Q 1984;11(4):349–59.
11. Shilling II RF, Gilchrist LD, Schinke SP. Smoking in the workplace: review of critical issues. Public Health Rep 1985;100(5):473–9.
12. Hallett R. Smoking intervention in the workplace: review and recommendations. Prev Med 1986;15:213–31.
13. Bibeau DL, Mullen KD, McLeroy KR, et al. Evaluation of workplace smoking cessation programs: a critique. Am J Prev Med 1988; 4(2):87–95.
14. Klesges RC, Cigrang JA. Worksite smoking cessation programs: clinical and methodological issues. In: Hersen M, Eisler RM, Miller PM, editors. Progress in Behavior Modification. New York: Sage, 1988:36–61.
15. Strasser PB. Smoking cessation programs in the workplace: review and recommendations for occupational health nurses. AAOHN J 1991;39(9):432–8.
16. Fielding JE. Smoking control at the workplace. Annu Rev Public Health 1991;12:209–34.
17. US Department of Health and Human Services. The Health Consequences of Smoking: Cancer and Chronic Lung Disease in the Workplace: A Report of the Surgeon General (DHHS Pub. No. 85-50207). Rockville, Maryland: USDHHS, 1985.
18. Fisher EJ, Glasgow RE, Terborg JR. Work site smoking cessation: a meta-analysis of long-term quit rates from controlled studies. J Occup Med 1990;32(5):429–39.
19. Heaney CA, Goetzel RZ. A review of health-related outcomes of multicomponent worksite health promotion programs. Am J Health Promot 1997;11(4):290–307.
20. Wilson M, Holman P, Hammock A. A comprehensive review of the effects of worksite health promotion health-related outcomes. Am J Health Promot 1996;10(6):429–35.
21. Sorensen G, Lando H, Pechachek TF. Promoting smoking cessation at the workplace. J Occup Med 1993;35(2):121–6.
22. Jason LA, Gruder CL, Martino S, et al. Work site group meetings and the effectiveness of a televised smoking cessation intervention. Am J Community Psychol 1987;15(1):57–72.
23. Jason LA, Gruder CL, Buckenberger L, et al. A 12-month follow-up of a worksite smoking cessation intervention. Health Educ Res 1987;2(3):185–94.
24. Jason LA, Lesowitz T, Michaels M, et al. A worksite smoking cessation intervention involving the media and incentives. Am J Community Psychol 1989;17(6):787–99.
25. Omenn GS, Thompson B, Sexton M, et al. A randomized comparison of worksite-sponsored smoking cessation programs. Am J Prev Med 1988;4(5):261–7.
26. Frank RG, Umlauf RL, Wonderlich SA, et al. Hypnosis and behavioral treatment in a worksite smoking cessation program. Addict Behav 1986;11:59–62.
27. Glasgow RE, Klesges RC, O'Neill HK. Programming social support for smoking modification: an extension and replication. Addict Behav 1986;11:453–7.
28. Glasgow RE, Klesges RC, Godding PR, et al. Evaluation of a worksite-controlled smoking program. J Consult Clin Psychol 1984;52(1): 137–8.
29. Malott JM, Glasgow, O'Neill HK, et al. Coworker social support in a worksite smoking control program. J Appl Behav Anal 1984; 17(4):485–95.
30. Dawley LT, Dawley HH, Glasgow RE, et al. Worksite smoking control, discouragement, and cessation. Int J Addict 1993;28(8):719–33.
31. Hymowitz N, Campbell K, Feuerman M. Long-term smoking intervention at the worksite: effects of quit-smoking groups and an "enriched milieu" on smoking cessation in adult white-collar employees. Health Psychol 1991;10(5):366–9.
32. Dawley HH, Dawley LT, Correa P, et al. A comprehensive worksite smoking control, discouragement, and cessation program. Int J. Addict 1991;26(6):685–96.
33. Jason LA, Jayaraj S, Blitz CC, et al. Incentives and competition in a worksite smoking cessation intervention. Am J Public Health 1990;80(2):205–6.
34. Maheu MM, Gevirtz RN, Sallis JF, et al. Competition/cooperation in worksite smoking cessation using nicotine gum. Prev Med 1989;18:867–76.
35. Shipley RH, Orleans CT, Wilbur CS, et al. Effect of the Johnson & Johnson LIVE FOR LIFE program on employee smoking. Prev Med 1988;17:25–34.
36. Klesges RC, Glasgow RE, Klesges LM, et al. Competition and relapse prevention training in worksite smoking modification. Health Educ Res 1987;2(1):5–14.
37. Klesges RC, Vasey MM, Glasgow RE. A worksite smoking modification competition: potential for public health impact. Am J Public Health 1986;76:(2):198–200.
38. Scott RR, Prue DM, Denier CA, et al. Worksite smoking intervention with nursing professionals: long-term outcome and relapse assessment. J Consult Clin Psychol 1986; 54(6):809–13.
39. Bertera RL, Oehl LK, Telepchak JM. Self-help versus group approaches to smoking cessation in the workplace: eighteen-month follow-up and cost analysis. Am J Health Promot 1990;4(3):187–92.
40. Olsen GW, Shellenberger JU, Lacy SE, et al. A smoking cessation incentive program for chemical employees: design and evaluation. Am J Prev Med 1990;6(4):200–7.
41. Olsen GW, Lacey SE, Sprafka JM, et al. A 5-year evaluation of a smoking cessation incentive program for chemical employees. Prev Med 1991;20:774–84.

42. Digrusto E. A workplace smoking cessation program: a strategy with potential for mass application. Community Health Stud 1987; 9(Suppl. 1):45–52.
43. Dawley HH Jr, Fleischer BJ, Dawley LT. Smoking cessation with hospital employees: an example of worksite smoking cessation. Int J Addict 1984;19(3):327–34.
44. Stachnik T, Stoffelmayr B. Worksite smoking cessation programs: a potential for national impact. Am J Public Health 1983;73(12): 1395–6.
45. Mossman PB. Changing habits—an experience in industry. J Occup Med 1978;20(3): 213.
46. Kanzler M, Zeidenberg P, Jaffe JH. Response of medical personnel to an on-site smoking cessation program. J Clin Psychol 1976; 32(3):670–4.
47. O'Hara P, Gerace TA, Elliott LL. Effectiveness of self-help smoking cessation guides for firefighters. J Occup Med 1993;35(8): 795–9.
48. Burling TA, Marotta J, Gonzalez R, et al. Computerized smoking cessation program for the worksite: treatment outcome and feasibility. J Consult Clin Psychol 1989;57(5): 619–22.
49. Jeffery RW, Pheley AM, Forster JL, et al. Payroll contracting for smoking cessation: a worksite pilot study. Am J Prev Med 1988; 4(2):83–6.
50. Sutton S, Hallett R. Randomized trial of brief individual treatment for smoking using nicotine chewing gum in a workplace setting. Am J Public Health 1987;77:1210–1211.
51. Windsor RA, Lowe JB, Bartlett EE. The effectiveness of a worksite self-help smoking cessation program: a randomized trial. J Behav Med 1988;11(4):407–21.
52. Windsor RA, Lowe JB. Behavioral impact and cost analysis of a worksite self-help smoking cessation program. Adv Cancer Control Innovations: and Res 1989;293:231–42.
53. Lowe JB, Windsor RA, Post KL. Effectiveness of impersonal versus interpersonal methods to recruit employees into a worksite quit smoking program. Addict Behav 1987;12: 281–4.
54. Sutton SR, Eiser JR. The effect of fear-arousing communications on cigarette smoking: an expectancy-value approach. J Behav Med 1984;7(1):13–33.
55. Gottlieb NH, Nelson A. A systematic effort to reduce smoking at the worksite. Health Educ Q 1990;17(1):99–118.
56. Hantula DA, Stillman FA, Waranch HR. Can mass-media campaign modify tobacco smoking in a large organization? Evaluation of the Great American Smokeout in an urban hospital. J Organ Behav Manage 1992; 13(1):33–47.
57. Kinne S, Thompson B, Wooldridge JA. Response to a telephone smoking information line. Am J Health Promot 1991;5(6):410–3.
58. Gritz ER, Marcus AC, Berman BA, et al. Evaluation of a worksite self-help smoking cessation program for registered nurses. Am J Health Promot 1988;3(2):26–35.
59. Nepps MM. A minimal contact smoking cessation program at the worksite. Addict Behav 1984;9:291–4.
60. Glasgow RE, Hollis JF, Ary DV, et al. Results of a year-long incentives-based worksite smoking-cessation program. Addict Behav 1993;18:455–64.
61. Rand CS, Stitzer ML, Bigelow GE, et al. The effects of contingent payment and frequent workplace monitoring on smoking abstinence. Addict Behav 1989;14:121–8.
62. Glasgow RE, Hollis JF, Pettigrew L, et al. Implementing a year-long worksite-based incentive program for smoking cessation. Am J Health Promot 1991;5(3):192–9.
63. Sloan RP, Dimberg L, Welkowitz LA, et al. Cessation and relapse in a year-long workplace quit-smoking contest. Prev Med 1990; 19:414–23.
64. Rosen GM, Lichtenstein E. An employee incentive program to reduce cigarette smoking. J Consult Clin Psychol 1977;45(5):957.
65. Sutton S, Hallett R. Smoking intervention in the workplace using videotapes and nicotine chewing gum. Prev Med 1988;17:48–59.
66. Li VC, Kim YJ, Ewart CK, et al. Effects of physician counseling on the smoking behavior of asbestos-exposed workers. Prev Med 1984;13:462–76.
67. Rose G, Hamilton PJS. A randomized controlled trial of the effect on middle-aged men of advice to stop smoking. J Epidemiol Community Health 1978;32:275–81.
68. Rose G, Hamilton PJS, Colwell L, et al. A randomized controlled trial of anti-smoking advice: 10 year results. J Epidemiol Community Health 1982;36:102–8.
69. Whitney E, Harris N. A progress report on an ongoing smoking cessation initiative as part of a major wellness program. Health Values 1994;18(1):84–90.
70. Kilburn KH, Warshaw RH. Effects of individually motivating smoking cessation in male blue collar workers. Am J Public Health 1990;80(11):1334–7.
71. Brigham J, Gross J, Stitzer ML, et al. Effects of a restricted work-site smoking policy on employees who smoke. Am J Public Health 1994;84(5):773–8.
72. Stave GM, Jackson GW. Effect of a total work-site smoking ban on employee smoking and attitudes. J Occup Med 1991;33(8):884–90.
73. Biener L, Abrams DB, Follick MJ, et al. A comparative evaluation of a restrictive smoking policy in a general hospital. Am J Public Health 1989;79(2):192–5.
74. Brenner H, Fleischle B. Smoking regulations at the workplace and smoking behavior: a study from Southern Germany. Prev Med 1994;23:230–4.
75. Jeffery RW, Kelder SH, Forster JL, et al. Restrictive smoking policies in the workplace: effects on smoking prevalence and cigarette consumption. Prev Med 1994;23:78–82.
76. Daughton DM, Andrews CE, Orona CP, et al. Total indoor smoking ban and smoker behavior. Prev Med 1992;21:670–6.
77. Goldstein AO, Westbrook WR, Howell RE, et al. Hospital efforts in smoking control: remaining barriers and challenges. J Fam Pract 1992;34(6):729–34.
78. Marcus BH, Emmons KM, Abrams DB, et al. Restrictive workplace smoking policies: impact on nonsmokers' tobacco exposure. J Public Health Policy 1992;13:42–51.
79. Offord KP, Hurt RD, Gerge KG, et al. Effects of the implementation of a smoke-free policy in a medical center. Chest 1992; 102(5):1531–6.
80. Baile WF, Gibertini M, Ulschak F, et al. Impact of a hospital smoking ban: changes in tobacco use and employee attitudes. Addict Behav 1991;16:419–26.
81. Hocking B, Borland R, Owen N, et al. A total ban on workplace smoking is acceptable and effective. J Occup Med 1991;33(2):163–7.
82. Sorensen G, Rigotti N, Rosen A, et al. Effects of a worksite nonsmoking policy: evidence for increased cessation. Am J Public Health 1991;81(2):202–4.
83. Borland R, Chapman S, Owen N, et al. Effects of workplace smoking bans on cigarette consumption. Am J Public Health 1990; 80(2):178–80.
84. Gottlieb NH, Eriksen MP, Lovato CY, et al. Impact of a restrictive work site smoking policy on smoking behavior, attitudes and norms. J Occup Med 1990;32(1):16–23.
85. Hudzinski LG, Frohlich ED. One-year longitudinal study of a no-smoking policy in a medical institution. Chest 1990;97(5):1190–202.
86. Mayo GS, Pritzi JA, Young WF, et al. Evaluation of an employee smoking policy—Pueblo, Colorado, 1989–90. MMWR 1990;39(38): 673–6.
87. Mullooly JP, Schuman KL, Stevens VJ, et al. Smoking behavior and attitudes of a large HMO before and after a work site ban on cigarette smoking. Public Health Rep 1990; 105(6):623–8.
88. Stillman FA, Becker DM, Swank RT, et al. Ending smoking at The Johns Hopkins Medical Institutions. JAMA 1990;264(12):1565–9.
89. Becker DM, Conner HF, Waranch HR, et al. The impact of a total ban on smoking in The Johns Hopkins Children's Center. JAMA 1989;262(6):799–802.
90. Scott CE, Gerberich SG. Analysis of a smoking policy in the workplace. AAOHN J 1989; 37(7):265–73.
91. Petersen LR, Helgerson SD, Gibbons CM, et al. Employee smoking behavior changes and attitudes following a restrictive policy on worksite smoking in a large company. Public Health Rep 1988;103(2):115–20.
92. Rosenstock IM, Stergachis A, Heaney C. Evaluation of smoking prohibition policy in a health maintenance organization. Am J Public Health 1986;76:1014–5.
93. Andrews JL. Reducing smoking in the hospital: an effective model program. Chest 1983; 84(2):206–9.
94. Pierce JP, Shanks TG, Pertschuk M, et al. Do smoking ordinances protect non-smokers from environmental tobacco smoke at work? Tob Control 1994;3:15–20.
95. Kinne S, Kristal AR, White E, et al. Work-site smoking policies: their population impact in Washington State. Am J Public Health 1993; 83(7):1031–3.
96. Pederson LL, Bull SB, Ashley MJ, et al. An evaluation of the workplace smoking bylaw in the City of Toronto. Am J Public Health 1993;83(9):1342–5.
97. Woodruff TJ, Rosbrook MS, Pierce J, et al. Lower levels of cigarette consumption found in smoke-free workplaces in California. Arch Intern Med 1993;153:1485–93.
98. Paulozzi LJ, Spengler RF, Gower MA. An evaluation of the Vermont worksite smoking law. Public Health Rep 1992;107(6):724–6.
99. Wakefield MA, Wilson D, Owen N, et al. Workplace smoking restrictions, occupational status, and reduced cigarette consumption. J Occup Med 1992;34(7):693–7.
100. US Environmental Protection Agency. Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders (EPA/600/6-90/006F). Washington, DC: US Government Printing Office, 1992.
101. Prochaska JO, DiClemente CC, Norcross JC. In search of how people change: applications to addictive behaviors. Am Psychol 1992;47:1102–14.
102. Longo DR, Brownson RC, Druse RL. Smoking bans in US hospitals. Results of a national survey. JAMA 1995;274:488–91.