reinforce smoking abstinence (Morgan 1981). Many smokers, particularly women, are concerned about potential weight gain as a result of smoking cessation, and such programs can address these concerns (Ellis 1980).

There are also potential disadvantages of multiple risk factor reduction programs. They may be difficult to implement because staff expertise is required in multiple areas and because some risk factors, such as smoking, may not be relevant for all participants. In addition, multiple risk factor reduction programs must present a large amount of complex information, usually in a limited time, and consequently the amount of attention devoted to a given risk factor such as smoking must often be less than is the case in single modality programs.

Two main types of multiple risk factor reduction programs have involved smoking cessation. The first is large-scale clinical trials for the prevention of coronary heart disease. The Belgian and British WHO studies reported by Kornitzer and Dramaix and colleagues (1980) and by Rose and colleagues (1980) were conducted solely in industrial settings and were discussed in detail in the 1983 Report of the Surgeon General (US DHHS 1983). These studies are well designed and have collected multiple dependent variables, including indices of overall health risk or morbidity and mortality statistics.

The other main type of multiple risk factor reduction program that has been developed is worksite wellness programs conducted by large companies for their employees. Examples include the STAY-WELL program of the Control Data Corporation (Naditch 1984), the Live for Life program of Johnson and Johnson (Nathan 1984), and programs offered by IBM, the Campbell Soup Company, and the Ford Motor Company (Parkinson et al. 1982; Ware and Block 1982). Unfortunately, the outcomes of almost all industry-sponsored programs reported to date are difficult to interpret owing to varying methods of reporting results, difficulties in following subjects, and lack of objective measures of smoking status. Reports of company wellness programs with more than anecdotal data on smoking modification results (e.g., Grove et al. 1979; Sorman 1979) are summarized in Table 1.

Cessation rates in multiple risk factor reduction programs in worksites have ranged from 7 to 33 percent at followup. Many of these rates are lower than those typically reported in other worksite smoking studies and are not consistently better than comparison conditions in controlled studies (Kornitzer, De Backer et al. 1980; Meyer and Henderson 1974). Interpretation of these data is problematic because of the lack of direct comparisons with smoking-cessation-only interventions, because subjects with multiple risk factors may be more recalcitrant than other subjects, and because

TABLE 4.—Organizational characteristics potentially affecting outcome of worksite smoking programs

(1)	Size of worksite	(7)	Union/management relations
(2)	Current worksite smoking policies	(8)	Percent of smokers in the worksite
(3)	Degree of management support for program	(9)	Growth oriented vs. consolidating climate of organization
(4)	History of health promotion efforts in the worksite	(10)	Rank and sociometric standing of primary contact person
(5)	Sex ratio of employees		
(6)	Job stability/turnover	(11)	Socioeconomic level of employees

the risk factor reduction programs reported in this section tend to be ongoing programs rather than one-shot smoking clinics.

Organizational Characteristics and Other Factors

Conducting outcome research in worksite settings involves a number of unique factors that may mediate or interact with program success. The organizational characteristics that may mediate program success are outlined in Table 4. Although this list is certainly not exhaustive, investigators should consider these factors when conducting worksite smoking programs. An example of the potential effects of organizational characteristics is the variability in outcome reported by Glasgow and Klesges and their colleagues (Glasgow et al. 1984, in press; Klesges et al. 1985). The basic treatment programs utilized in these studies were almost identical and were implemented by many of the same therapists. Yet, the 6-month abstinence rates in the different organizations ranged from 14 to 33 percent.

Few of these variables have been addressed in worksite smoking studies. Bishop and Fisher (1984) have conducted similar multilevel smoking cessation programs in a number of different organizations, ranging in size from 200 to 6,000 employees. They reported substantially lower participation rates in large companies, a finding that is consistent with results of studies of worksite weight loss programs (Brownell et al., in press). Also, the studies outlined in Tables 1 through 3 suggest that the highest cessation rates are obtained in smaller worksites. Taken together, these trends suggest that different interventions and different ways to assure participation need to be developed for large corporations. The problem may be one of

implementation, not design. Company policy regarding vesting responsibility in division leadership may be a critical variable.

In terms of the second variable in Table 4, worksite smoking policies, it is important to emphasize that smoking cessation groups are but one way to influence rates of worksite cigarette smoking (Bennett and Levy 1980). Although there have certainly been more reports on cessation programs than on other approaches to occupational smoking control, evaluations of alternative procedures are beginning to appear. In particular, Dawley and colleagues (Dawley and Baldwin 1983; Dawley and Burton, in press; Dawley et al. 1980) and Jason and colleagues (Jason and Liotta 1982; Jason and Clay 1978; Jason and Savio 1978) have studied the effects of no-smoking signs and requests not to smoke. These studies indicate that the posting of nonsmoking signs and the establishment of nonsmoking areas temporarily reduce smoking rates, but that active enforcement of such policies is necessary to produce substantial or lasting decrements in smoking behavior (Dawley et al. 1980; Jason and Liotta 1982; Jason and Savio 1978). One caveat to be kept in mind in evaluating the effects of worksite smoking restrictions is that workers may "compensate" by smoking more during breaks and after work (Meade and Wald 1977). Evaluations of the effectiveness of smoking restrictions should therefore assess smoking rates during both work and nonwork hours and include objective measures of smoking exposure.

Dawley and colleagues subdivided smoking modification efforts into three categories: smoking control (limiting or restricting smoking to designated areas); smoking discouragement (educational efforts to encourage people to stop smoking); and smoking cessation (more formal treatment programs). They also suggested that "worksite smoking cessation programs operate most effectively when offered in conjunction with worksite smoking control and discouragement efforts" (Dawley et al. 1984, p. 329), a highly testable hypothesis that has yet to be experimentally investigated.

The potential to use modifications of the work environment to aid in smoking cessation, including restricting smoking, removing cigarette machines, and altering work rules or situations that promote smoking, make the worksite more than simply a location for cessation interventions. The elimination of environmental supports for smoking, alteration of the smoker's self-image, changing the perception of the smoker among peers, and revising the social norms about smoking in the worksite may all provide a powerful motivation for the smoker to quit and support the successful maintenance of cessation. These changes in the workplace environment and attitudes may be more important than the components of the behavioral intervention used to get workers to quit, and experimental verification of the impact of these changes would provide a useful

guide for the structuring of future comprehensive worksite interventions. Because it would probably be unlikely that researchers would gain access to experimental manipulation of some of the more controversial aspects of guidelines (hiring policies and penalities for smoking), opportunities that may arise to study such changes in noncontrolled research would be worth pursuing.

Few data have been collected on the other variables listed in Table 4. Research on worksite smoking programs should at least provide descriptive information to determine how these variables affect program success. The fit between organizational and program characteristics has been neglected in past occupational smoking control research. It is hoped that future research will be able to identify the types of programs that are most effective in each different worksite setting.

Implementation of Worksite Smoking Programs

This section focuses on two major classes of implementation issues: recruitment procedures and characteristics of intervention programs.

Promotion and Recruitment

The initial contact with a worksite can prove critical to the success of a project. It is generally recommended that the initial meeting be with the chief executive of the organization (Klesges and Glasgow 1985). Although this officer typically does not coordinate the program, support from top-level management appears to be important in program recruitment and implementation (Grove et al. 1979). Another method of enhancing participation and organizational involvement is the formation of a steering committee (Bishop and Fisher 1984; Stachnik and Stoffelmayr 1981) composed of key representatives from both labor and management. Employees should perceive that the program is voluntary and that they have input into its implementation. Steering committees of this kind may be particularly important in large worksites with unionized employees. Management support appears to be quite important to the success of the committee (Bishop and Fisher 1984).

Upon securing permission to offer a program, it is helpful to conduct a brief worksite needs assessment (e.g., Heckler 1980; Kanzler et al. 1976; Klesges and Glasgow 1985). The survey can be used to determine (1) the number and characteristics of smokers in the worksite, (2) the number of smokers potentially interested in participating, and (3) preferences concerning the types of programs that might be offered (e.g., self-help versus group meetings; abstinence versus reduced smoking) and the most convenient times for meetings to be scheduled.

During the recruitment phase, information about the program should come from a variety of sources, such as posters, memos, and brochures. Advertising experts recommend providing multiple exposures to a "product" (in this case, a smoking program) to promote attitude change and to convince participants to take action regarding the product (Sawyer 1981). Promotional materials should include information about the cost of a program, stress that participation is voluntary and individual results are confidential, and counter possible misconceptions (e.g., "I have to quit at the first session"; "I'll lose my job if I don't participate"). It is helpful if at least one memo or announcement comes from top management. At this stage, human resources or personnel directors can be extremely useful in suggesting the best ways to promote the program in their particular setting. Involving the local media may also increase the credibility of the program as well as provide no-cost advertising for both the program and the worksite.

Prior to the actual implementation of a smoking program, some programs prepare worksites for health-behavior change (Andrews 1983; Bennett and Levy 1980; Ellis 1979; Grove et al. 1979; Heckler 1980). These preparatory procedures have ranged from prescreening health exams (Ellis 1979) to the initiation of smoking restrictions (Andrews 1983; Bennett and Levy 1980). Warnings of the impending restrictions with indications of the "target restriction date" allow workers to prepare for changes, such as by joining available programs. Although empirically untested, these recruitment procedures may help to convince employees to join smoking programs.

Program Characteristics

The advantages of occupational smoking control programs discussed earlier do not *automatically* or *necessarily* occur. Programs must be made convenient. Higher participation rates are usually found in programs that offer time off work (e.g., Klesges et al. 1985; Scott et al. 1983). Time off work for participation can be a double-edged sword, however. It may increase the number of smokers who participate primarily to be excused from their work stations, and it may also create demands among nonsmoking employees for time off work to attend other health-related classes. Generally, the benefits of conducting programs during work hours outweigh the potential costs, and if management is not willing to grant time off work, it may at least be possible to negotiate time sharing between employee and employer (e.g., 1/2 hour of work time, 1/2 hour during lunch hour or after work). Investigators should also be aware of the difficulties involved in scheduling group meetings in worksites where employees work rotating shifts, such as hospitals.

In addition to being convenient, programs should be attractive to participants. For example, allowing smokers to choose the type of

program (such as nicotine fading versus aversive smoking), the modality of intervention (self-help manual versus group meetings), the treatment goals (abstinence versus reduced smoking), and the type of group leader (health professional versus peer facilitator) may be helpful in attracting and retaining participants. Different components of a comprehensive program, such as physician advice, no-smoking policies, stop-smoking contests, or group meetings, may mutually reinforce each other. While these suggestions await empirical verification, providing smokers with a number of choices should serve to increase participation rates.

Finally, feedback on progress may serve to increase the magnitude of behavior change. For example, participants can be provided with frequent feedback on carbon monoxide levels as they reduce their smoking (e.g., Rand et al. 1984; Scott et al. 1983). Charts displaying the weekly progress of different groups can be posted in employee lunchrooms or lounges. Periodic progress reports to department supervisors might also be helpful. To avoid stigmatizing particular individuals, public feedback should be provided on progress by the group rather than by individuals.

There are a number of problems in conducting worksite smoking modification groups that should be avoided, or at least anticipated. Group composition is one such sensitive issue. For example, mixing high-ranking executives with production workers can almost eliminate group discussion. However, this may depend on the company's tradition of interaction among workers of different levels, on the skills of the group leaders, and so on. Scheduling difficulties can arise in settings were employees rotate shifts or travel frequently, or where meeting rooms are scarce or distant from work stations. One also needs to be sensitive to negativism or complaining, which can become contagious; the group's focus must be kept positive. A positive perspective is particularly important when conducting competition or incentive interventions in which certain individuals or groups must "lose." A more optimistic perspective that can be used to encourage participants is that eveyone can win something by changing their smoking, so there are no losers.

Finally, Marlatt and Gordon's (1985) concept of stopping smoking as a "journey" can be quite helpful. On their journey, people may experience temporary setbacks or detours (relapses), but this should not prevent them from reaching their destination (abstinence). The presence of an ongoing program that makes it easy to try different options or to recycle a procedure can serve to reinforce this concept and to improve long-term results.

Recommendations for Future Research

A number of suggestions for the implementation of worksite smoking modification programs have been outlined. Given the limited nature of the data available, few of these guidelines are experimentally derived. Research is needed to empirically support or refute these recommendations. This section discusses needs for future research in the field of worksite smoking modification. Recommendations are made on both research methodology and substantive issues for further investigation.

Methodological Issues

Greater use should be made of creative experimental and quasi-experimental designs, as discussed by Cook and Campbell (1979). In particular, it should be possible to sequentially introduce an intervention or intervention components in different worksites using time-series or multiple baseline designs or to investigate the incremental effects of adding different strategies, such as physician messages, incentives, and social support procedures, to a basic treatment program.

Greater consistency across studies in the criteria used to define smoking status would substantially aid in the interpretation of results. Berglund and colleagues (1974) and Shipley and colleagues (1982) have provided guidelines for reporting outcomes of smoking cessation studies that should be more widely adopted. For calculating abstinence rates, a standard common denominator representing the number of subjects entering a program should be used across all points in time and any dropouts should be considered conservatively as smokers. In studies in which it is deemed important to evaluate reductions in smoking behavior (e.g., percent reduction in number of cigarettes smoked or nicotine content) in addition to the proportion of abstinent subjects, analyses should be conducted on nonabstinent subjects only. This procedure avoids confounding the results due to cessation with results due to changes in smoking rate or topography. Worksite programs should report cessation success as the fraction of the smokers in the workforce as well as the fraction who agreed to participate in the program.

Objective verification of smoking status is particularly important in programs involving financial incentives, competition between rival organizations, social pressure and support to quit, or controlled smoking instead of abstinence. Each of the biochemical measures of smoking exposure has its own advantages and limitations (Benowitz 1983; Pechacek et al. 1984).

Another methodological problem faced by occupational smoking modification programs concerns the consistency between units of assignment and units of analysis (Biglan and Ary 1985). Typically,

whole companies are assigned to treatment or control conditions, but results are analyzed using individual subjects as the unit. This creates interpretive problems because of the potential dependency among results of smokers within a given worksite (or treatment group). Although there are no easy answers to this dilemma, investigators should consider (1) conducting treatment in a sufficiently large number of companies that the worksite can be used as the unit of analysis; (2) utilizing hierarchical or nesting designs to separate the effects of worksite from intervention condition (Myers 1972); or (3) when feasible, assigning individuals within worksites to different treatment conditions.

Future research should pay greater attention to possible interactions between worksite and treatment variables. For example, interorganizational competition procedures may be highly effective in worksites where employees feel highly committed to the company, but ineffective in settings low in organizational commitment. Organizational and social network factors may also interact with, mediate, or enhance program impact.

More data also need to be collected on the "generalization" effects of worksite smoking modification programs. Employers may be more interested in program effects on employee morale, job satisfaction, and absenteeism than on health outcomes such as smoking status. Similarly, more information should be reported on the costs and health benefits of occupational smoking reduction programs. Progress in this area would be facilitated by a systematic review of and recommendation for procedures to be employed in determining the cost effectiveness and cost benefit of worksite smoking programs.

Substantive Areas

Three primary objectives need to be achieved by future research in worksite smoking modification. First, more research should be conducted on ways to increase participation and followthrough rates in worksite programs. For example, using various incentive procedures (e.g., paycheck bonuses versus team competition versus lotteries) might be expected to enhance participation. Further investigations are needed on the impact on participation rates of interventions such as quitting contests, self-help materials, or hotlines that do not require a large investment of time and effort by participants. The majority of worksite smoking studies to date have focused on group cessation programs, but surveys consistently indicate that most smokers are not interested in participating in such programs (US DHHS 1982; Schneider et al. 1984). For the reasons discussed earlier, renewed emphasis on physician stop-smoking messages is also indicated.

The second main content issue is how to enhance the outcome rates of worksite smoking modification programs. One approach to

this problem is to evaluate the utility of comprehensive intervention programs and environmental changes (no-smoking policies, cigarette machine removal, prominent no-smoking posters) with cessation groups. Other approaches are assessing the impact of multiple risk factor programs versus single modality programs and of ongoing, continuous intervention programs in place for a year or more versus one-time-only program offerings.

The final category of recommendations for future research involves investigating subject and therapist factors that affect treatment outcome (Klesges and Glasgow 1985; Orleans and Shipley 1982). Additional study is needed of the enrollment patterns and success rates of men versus women, white-collar workers versus blue-collar workers, and heavy smokers versus light smokers. Also, little is known about the characteristics of successful program leaders (e.g., ex-smoker coworkers versus professional group leaders).

Summary and Conclusions

1. Smoking modification and maintenance of nonsmoking status among initial quitters has the promise of being more successful in worksite programs than in clinic-based programs. Higher cessation rates in worksite programs are achieved with more intensive programs.
2. Incentives for nonsmoking appear to be associated with higher participation and better success rates. Further research is needed to specify the optimal types of incentive procedures.
3. Success of a worksite smoking program depends upon three primary factors: the characteristics of the intervention program, the characteristics of the organization in which the program is offered, and the interaction between these factors.
4. Research is needed on recruitment strategies and participation rates in worksite smoking programs and on the impact of interventions on the entire workforce of a company.
5. More investigations are needed on worksite characteristics associated with the success of occupational programs and on comprehensive programs including components such as quit-smoking contests, no-smoking policies, physician messages, and self-help materials in addition to smoking cessation clinics.
6. The implementation of broadly based health promotion efforts in the workplace should be encouraged, with smoking interventions representing a major component of the larger effort to improve health through a worksite focus.

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