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CO-WORKER SOCIAL SUPPORT IN A WORKSITE SMOKING CONTROL PROGRAM

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We evaluated the effects of adding a social support component to a worksite controlled smoking treatment program. Twenty-four participants were randomly assigned to either a controlled smoking or a controlled smoking plus partner support condition. Within a multiple baseline across behaviors design, smokers in both conditions made efforts to achieve sequential 50% reductions in: (a) nicotine content of brand smoked, (b) number of cigarettes smoked per day, and (c) percentage of each cigarette smoked. Self-monitoring records, laboratory analyses of spent cigarette butts, and carbon monoxide determinations indicated that both conditions were effective in producing significant reductions in each of the three target behaviors and in carbon monoxide levels. All participants who quit smoking during the program maintained their abstinence at a 6-month follow-up, and those who did not quit were smoking less at follow-up than they had at pretest on all dependent variables. However, few differences were observed between controlled smoking and controlled smoking plus partner support conditions either during treatment or at the 6-month follow-up. Results are discussed with regard to previous worksite studies, future directions for research on social support, and variables that may have mediated treatment outcome.

DESCRIPTORS: smoking, worksite, social support

There has recently been increased interest in health promotion programs conducted in worksite settings (Cataldo & Coates, in press; Follick, Abrams, Pinto, & Fowler, in press). Such programs offer a number of potential advantages to participants, employers, and program developers. Programs conducted in occupational settings may be more effective than clinic-based programs because of ongoing social interaction among participants and social reinforcement of behavior change. They are attractive to participants because of the increased convenience of treatment, particularly if time off work is provided for participation.

Worksite smoking modification programs are attractive to employers due to the increased productivity associated with smoking cessation and the likelihood of reduced medical expenses and absenteeism (Orleans & Shipley, 1982). Indeed, many employers have recently offered some form of stop smoking program (Fielding, 1982; National Interagency Council on Smoking and Health, 1980). Unfortunately, most worksite smoking modification programs have not been evaluated in a controlled manner or have not used objective measures of smoking status (Klesges & Glasgow, in press).

Recent experiments on controlled smoking (Frederiksen, 1979; Glasgow, Klesges, Godding, & Gegelman, 1983; Glasgow, Klesges, Godding, Vasey, & O'Neill, 1984; Glasgow, Klesges, & Vasey, 1983) have demonstrated significant reductions in carbon monoxide levels associated with self-reported reductions in nicotine content of brand smoked, number of cigarettes smoked, and various topographical aspects of smoking. Across three

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studies in our laboratory (Glasgow, Klesges, Godding & Gegelman, 1983; Glasgow et al., 1984; Glasgow, Klesges, & Vasey, 1983), we have achieved an average reduction of 54% in nicotine content. However, the number of cigarettes consumed and the percentage of each cigarette smoked have proven less amenable to change, with average reductions of 30% and 24%, respectively. Attempts to enhance the effectiveness of our basic controlled smoking (CS) package to date have been unsuccessful. Glasgow, Klesges, Godding, & Gegelman (1983) found that the addition of carbon monoxide feedback did not increase the efficacy of the basic program. Similarly, Glasgow et al. (1984) reported no increment in treatment outcome when either feedback on daily nicotine intake or more gradual reduction goals were added to the basic CS package.

An alternative approach for improving the results obtained with CS, which seems particularly appropriate for worksite programs, is to include a social support component whereby the smoker receives some form of systematic support for his or her efforts from one or more significant others. Although such an approach has been advocated for improving the success of treatment programs for addictive behaviors (Brownell, 1982; Lichtenstein, 1982), we are aware of only two published studies that have experimentally evaluated the use of social support as a component of smoking modification programs. Janis and Hoffman (1970) compared the effectiveness of three levels of social support, each in combination with the same standardized smoking cessation program. Results showed that smokers in a high-contact condition (e.g., daily partner meetings) reported smoking significantly fewer cigarettes per day at both 6-month and 1-year follow-ups than did smokers in lower contact conditions. A recent 10-year follow-up to this study indicated that smokers in the high-contact group continued to report less smoking than did those in the other two conditions (Janis, 1983).

Hamilton and Bornstein (1979) used phone contact between partners as one aspect of a social support intervention, which was added to a multicomponent behavioral treatment program. Intended mainly to enhance long-term maintenance of treatment gains, the social support manipulation resulted in significantly lower smoking rates at 3- and 6-month follow-ups than were observed with the same program without social support. Unfortunately, neither of these studies included measures of treatment credibility or objective measures of smoking exposure, and the buddy system used by Hamilton and Bornstein (1979) was confounded with other procedural differences.

The purpose of our project was to test the efficacy of two variants of a CS program conducted in an occupational setting. More specifically, in this study, we examined the effects of adding a coworker social support component to the basic CS intervention.

METHOD

Participants

Participants were 24 adult cigarette smokers (20 females and 4 males balanced for sex across conditions) who were recruited by means of posters and in-house newsletters announcing a smoking reduction program to be conducted at their worksite. Announcements were geared toward "moderate to heavy smokers who wish to reduce their smoking or quit smoking smoking entirely." The announcements also indicated that a $15 deposit was required, which would be refunded contingent on attendance at treatment and follow-up sessions.

The program was conducted at a telephone company and a medical clinic. Sixteen smokers were recruited from the medical clinic and eight from the phone company, with a proportionate number of participants from the two settings assigned to each treatment condition. Participants were generally clerical or lower level professional staff (e.g., nurses, telephone operators).

Participants averaged 34 years of age, had smoked for an average of 16 years, and at pretreatment estimated that they smoked an average of 24 cigarettes per day. Average reported nicotine

content of brand smoked was 0.75 mg, and the average score on the Tolerance Questionnaire (Fagerstrom, 1978) was 6.0. The stated objective for 54% of the participants was to quit smoking entirely, whereas the remaining 46% indicated that they wanted to reduce but not quit altogether.

Therapists

Therapists were a female master's level research associate and a male psychology graduate student, both of whom were required to read relevant background materials and conduct smoking modification groups under supervision prior to the actual study. To increase standardization of treatment, written outlines were developed for all sessions, and therapists role played treatment procedures for the upcoming session during weekly staff meetings. At these meetings, therapists also discussed any problems that might have occurred during the previous treatment session. Although therapists treated different numbers of participants, they were crossed with experimental conditions so that each therapist saw a proportionate number of participants in each condition.

Design

A combined between-subjects/intrasubject design was used. Smokers were assigned to either standard controlled smoking (CS) or controlled smoking plus partner support (CS plus PS). As in our previous studies, within each condition, participants sequentially attempted to alter the three target behaviors of nicotine content, number of cigarettes, and percentage of each cigarette smoked in a multiple baseline across behaviors design. There was also a changing criterion component of the experimental design for the target behaviors of number of cigarettes smoked and percentage of each cigarette smoked (see Figure 1). Smokers first attempted to achieve a 25% reduction in these behaviors and later, a 50% reduction.

Procedure

An initial orientation meeting was held to: (a) provide participants with an overview of the program, (b) complete informed consent forms and collect deposits, (c) assess pretreatment carbon monoxide levels, and (d) administer a battery of pretest questionnaires (see *Measures* section). Following the orientation meeting, participants self-monitored their cigarette smoking for a 1-week baseline period. They were instructed to record the brand as well as the amount of each cigarette smoked.

Participants were assigned to groups of 2–6 smokers, consisting of individuals who worked in the same office or had compatible schedules so that group meetings were feasible. Groups were then randomly assigned to either CS or CS plus PS conditions (there were three groups per condition). Sessions took place in the worksite and were held at maximally convenient times (i.e., lunch hours or when participants were excused from work).

Treatment Conditions

Basic controlled smoking (CS). Six weekly group meetings (approximately 50 minutes long) focused on sequentially reducing nicotine content (i.e., brand of cigarette), number of cigarettes smoked per day, and percentage of each cigarette smoked. Each meeting included discussion of participants' progress during the previous week, presentation of new information, and selection of individual goals based on current smoking levels.

Session 1 focused on making brand changes to reduce nicotine/tar content by approximately 50%. Using nicotine yield information from the Federal Trade Commission, smokers selected two or three brands containing approximately half the nicotine content of their current brand and were instructed to switch to one of these new brands. The second and third sessions focused on achieving reductions in the number of cigarettes smoked. The therapist described three strategies for reducing smoking rate: (a) controlling accessibility to cigarettes (e.g., keeping cigarettes in a locked drawer rather than on the desk, putting cigarettes in the trunk of the car while driving, taking only a specified number of cigarettes to work); (b) temporal control (e.g., limiting smoking to one cigarette per hour, progres-

sively waiting longer after meals before having a cigarette); and (c) situational control (e.g., not smoking while talking on the phone or viewing television, confining smoking to one room of the house). Smokers then chose the strategies they felt would be most effective and made individual plans for implementation. They attempted to achieve a 25% reduction in the number of cigarettes smoked between Sesssions 2 and 3 and an additional 25% reduction between Sessions 3 and 4.

At Session 4, participants were asked to decide if they wished to stop smoking completely or only to make further reductions. Those who chose cessation were encouraged to set a "target date" for quitting sometime between Sessions 4 and 5 and were assisted in developing specific plans. For those not attempting abstinence, the goal for this week was to achieve a 25% reduction in the amount of each cigarette smoked. To cue adherence to this goal, smokers were instructed to mark their cigarettes at the desired length. The fifth session focused on achieving an additional 25% reduction in the amount of each cigarette smoked or on achieving/maintaining abstinence.

The final session began with an evaluation of progress. The therapist then administered posttreatment questionnaires, measured carbon monoxide (CO) levels, and discussed situations that have been found to be associated with relapse in previous research (cf. Marlatt & Gordon, 1980; Shiffman, 1982). He or she warned participants about the dangers of falling victim to the "goal violation effect"—an adaptation of Marlatt and Gordon's (1980) abstinence violation effect. Participants were then asked to choose, from among three options, the goal that they wished to achieve over the next few months: (a) make further reductions, (b) quit entirely, or (c) maintain abstinence or present level of smoking. Each person was given a list of steps to follow should an increase in smoking occur. They were also given additional monitoring booklets and advised to monitor their smoking periodically if they continued to smoke. Finally, each received a handout summarizing the various techniques that had been discussed during treatment.

Controlled smoking plus partner support (CS plus PS). The same treatment procedures as in the basic CS condition were in effect. In addition, each CS plus PS participant was paired with a partner with whom he or she was to discuss progress on a daily basis. During the first treatment session, participants were given the opportunity to choose their own partners. The therapist asked, "Are there any pairings that make sense? For example, if two people have known each other for a long time or see a lot of each other during the day, that might be a good reason for being partners." In all cases except one, participants readily formed partnerships on their own. In that case, the therapist assigned the two remaining people as partners. Each of the six partnerships was composed of same-sexed individuals.

Partners were instructed to discuss their progress and any difficulties they were having at least once per day. Because partners were co-workers in the same workplace, it was anticipated that the presence of the partner would serve as a cue for adherence. Each individual also received short, weekly installments of the *Partner's Controlled Smoking Manual.* The manual is modeled after a manual of support procedures found to be effective in weight control by Brownell, Heckerman, Westlake, Hayes, and Monti (1978). Our 17-page partner's manual included general instructions regarding appropriate partner behaviors (e.g., "Be sure to keep interactions with your partner positive") as well as more specific instructions on how to help one's partner achieve each weekly goal.

In addition, at the first treatment session, participants were given a partner support checklist listing 25 potentially "supportive behaviors" (e.g., "Helps me to calm down when I'm feeling stressed"). They were asked to indicate which partner behaviors would be helpful to them and to write down the three or four behaviors that they would most prefer their partner to perform. Participants then exchanged checklists, so that each had a written record of the partner's preferences. Participants also self-monitored their partner support behaviors between sessions. At the beginning of each session, monitoring booklets were collected

and partner support activities during the previous week were discussed.

Measures

Dependent variables. Multiple measures of treatment outcome were used, consisting of self-reports of smoking topography, self-monitoring records of smoking, examination and weighing of cigarette butts, and a biochemical measure of smoking exposure. The Smoking Patterns Questionnaire, administered at pretest, posttest, and follow-up, had participants rate their current smoking behavior along a number of dimensions including the three target behaviors discussed above. Responses from this questionnaire have been demonstrated to correlate highly with self-monitoring records and with more objective measures of smoking exposure such as CO levels (Glasgow, Klesges, Godding, & Gegelman, 1983; Glasgow et al., 1984). In addition, because it has been used in our previous research, the Smoking Patterns Questionnaire provides a way of comparing results across studies. Self-monitoring booklets, which were completed throughout treatment and for a 1-week interval at the 6-month follow-up, were scored to produce average weekly levels of nicotine content of cigarette brand(s) smoked, number of cigarettes per day, and amount of each cigarette smoked.

Although self-monitoring records provide an economical, continuous measure of behavior in the natural environment, their accuracy is questionable. To document specific behavioral changes in smoking rate and topography, participants were contacted on a rotating basis and asked to collect the remnants of all cigarettes smoked on a specific day during baseline, treatment, and follow-up intervals. Cigarette butts were counted, checked for brand, and weighed to determine the percentage of the cigarette consumed. These data were compared with self-monitoring records of brand, number, and amount smoked on the same day.

To provide additional validation of self-reported smoking rates, CO levels were assessed using an Energetics Science 2000 Series Ecolyzer Gas Analyzer, which was calibrated daily. Carbon monoxide collection procedures followed those described by Hughes, Frederiksen, and Frazier (1978) and were conducted at the same time of day for each assessment.

Because no validated measure of co-worker support for a smoking modification attempt was available, a modification of the Mermelstein, Lichtenstein, and McIntyre (1983) Partner Interaction Questionnaire was used. The modified scale allowed participants to rate the amount of support provided by co-workers and it applied to controlled smoking as well as to abstinence goals. This 45-item co-worker interaction questionnaire was then scored to produce two summary scores by totaling the frequency of occurrence of behaviors rated by participants as either helpful (positive score) or unhelpful (negative score). The scale was administered only at posttreatment to decrease possible reactive effects.

Finally, to assess for potentially differential levels of treatment credibility across conditions, a 7-item questionnaire based on the scale developed by Borkovec and Nau (1972) was administered at the end of the first treatment session.

RESULTS

Preliminary Analyses

All 24 participants completed treatment and were available for posttreatment assessment. At the 6-month follow-up, one individual in the basic CS condition had moved out of the area, but all 12 participants in the CS plus PS condition were contacted.

One-way analyses of variance on pretreatment scores revealed no between-groups differences on any of the four main dependent variables (i.e., nicotine content, number of cigarettes per day, percentage of cigarette smoked, and CO), or on any of several demographic variables. Separate analyses of covariance (covarying out the influence of pretreatment scores) were conducted on posttreatment scores to evaluate possible main effects and interactions with treatment condition due to therapist and worksite setting. All failed to reveal significant

effects; therefore, the data were collapsed across therapists and worksites for the remaining analyses. An unexpected between-groups difference arose on the credibility measure. Participants in the CS plus PS condition rated treatment as significantly *less* credible than did those in the basic CS condition. This was the case for each of the seven individual items on the questionnaire (all $p < .05$) as well as the total summary score (CS $M = 56.0$, CS plus PS $M = 38.1$), $F(1, 21) = 16.06$, $p < .001$.

Between-Groups Analyses

Two participants in each condition (17%) achieved cessation by the end of treatment and all four had maintained abstinence at the 6-month follow-up (verified by CO levels <5 ppm). One additional individual in the CS condition had quit smoking by follow-up (also verified by a CO reading <5 ppm).

To avoid confounding of results due to smoking reductions with those due to abstinence, participants who achieved abstinence were excluded from the following analyses. Table 1 presents pretreatment, posttreatment, and 6-month follow-up means for nonabstinent participants in both conditions on data derived from the Smoking Patterns Questionnaire and on carbon monoxide levels. As can be seen, there were few meaningful differences between conditions by the 6-month follow-up. Two (Treatment) × two (Time) repeated measures analyses of covariance (covarying out the effects of pretreatment scores) comparing the CS and CS plus PS conditions at posttreatment and at the 6-month follow-up revealed only one significant effect. A significant Time × Treatment interaction was observed on the nicotine content measure, $F(1, 16) = 6.72$, $p < .05$. The pattern of this interaction indicated that, although participants in the CS condition had switched to brands lower in nicotine than had those in the CS plus PS condition by posttreatment, they did not maintain these improvements nearly as well as CS plus PS participants.

Analyses of variance were conducted on each of the two sections of the co-worker interaction questionnaire. Contrary to our expectations, there were no differences between conditions in the number of positive or negative smoking-related interactions reported with coworkers during treatment.

Within-Group Analyses and Magnitude of Change

Data from self-monitoring records indicated that partners in the CS plus PS condition did interact outside of group meetings. They met to discuss their smoking progress/problems an average of 16.8 times during the 5 weeks of treatment (range = 3 to 24; total possible = 25). With the exception of one pair, all partners met at least 11 times. There was a 0.98 correlation between the two partners' self-monitored frequency of interactions ($p < .05$), tending to support the accuracy of these records.

Multiple baseline analyses. Figure 1 presents weekly averages from participants self-monitoring records (excluding data from those who became abstinent). As can be seen, there was a marked reduction in each of the three dependent measures concurrent with that variable being targeted for modification (indicated by solid vertical line). Further reductions in smoking were observed when weekly goals were switched from 25% to 50% reductions within the changing criterion aspect of the design (indicated by broken vertical lines). Inspection of Figure 1 also reveals that participants did not respond to reductions in one target behavior with compensatory increases in other measured smoking behaviors.

Correlated t tests contrasting average baseline scores from self-monitoring data with average postintervention scores were performed separately within each treatment condition (after excluding those who became abstinent). Results from these analyses revealed significant reductions in each of the three target behaviors for both conditions (all $p < .001$). Across treatment conditions, the greatest reductions were observed in nicotine content ($M = 52\%$ reduction). Significant, but smaller reductions occurred in number of cigarettes smoked ($M = 38\%$ reduction) and percentage of each cigarette smoked ($M = 22\%$ reduction). It should be noted that these percent reduction analyses are fair-

ly conservative procedures because postintervention means included initial intervention weeks having 25% reduction goals as well as weeks when the final 50% reduction goals were in effect. Similar analyses conducted on pretest versus posttest Smoking Patterns Questionnaire data revealed larger percent reductions, but the same relative pattern of amount of change among target behaviors. Correlated t tests performed on CO data revealed that participants in both conditions achieved significant reductions from pre- to posttreatment (both $p < .001$; $M = 49\%$ reduction). These data also suggest that participants did not compensate for the behavior changes that were reported.

Posttreatment to follow-up changes. As can be seen in Table 1, there was a tendency for nonabstinent participants in both conditions to relapse partially by the 6-month follow-up. Repeated measures ANOVAs were conducted separately for each condition to compare posttreatment scores with 6-month follow-up scores on the three measures from the Smoking Patterns Questionnaire and on CO level. In both conditions, participants relapsed significantly on number of cigarettes smoked ($p < .05$). In addition, CS participants showed significant relapse on nicotine content ($p < .05$), and CS plus PS participants relapsed significantly on percentage of the cigarette smoked ($p < .01$). Although the general pattern was of increased smoking at follow-up, in neither condition did participants relapse significantly on CO levels, and nonabstinent smokers in both conditions were smoking less at follow-up than they had at pretreatment on all variables.

Table 1
Average Pretreatment, Posttreatment, and Follow-up Scores by Condition on Major Dependent Variables

Variable	Pre-treatment	Post-treatment	6-month follow-up
Number of participants abstinent[a]			
CS	0/12	2/12	3/11
CS + PS	0/12	2/12	2/12
Nicotine Content of brand (mg)[b]			
CS	0.70	0.22	0.52
CS + PS	0.84	0.45	0.45
Cigarettes per day[b]			
CS	24.5	10.2	21.5
CS + PS	24.2	14.7	20.1
Percentage of cigarette smoked[b]			
CS	83.5	66.3	76.4
CS + PS	90.4	63.2	82.0
Carbon monoxide level (ppm)[b]			
CS	33.5	16.8	24.8
CS + PS	33.8	17.8	25.4

[a] Ratios presented are number of participants abstinent over number of participants available for assessment.
[b] Data on these variables do not include participants who became abstinent during treatment.

Relationships Among Variables

There was good convergent validity among the various self-report and self-monitoring measures. The three main variables from the Smoking Patterns Questionnaire (nicotine content, number per day, and percentage of cigarette smoked) correlated from 0.76 to 0.89 with respective measures from self-monitoring data for the same week. Furthermore, the objective measures of brand of cigarette smoked, number of butts collected, and percentage of the cigarette smoked (by weight) from laboratory analyses of spent cigarette butts correlated 0.99, 0.98, and 0.82, respectively, with the corresponding self-monitoring records. Finally, two of the three measures from the Smoking Patterns Questionnaire correlated significantly with CO levels ($r = 0.82$, 0.52, and 0.14 for number, percent smoked, and nicotine content, $p < .005$ for number and percent smoked).

Correlational analyses of the relationship between scores on the co-worker interaction questionnaire and treatment outcome revealed an interesting pattern of results. Partial correlations (including all participants) were conducted between posttest status on each of the four dependent variables and scores from the interaction questionnaire, partialing out the effects of pretest scores on the dependent variables. The frequency of supportive interactions was not generally associated with outcome (average $r = 0.22$, ns). However, the frequency of negative or nonsupportive interactions with co-workers was consistently inversely related to treatment outcome

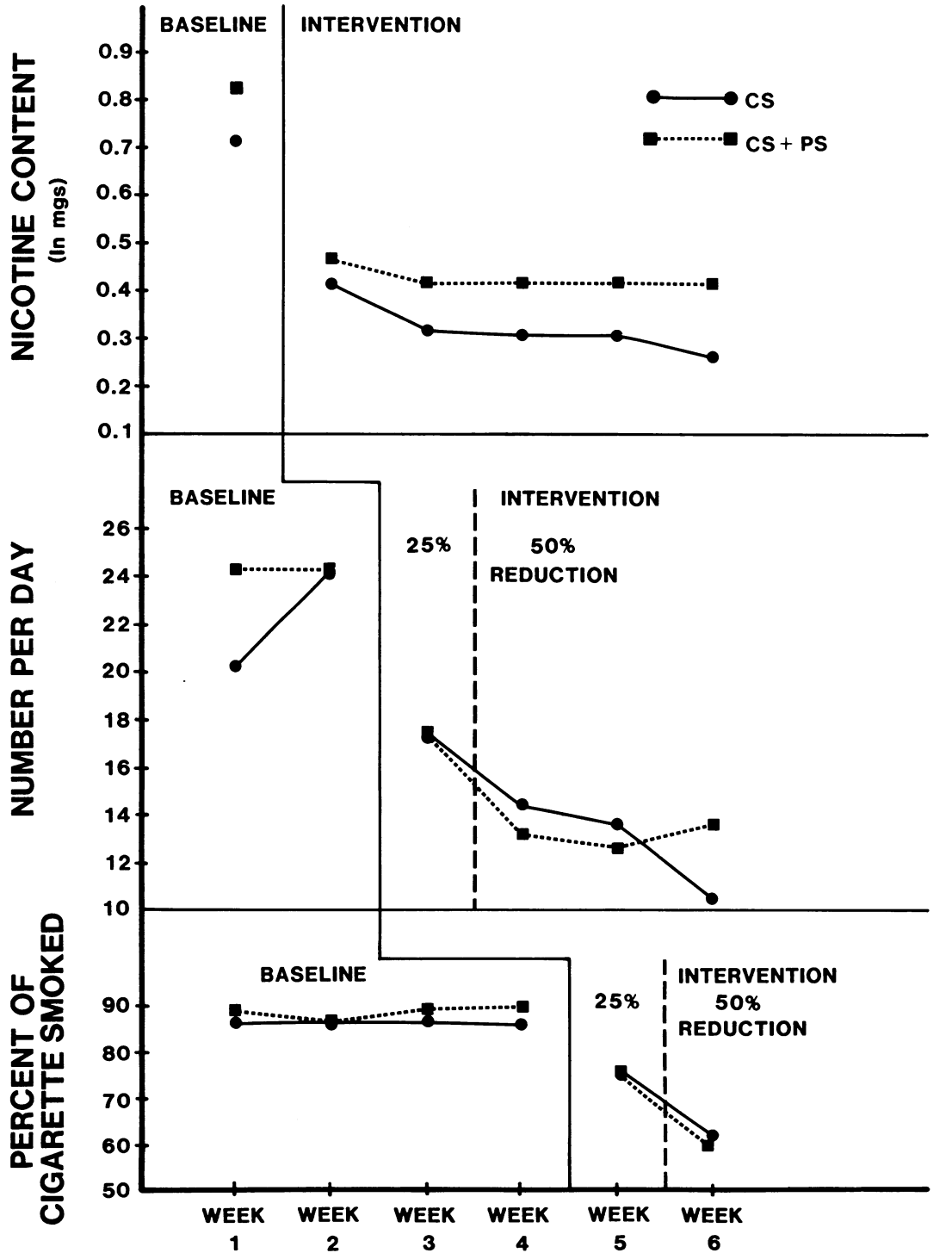

Figure 1. Effects of sequential introduction of treatment on nicotine content, number per day, and percentage of cigarette smoked for nonabstinent participants ($n = 20$).

($r = -0.25$ to -0.49; average $r = -0.41$, $p < .05$). Although these findings are retrospective and only correlational in nature, they suggest that our partner support program should have been less concerned with increasing positive interactions among partners and more concerned with decreasing the occurrence of negative (but possibly well-intentioned) co-worker interactions.

DISCUSSION

This study represents one of the few controlled investigations of a worksite smoking control program (Fielding, 1982; Klesges & Glasgow, in press). Discussion of both the positive and the negative aspects of this investigation may point to important issues for other researchers interested in occupational smoking modification programs to study. On a positive note, both follow-through and retention rates were very high in this study. It is unusual to see reports of programs that do not experience any subject mortality during treatment and are able to assess all participants residing in the local area at follow-up. This suggests that at least some worksites may provide settings very conducive to behavioral medicine research. Other research on worksite programs has revealed considerably higher attrition rates (see Cataldo & Coates, in press). Future investigations are needed to identify characteristics of occupational settings and worksite programs associated with high and low attrition rates.

Another encouraging aspect of this study was that all participants who quit smoking using this gradual CS approach remained abstinent at the 6-month follow-up. Glasgow et al. (1984) also found that all participants in their worksite CS condition who quit smoking maintained their abstinence. Although the posttreatment quit rates resulting from CS are predictably rather low, the 6-month abstinence rates (21% in this study; 33% in Glasgow et al., 1984) are comparable to those found in many cessation-based approaches (Lichtenstein, 1982). These maintenance data are preliminary and need to be replicated with much larger samples, but this stability in quit rates over time has been infrequently reported in controlled outcome studies. Thus, it is possible that CS may provide benefits for a much broader range of smokers than alternative approaches because even nonquitters showed consistent improvements over baseline smoking levels.

There is both good and bad news in the outcome results for nonabstinent participants. The magnitude of the pretreatment-to-posttreatment reductions in number of cigarettes smoked and CO levels are larger than those observed in our previous CS research. In this study, we found an average reduction of 38% in cigarettes per day and of 49% in CO levels, compared to average reductions of 28% in number per day and 29% in CO levels in our three previous studies (Glasgow, Klesges, Godding, & Gegelman, 1983; Glasgow, Klesges, & Vasey, 1983; Glasgow et al., 1984). On the other hand, participants in this investigation relapsed somewhat more from posttest to follow-up, demonstrating once again the resilience of the smoking habit to lasting modification (Leventhal & Cleary, 1980). The end result is that the long-term effects of this intervention are not meaningfully different from those we have previously reported. Also, the health implications of modest smoking reductions, even if lasting (e.g., long-term reductions in CO levels of 26%—see Table 1) are simply not known. Two types of studies are needed to address this issue: (a) prospective epidemiological investigations of the health benefits (or lack of such) associated with CS and other dosage reduction approaches and (b) additional investigations of ways to enhance the efficacy of the basic CS program.

A disappointing result of this study was the failure of the co-worker social support manipulation to enhance treatment outcome. In fact, at posttreatment, the partner support group had improved *less* than the basic CS group on one target behavior (nicotine content). Although CS plus PS participants maintained their smoking reductions more effectively than did CS participants on this measure, significant differences between conditions

were not found on any dependent variable at the 6-month follow-up.

There are several possible explanations for the general pattern of no between-groups differences. There was the unexpectedly higher credibility ratings produced by the basic CS condition compared to the CS plus PS condition. This differential credibility may, in part, account for the lack of success of the partner support manipulation. However, treatment credibility failed to correlate significantly with outcome on any dependent variable, suggesting that reduced expectations do not directly result in lessened effectiveness of treatment. Similarly, it is not felt that the negative results are due to a lack of statistical power because of the small number of participants. Such an explanation would be feasible if the pattern of results favored the CS plus PS condition. However, such was not the case: Group means were either essentially identical or in favor of the basic CS condition.

Perhaps the most problematic result was the lack of differences between conditions on the co-worker interaction questionnaire. It could be argued that the partner support intervention was not effective in inducing interaction with partners. However, this is unlikely because CS plus PS participants reported frequent interactions with their partners throughout the course of treatment (albeit not every day, as recommended). Alternatively, it may be that within the specific worksites studied, high levels of social support occurred naturally. Informal therapist observations during the program, plus the fact that all groups were formed of smokers from the same departments, support this view.

Diffusion of treatment effects across treatment conditions (Cook & Campbell, 1979) is also a distinct possibility and may account for the observed results. If this explanation is correct, it suggests that because of frequent interaction among co-workers, it may not be possible to assign people within the same worksite to different treatment conditions. To differentiate between the previous suggestion of high baseline levels of social support and the diffusion effects hypothesis, it would be helpful to have data on pretest levels of social support—which were unfortunately not collected because of concerns about reactivity. Finally, we must allow for the possibility that our abbreviated version of the Partner Interaction Questionnaire may not have been a sufficiently reliable and sensitive measure to detect existing between-groups differences in frequency and types of co-worker interaction.

In this study, we focused on increasing the frequency of supportive co-worker interactions. However, correlational data from the co-worker interaction questionnaire suggest that future investigators may also want to emphasize decreasing negative interactions among partners. We found that the frequency of negative interactions was inversely associated with treatment outcome, but that the frequency of positive interactions was not related to success. In addition, it may be that future efforts to enhance social support in the context of worksite programs should focus on family members or significant others in nonwork settings. Participating in group meetings with coworkers may inherently generate high levels of social support during working hours, and it is possible that increasing the amount of spouse/significant other support available during nonwork hours would have a greater effect on treatment outcome.

In summary, we suggest that occupational settings have much to offer behavioral medicine researchers. Future investigations of social support and other variables such as job stress and employee characteristics that may mediate treatment outcomes in occupational behavior change programs seem particularly indicated. One final limitation to our study was the small percentage of eligible smokers who chose to participate in the program (estimated at 6%–8%). This is far from an isolated finding (see review by Klesges & Glasgow, in press), and it poses a significant challenge to health behavior modifiers. As Kanzler, Zeidenberg, and Jaffe (1976) pointed out several years ago in reference to their own study, "Even if a given approach boasts a 90% success rate, it would have little impact on smoking as a public health problem if only 5% of smokers will agree to participate" (p. 670). Studies of ways to increase participation rates

in worksite smoking modification programs should be a high priority for future research.

REFERENCES

Borkovec, T. D., & Nau, S. D. (1972). Credibility of analogue therapy rationales. *Journal of Behavior Therapy and Experimental Psychiatry,* **3**, 257–260.

Brownell, K. D. (1982). Obesity: Understanding and treating a serious, prevalent, and refractory disorder. *Journal of Consulting and Clinical Psychology,* **50**, 820–840.

Brownell, K. D., Heckerman, C. L., Westlake, R. J., Hayes, S. C., & Monti, P. M. (1978). The effect of couples training and partner cooperativeness in the behavioral treatment of obesity. *Behaviour Research and Therapy,* **16**, 323–333.

Cataldo, M., & Coates, T. J. (in press). *Health and industry: A behavioral medicine perspective.* New York: Academic Press.

Cook, T. D., & Campbell, D. T. (1979). *Quasi experimentation: Design & analysis issues for field settings.* Chicago: Rand McNally.

Fagerstrom, K. (1978). Measuring degree of physical dependence to tobacco smoking with reference to individualization of treatment. *Addictive Behaviors,* **3**, 235–242.

Fielding, J. E. (1982). Effectiveness of employee health improvement programs. *Journal of Occupational Medicine,* **24**, No. 11, 907–916.

Follick, M. J., Abrams, D. B., Pinto, R. P., & Fowler, J. L. (in press). Health promotion in industrial and organizational settings. In G. Stone, S. Weiss, and J. Matarrazzo (Eds.), *Health Psychology: A Discipline and a Profession.*

Frederiksen, L. W. (1979). Controlled smoking. In N. A. Krasnegor (Ed.), *Behavioral analysis and treatment of substance abuse* (pp. 128–139). NIDA Research Monograph 25, DHEW Publication No. (ADM) 79–839.

Glasgow, R. E., Klesges, R. C., Godding, P. R., & Gegelman, R. (1983). Controlled smoking with or without carbon monoxide feedback, as an alternative for chronic smokers. *Behavior Therapy,* **14**, 386–397.

Glasgow, R. E., Klesges, R. C., Godding, P. R., Vasey, M. W., & O'Neill, H. K. (1984). Evaluation of a worksite controlled smoking program. *Journal of Consulting and Clinical Psychology,* **52**, 137–138.

Glasgow, R. E., Klesges, R. C., & Vasey, M. W. (1983). Controlled smoking for chronic smokers: An extension and replication. *Addictive Behaviors,* **8**, 143–150.

Hamilton, S. B., & Bornstein, P. H. (1979). Broad-spectrum behavioral approach to smoking cessation: Effects of social support and paraprofessional training on the maintenance of treatment effects. *Journal of Consulting and Clinical Psychology,* **47**, 598–600.

Hughes, J. R., Frederiksen, L. W., & Frazier, M. (1978). A carbon monoxide analyzer for measurement of smoking behavior. *Behavior Therapy,* **9**, 293–296.

Janis, I. L. (1983). The role of social support in adherence to stressful decisions. *American Psychologist,* **38**, 143–160.

Janis, I. L., & Hoffman, D. (1970). Facilitating effects of daily contact between partners who make a decision to cut down on smoking. *Journal of Personality and Social Psychology,* **17**, 25–35.

Kanzler, M., Zeidenberg, P., & Jaffe, J. H. (1976). Response of medical personnel to an on-site smoking cessation program. *Journal of Clinical Psychology,* **32**, 670–674.

Klesges, R. C., & Glasgow, R. E. (in press). Smoking modification in the worksite. In M. Cataldo & T. J. Coates (Eds.), *Health and industry: A behavioral medicine perspective.* New York: Academic Press.

Leventhal, H., & Cleary, P. D. (1980). The smoking problem: A review of the research and theory in behavioral risk modification. *Psychological Bulletin,* **88**, 370–405.

Lichtenstein, E. (1982). The smoking problem: A behavioral perspective. *Journal of Consulting and Clinical Psychology,* **50**, 804–819.

Marlatt, G. A., & Gordon, J. R. (1980). Determinants of relapse: Implications for the maintenance of behavior change. In P. O. Davidson & S. M. Davidson (Eds.), *Behavioral medicine: Changing health lifestyles* (pp. 410–452). New York: Brunner/Mazel.

Mermelstein, R. J., Lichtenstein, E., & McIntyre, K. (1983). Partner support and relapse in smoking-cessation programs. *Journal of Consulting and Clinical Psychology,* **51**, 465–466.

National Interagency Council on Smoking and Health. (1970). Smoking and the workplace: National Interagency Council on Smoking and Health Survey. Unpublished manuscript.

Orleans, C. S., & Shipley, R. H. (1982). Worksite smoking cessation initiatives: Review and recommendations. *Addictive Behaviors,* **7**, 1–16.

Shiffman, S. M. (1982). Relapse following smoking cessation: A situational analysis. *Journal of Consulting and Clinical Psychology,* **50**, 71–86.

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