

## A worksite smoking intervention: a 2 year assessment of groups, incentives and self-help

Leonard A. Jason, Doreen Salina<sup>1</sup>, Susan D. McMahon, Donald Hedeker<sup>2</sup> and Mary Stockton

### Abstract

Sixty-three companies in the Chicago area were recruited to participate in a worksite smoking cessation program. Participants in each worksite received a television program and newspaper supplement (part of a community-wide media campaign), and one of three conditions: (1) self-help manuals alone (M), (2) self-help manuals and incentives for 6 months (IM) or (3) maintenance manuals, incentives and cognitive-behavioral support groups for 6 months (GIM). Results at the 2 year assessment are examined using a random-effects regression model. In addition, various definitions of quit-rate commonly used in smoking cessation research are explored and the advantages of using a public health approach in the worksite are examined.

### Introduction

Smoking is linked with over 400 000 deaths in the US each year, which represents more than 5 million years of potential life lost (CDC, 1993). Smoking remains the leading cause of preventable death in the US (McGinnis and Foege, 1993), and costs the US approximately \$100 billion annually in terms of health care expenditures and lost productivity (MacKenzie *et al.*, 1994). Self-help, mass media

and worksite approaches to smoking cessation represent modalities which may be used to reach entire communities, including smokers who might not make the effort to attend a formal clinic (Warnecke *et al.*, 1989).

Worksite interventions have demonstrated promising results in producing higher quit-rates and recruiting more participants than clinic-based approaches (Klesges *et al.*, 1987a; Fischer *et al.*, 1990). Multicomponent behavioral worksite interventions have yielded an average cessation rate of 34.6% at post-test and 20.8% at follow-up (Klesges *et al.*, 1987a). When 20 controlled worksite smoking cessation studies were examined, participants in worksite interventions were 58% more likely to quit smoking than those in corresponding control conditions (Fisher *et al.*, 1990). Although there are many advantages of worksite approaches (i.e. reduced costs, opportunity to promote non-smoking norms), one of the major weaknesses of worksite approaches is the inability to attract and maintain a large number of smokers (Klesges *et al.*, 1987a).

Worksite programs incorporating structured support groups have yielded mixed results (Malott *et al.*, 1984; Glasgow *et al.*, 1986; Cohen *et al.*, 1988). Groups have the potential of being particularly effective in worksite settings because stress and negative affect, which often occur at work, are thought to be precipitants of smoking relapse (Shiffman, 1982; Marlatt and Gordon, 1985). Social support may encourage smokers to make the initial decision to quit, to continue participating in cessation programs and to maintain abstinence (Mermelstein *et al.*, 1986).

Mass media interventions are relatively economical, can be used to reach a large number of

Department of Psychology, DePaul University, 2219 N. Kenmore Avenue, Chicago, IL 60614-3504, <sup>1</sup>Department of Psychology and Behavioral Sciences, Northwestern University, Chicago, IL 60611 and <sup>2</sup>Department of Epidemiology and Biostatistics, University of Illinois at Chicago, Chicago, IL 60612, USA

people and can contribute to the public perception that social norms are becoming less tolerant of smoking (Warnecke *et al.*, 1989). Furthermore, specific cognitive and behavioral strategies for quitting may be modeled in a media program (Flay, 1987). Self-help manuals are another method for presenting smoking cessation strategies at a fraction of the cost of clinical approaches. Self-help manuals are practical because the majority of smokers prefer self-change approaches to quitting (Flay *et al.*, 1989). Furthermore, a combination of self-help manuals and media programs has been found to be more effective than either strategy used alone (Flay, 1987).

Monetary incentives have also been used as an adjunct to treatment in a number of studies in order to motivate people to quit and remain quit (e.g. Klesges *et al.*, 1986, 1987b; Jason *et al.*, 1990). Incentives have been associated with higher participation rates and higher cessation rates in worksite smoking cessation interventions, but large studies utilizing control groups are needed to confirm their effectiveness (Malone and Jason, 1990).

Several worksite smoking cessation studies have been conducted by Jason and associates to improve upon existing methods and facilitate many smokers through the process of quitting (Jason *et al.*, 1987a, 1989; Salina *et al.*, 1994). Initially, a 3 week intervention involving groups, media and manuals (G) was compared to media and manuals only (NG) (Jason *et al.*, 1987b). Large differences at post-test (41 versus 21%) were not maintained, however, at the 12 month assessment (Jason *et al.*, 1987a). A subsequent study, which added incentives and 12 monthly support groups to G, resulted in significantly higher quit-rates for G over NG at the 2 year assessment (Salina *et al.*, 1994).

The present large-scale worksite smoking cessation study was designed to examine the effects of a combination of self-help manuals, monetary incentives and group sessions in the worksite to increase quit-rates and reduce recidivism rates. In addition, the entire Chicagoland area was also targeted through the media (television series presented on the news and newspaper supplements

distributed throughout the area), in order to provide many people in the community with strategies to quit smoking. In order to improve upon previous studies, more worksites were recruited (63) and more frequent group booster sessions were conducted earlier in the intervention, when it was expected that participants would be in the greatest need of support. It was hypothesized that groups, incentives and manuals (GIM) would produce higher quit-rates than incentives and manuals (IM), which in turn would produce higher quit-rates than manuals only (M).

Initial findings suggest that quit rates among participants in GIM were significantly higher than those among participants in IM at post-test, and 6 and 12 month assessments. While subjects in IM had significantly higher quit rates than those in M at post-test and at the 6 month assessment, the quit rates for these groups at the 12 month assessment were not significantly different (Jason *et al.*, 1995). The purpose of this paper is to examine the data collected 2 years following the beginning of the intervention and to compare findings obtained using various definitions of quit-rate that are frequently used in smoking cessation research.

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## Method

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### Sample

The directors of personnel at 400 companies were contacted by letter about participation in the study. These companies were randomly selected through lists obtained from Dun and Bradstreet, Standard and Poors, and the Metropolitan Chicago Guide. Of the 400 companies originally contacted, 63 expressed interest in participation and agreed to receive any of the components of the intervention (i.e. self-help manuals, incentives, groups). There were approximately 21 companies in each size range (100–199, 200–299 and 300–400 employees). Participating companies were categorized by type of business as follows: manufacturing ( $n = 18$ ), finance ( $n = 12$ ), business and legal services ( $n = 11$ ), communications ( $n = 7$ ), wholesale and retail trade ( $n = 6$ ), health ( $n = 6$ ),

and hospitality ( $n = 3$ ). These companies were matched according to size and type, and then randomly assigned to one of three conditions (GIM, IM and M). Data were available on 61 companies at post-test (McMahon *et al.*, 1994), and 58 companies at 6, 12, 18 and 24 months. Companies dropped out for various reasons (i.e. out of business, difficult for employees to attend sessions on company time and financial problems).

All employees within each firm were provided general information through flyers distributed and posted which described the specific intervention (GIM, IM or M) to be implemented in each worksite. Participants were paid release time to participate in the interventions and assessments, and neither participants nor worksites were charged for the intervention. The baseline percentage of smokers per firm were similar across conditions, with 28% in M, 25% in IM and 27% in GIM. Smoker recruitment rates were also very similar, with 58% in M, 59% in IM and 55% in GIM.

### Media intervention

Participants in all conditions were asked to watch a 5 day smoking cessation media program, 'Smoke-free in the 90s', which aired twice daily on WGN television in Chicago. The program discussed behavior change strategies, smoking laws and ordinances, the effects of second-hand smoke, and smoking at the workplace, and followed the progress of one reporter who quit with the program. Television ratings indicate that approximately 333 000 and 526 000 people watched the midday news and the evening news programs, respectively. Approximately 50 000 copies of an 8 page newspaper supplement, designed to accompany the program, were distributed to Chicago public libraries, participating worksites and worksites affiliated with the Illinois Chamber of Commerce.

### Worksite interventions

The three worksite interventions were implemented in each worksite by the research team, 18 leaders hired and trained specifically to conduct orientation sessions, biochemical verification procedures, data collection, group sessions and distribution of

incentives. Detailed treatment manuals were developed to use throughout the intervention, and weekly meetings were held for training and planning. In addition, a coordinator was identified at each firm to serve as the liaison between the project team and the company.

- *Self-help condition (M)*. Participants in the self-help condition received the media, the self-help manual, *Freedom From Smoking in 20 Days* (American Lung Association, 1986b), and the newspaper supplement. They completed 14 ecolyzer readings, following the same schedule as sessions in GIM, during the 6 month intervention.
- *Incentive condition (IM)*. Participants in the incentive condition received the media, the self-help manual (American Lung Association, 1986b), the newspaper supplement and the opportunity to earn \$1 per day for each day abstinent during the 6 months, for a total possible of \$175. Self-report of smoking status was verified using ecolyzer readings at the time of each payment (14 ecolyzer readings following same schedule as sessions in GIM).
- *Group condition (GIM)*. Participants in the group condition received the media, manuals (American Lung Association, 1986a), newspaper supplements, the opportunity to earn \$1 per day for 6 months and group meetings. Group meetings were held twice a week during the initial 3 week phase of the intervention. The meetings were based on the self-help manual (American Lung Association, 1986b) and the newspaper supplement. Group participants were presented with strategies to identify one's smoking patterns and triggers to smoke, to change one's pattern, and to anticipate and cope with urges to smoke. The sharing of experiences and the buddy system were emphasized in order to foster group support.

During the 6 months following the initial 3 week intervention, 14 booster meetings were held for participants in the group condition. The first eight meetings were held weekly, the next four were held biweekly and the last two were held monthly

in order to provide more support initially. Booster session topics included identifying reasons for quitting smoking, using the buddy system and building support networks, using coping strategies for dealing with those who encourage smoking and for living with a smoker, weight control, exercise and stress management. Group condition participants also received the maintenance manual *A Lifetime of Freedom from Smoking* (American Lung Association, 1986a).

In addition to receiving worksite support groups, group condition participants were eligible to earn \$1 per day for each day abstinent between each of the 14 booster sessions. Self-report of smoking status was verified using ecolozer readings at each booster session.

### **Data collection**

Self-report questionnaires were used to collect pre-test data during orientation. Data were collected immediately following the initial 3 week phase of the intervention (post-test), and 6 (immediately following the end of the group booster sessions), 12, 18 and 24 months after the beginning of the intervention. A lottery system was used to encourage the completion of the survey at each assessment. Ecolyzers by Draeger were used to measure carbon monoxide and verify self-report of smoking status. Cotinine samples were collected at the 6 month assessment as an additional measure to verify smoking status.

### **Random-effects model**

#### *Clustered data*

A random-effects probit regression analysis (Gibbons and Bock, 1987; Hedeker, 1992) was first used to assess the effects of the three worksite interventions upon quit-rate at each assessment of the study (post, and 6, 12, 18 and 24 months). In these analyses, assessment of the intervention effects was performed while concurrently estimating and adjusting for the degree of intraclass correlation in the data due to the nesting of individuals within firms. This is accomplished by including a random firm effect in the model which indicates the extent to which individuals within

the same firm have non-independent outcomes. Thus, the random-effects analysis effectively handles the 'unit of analysis' problem of clustered data and is neither too liberal nor too conservative as, respectively, ordinary individual-level analysis and aggregate-level (worksite-level) analysis typically are (see Bryk and Raudenbush, 1992; Hedeker *et al.*, 1994a,b). Results from these random-effects analyses, in addition to previous analyses (Jason *et al.*, 1995), indicated no estimable firm-level influence on individual smoking outcomes over and above the intervention effects.

#### *Longitudinal data*

The random-effects probit model was also used to assess time-related trends in the repeated classifications of each participants' smoking status across the five assessments. For longitudinal data, random-effects models account for the dependency in the data resulting from the repeated assessments of individuals over time by including random individual effects in the model. These random effects reveal the degree of variation that exists in terms of time-related trends of the model. Also, since random-effects models do not place restrictions on the number of observations per individual, subjects who are missing at a given interview wave are excluded from that wave only, but not excluded from the overall analysis. An assumption of the model is that the available data for a given subject are representative of that subject's deviation from the average trend lines that are estimated from the whole sample. Thus, the model characterizes the subject's trend across time based on whatever data that subject has (complete or incomplete), augmented by the time-trend that is estimated from the whole sample. See Laird (1988) for more information with respect to missing data in random-effects models.

### **Logistic regression approaches**

Logistic regression was utilized to examine quit-rate from a variety of perspectives often used in smoking cessation literature. Since there has been little consistency in smoking literature regarding the criteria used to define cessation (Klesges *et al.*,

1987a,b), several approaches were used (recoding missing data as smoking, utilizing only complete data and examining continuous quit-rates) in order to provide a comparison of techniques to assess intervention effectiveness.

### *Point-prevalence*

Traditionally, point-prevalence rates (number of baseline smokers abstinent at a given point in time) have been reported. The advantage of this approach lies in the fact that all available data are utilized and that this data has the same validity. To the extent that sample sizes vary across time, missing participants are actually smoking and/or missing data varies by condition, this approach becomes less accurate. In addition, point-prevalence rates can be problematic, because a different sample of participants is assessed at each time-point, and people often oscillate between quitting and abstinence. Since individuals were nested within work-sites, we used both ordinary logistic regression and random effects regression for clustered data in order to examine point prevalence.

### *Recoding missing data as smoking*

Many smoking cessation researchers have recommended that people missing at any particular assessment should be 'conservatively' considered as smokers, since participants that are missing data at a given assessment are more likely to be smoking than abstinent (e.g. Klesges *et al.*, 1987a,b; Curry *et al.*, 1988). This approach is advantageous, because missing participants are more likely to be smoking than non-smoking and the smoking status of all participants can be considered so power is not lost. However, this technique is usually problematic, since missing data rates typically differ between groups. Less intensive interventions often have higher rates of attrition (e.g. a control condition will likely have more attrition than an intervention condition), thus biasing the quit-rates to favor more intensive interventions.

### *Complete data*

This approach has often been used because traditionally, researchers have had difficulty dealing with

longitudinal data when the number of observations per subject differs (random-effects models have addressed this issue). In addition, the same people are examined across time, so that the meaning of abstinence rates among these people can be more clearly interpreted than when different people are included in these rates. However, a selection problem arises when we rely on the use of complete data. The sample of participants with complete data is not necessarily representative of the population of participants that began the study and that we wish to make inferences about. In addition, the power of statistical tests is reduced as a result of throwing out data that has been collected.

### *Continuous quit-rates*

Since many smokers cycle through the stages of quitting several times before successful maintenance (Prochaska and DiClemente, 1992) and the health consequences of short-term quitting remain unclear, there has been a trend toward reporting continuous abstinence rates (Klesges *et al.*, 1987a,b). Complete data up to a specific time point is necessary to examine continuous quit-rates at that time point, so the same advantages and disadvantages discussed above apply to this method. In addition, use of continuous quit-rates can bias results against interventions that may improve quit-rates across time. For example, in our study, the self-help condition produced quit-rates that were initially fairly low, but which increased across time. The examination of continuous quit-rates presents a different view of this phenomena, because people that did not quit at post-test could never, by definition, be classified as a continuous quitter.

### **Preliminary analyses**

Considerable attrition occurred between pre-test and the 24 month assessment, and missing data rates across conditions were significantly different at all assessments except 6 months: post-test [ $\chi^2(2, N = 844) = 7.50, P < 0.024$ ], 12 months [ $\chi^2(2, N = 844) = 13.13, P < 0.002$ ], 18 months [ $\chi^2(2, N = 844) = 28.99, P < 0.001$ ] and 24 months [ $\chi^2(2, N = 844) = 15.53, P < 0.001$ ]. In order to control for the potential confounding effect on

**Table I.** Pre-test demographic characteristics by condition

Variable	Self-help ( <i>n</i> = 280)	Incentive ( <i>n</i> = 281)	Group ( <i>n</i> = 283)
Gender (%)			
female	71.8	58.1	59.2
male	28.2	41.9	40.8
Race (%)			
black	16.6	16.5	28.5
white	77.6	70.6	63.0
other	5.8	12.9	8.5
Employment (%)			
unskilled, skilled	27.4	25.4	28.8
clerical, technician	43.8	52.1	56.7
manager, professional	28.8	22.5	14.4
Mean age (SD)	37.4 (10.6)	37.8 (9.8)	38.3 (11.1)
Mean years smoked (SD)	19.9 (10.2)	19.7 (9.8)	20.2 (11.0)
Mean cigarettes per day (SD)	22.5 (10.4)	21.3 (11.5)	20.7 (12.0)
Mean years education (SD)	13.8 (2.2)	14.1 (2.2)	13.5 (2.3)
Mean SES (SD)	42.9 (19.4)	44.5 (19.1)	41.4 (19.8)

condition-related results, baseline characteristics related to attrition at each wave were examined. Statistically significant differences were found for seven baseline variables. Drop-outs were likely to be younger, male, heavier smokers, as well as to report lower health ratings, less effort to quit smoking, more confidence to quit and more concern about weight gain. These variables were used to control for attrition in all subsequent analyses. In addition, sex and race differed across conditions and were also controlled for in all subsequent analyses. See Table I for demographic information.

## Results

Pre-test data were collected from 844 participants: 280 SH, 281 I and 283 G. Table II lists the observed individual-level quit rates at each of the five assessments of the study. Point prevalence quit-rates were based upon available data on each subject at each assessment. Table II also lists quit-rates obtained when missing data was recoded as smoking.

### Point-prevalence (random-effects model for clustered data)

Since there was no estimable firm effect upon participants nested within firm, the results reported

from the random-effects regression model for clustered data are equivalent to results obtained using ordinary logistic regression. In terms of condition effects at the five waves, results indicated a significant main effect of condition at post-test [ $\chi^2(2, N = 565) = 85.10, P < 0.001$ ], 6 month [ $\chi^2(2, N = 465) = 34.67, P < 0.001$ ] and 12 month [ $\chi^2(2, N = 441) = 13.27, P < 0.002$ ] assessments. There was not a significant main effect of condition at 18 months [ $\chi^2(2, N = 496) = 2.76$ ] or 24 months [ $\chi^2(2, N = 501) = 4.28$ ]. Specific condition comparisons for GIM versus IM at post, 6 and 12 months revealed significant effects [( $z = -6.90, P < 0.001$ ; note, here a negative  $z$ -value represents less smoking), ( $z = -3.53, P < 0.001$ ) and ( $z = -2.70, P < 0.01$ ), respectively]. Condition comparisons for IM versus M also exhibited significant effects at post-test and 6 month assessments [( $z = -2.50, P < 0.02$ ), ( $z = -2.45, P < 0.02$ )], but not at 12 months ( $z = -0.68, NS$ ).

### Longitudinal data (random-effects model)

In terms of the longitudinal analyses, smoking status classifications (the analyses included subjects who reported smoking status for at least one assessment period and were not missing sex, race or variables associated with attrition) were first fit



**Table II.** Quit rates across time by condition: point-prevalence rates including all available data and (recoding missing data as smoking)

	Group (GIM)		Incentive (IM)		Self-help (M)	
	<i>n</i>	% Quit	<i>n</i>	% Quit	<i>n</i>	% Quit
Post	193 (283)	47.7 (32.3)	221 (281)	12.2 (9.4)	191 (280)	5.2 (3.5)
6 month	179 (283)	39.1 (24.6)	154 (281)	19.5 (10.4)	160 (280)	7.5 (4.3)
12 month	178 (283)	33.1 (20.7)	152 (281)	18.4 (9.7)	134 (280)	15.7 (7.4)
18 month	208 (283)	21.6 (15.8)	174 (281)	19.0 (11.5)	144 (280)	14.6 (7.4)
24 month	203 (283)	25.6 (18.2)	162 (281)	23.5 (13.2)	166 (280)	17.5 (10.3)

including terms for the main effect of time, the main effect of condition (IM versus M and GIM versus IM) and random subject effects which account for the dependency in the data resulting from the repeated measurement of the same subjects. The results from these analyses indicated a significant main effect of condition [ $\chi^2(2, N = 746) = 56.04, P < 0.01$ ]. Turning to the specific condition comparisons, we observed significant differences favoring (in terms of greater abstinence) GIM versus IM ( $z = -4.61, p < 0.001$ ) and IM versus M ( $z = -2.75, P < 0.01$ ). To test whether the effect of condition varied across the assessments, an interaction of condition by time was added to this basic model. The inclusion of this condition by time interaction into the model was observed to be significant [ $\chi^2(2, N = 746) = 61.44, P < 0.01$ ], and inspection of the contrasts revealed a significant GIM versus IM comparison ( $z = 6.25, P < 0.001$ ) and a significant effect for IM versus M ( $z = 1.97, P < 0.05$ ). With the inclusion of the condition by time interaction in this model, the main effect of condition reflects differences at post-test, for which significant differences were observed favoring GIM versus IM ( $z = -6.99, P < 0.001$ ) and IM versus M ( $z = -3.32, P < 0.001$ ). The observed condition quit rates at the five assessments given in Table II depict these condition differences at the first wave and the condition by time effect, i.e. the large difference that is observed between GIM and IM at post-test (47.7 versus 12.2%) significantly decreases across time, and the difference between

IM and M at post-test (12.2 versus 5.2%) also significantly decreases across time.

### Logistic regression analyses of quit-rate

We also examined quit-rates from a variety of other approaches and the following analyses utilize a logistic regression at each specific time-point. Again, sex, race and variables associated with attrition were included in the models.

### Recoding missing data as smoking

When participants with missing data at each assessment were recoded as smoking (see Table II for quit-rates), the overall effect of the interventions (favoring GIM versus IM and M) was significant at all time points [post-test ( $\chi^2(2, N = 797) = 72.97, P < 0.001$ ), 6 months ( $\chi^2(2, N = 797) = 37.54, P < 0.001$ ), 12 months ( $\chi^2(2, N = 797) = 19.28, P < 0.001$ ), 18 months ( $\chi^2(2, N = 797) = 7.44, P < 0.03$ ) and 24 months ( $\chi^2(2, N = 797) = 7.85, P < 0.02$ )].

### Complete data

When participants with complete data across all assessments were examined (see Table III for quit-rates), results reveal a main effect of condition (favoring GIM versus IM and M) at post-test, and 6, 12 and 24 months [ $(\chi^2(2, N = 183) = 35.68, P < 0.001)$ , ( $\chi^2(2, N = 183) = 18.64, P < 0.001$ ), ( $\chi^2(2, N = 183) = 10.86, P < 0.01$ ) and ( $\chi^2(2, N = 183) = 6.57, P < 0.04$ )], but not at 18 months.

### Continuous quit-rates

Finally, continuous quit-rates were examined utilizing complete data, as suggested by Curry *et al.*

**Table III.** Quit rates across time by condition with complete data: point-prevalence rates and (continuous quit rates)

	Group (GIM)		Incentive (IM)		Self-help (M)	
	<i>n</i>	% Quit	<i>n</i>	% Quit	<i>n</i>	% Quit
Post	86	59.3	60	18.3	45	11.1
6 month	86 (141)	52.3 (38.3)	60 (133)	26.7 (9.8)	45 (118)	13.3 (5.1)
12 month	86 (109)	47.7 (31.2)	60 (91)	28.3 (11.0)	45 (79)	17.8 (5.1)
18 month	86 (93)	31.4 (19.4)	60 (71)	23.3 (14.1)	45 (54)	22.2 (3.7)
24 month	86 (86)	38.4 (19.8)	60 (60)	26.7 (13.3)	45 (44)	22.2 (4.5)

(1988) and Klesges *et al.* (1987a,b) (see Table III). Analyses indicated a main effect of condition (favoring GIM versus IM and M) at 6 and 12 months [ $\chi^2(2, N = 183) = 19.03, P < 0.001$ ], ( $\chi^2(2, N = 183) = 10.90, P < 0.01$ ), but not at 18 and 24 months.

### Discussion

The results suggest that the interpretation of the effects of the three interventions upon smoking status varies depending on how the outcome variable is defined. When focusing on point-prevalence rates at specific time points, groups significantly enhanced quit-rates beyond incentives at post-test, and 6 and 12 months, but not at 18 and 24 months. Incentives increased quit-rates beyond self-help manuals at post-test and 6 months, but not at 12, 18 or 24 months. When the random-effects model was used to examine trends across time, the initially strong group effects diminished across time, and quit-rates in the incentive and self-help conditions increased across time.

Since the random-effects model is not typically used in smoking cessation research and quit-rate is often defined differently, various definitions were used for comparability purposes. When missing data is recoded as smoking and when complete data is examined, participants in GIM had significantly higher quit-rates than those in IM or M at 24 months. When point-prevalence rates or continuous quit-rates are considered, the significant group effects at 6 and 12 months are in the expected direction at 24 months but are no longer significant. Thus, the examination of condition effects through

a variety of lenses can have important implications for smoking cessation interventions. The combination of social support, cognitive-behavioral skills and incentives clearly resulted in higher quit-rates than incentives or self-help manuals at 12 months, but the effects at 24 months are less clear.

Given the pros and cons of the various definitions and the differing conclusions that can result, presenting the data from different perspectives may facilitate more appropriate comparisons across studies. A rigorous statistical approach is to model available data (random-effects models) and, if there are differential attrition rates by condition, to control for attrition. In terms of reporting quit-rate percentages, the truth is probably somewhere between using all available data (point-prevalence rates) and recoding missing data as smoking. As the probability that missing participants are smoking approaches one, recoding missing data represents a more accurate approach, but the more this probability differs from one, point-prevalence rates are more accurate.

The long-term focus of this study and use of the random-effects model enable us to examine group trends across time. Distributing self-help manuals enabled people to quit smoking and the number of people quitting with this program increased across time. Thus, from a public health perspective, this intervention illustrates a cost-effective approach for smoking cessation. The addition of incentives enhanced quit-rates beyond the self-help condition and, again, more people were able to quit across time with this program. The frequent presence of smoking cessation leaders in the worksites, and the personalized feedback



from ecolyzer readings may have contributed to increasing quit-rates in IM and M. The group intervention boosted quit-rates even more, and although differences between conditions diminished with time, results suggested that the group had a beneficial effect, either directional or statistically significant, on quit-rates.

The costs of smoking to our society (\$100 billion annually) are enormous. When the costs and the benefits of these three worksite programs are considered, all three are highly cost-effective (Jason *et al.*, 1995). However, given the convergent nature of the data and the expense involved in the implementation of the group intervention, the self-help and incentive interventions could be considered relatively more cost-effective than the group intervention at long-term follow-up. Yet, each intervention has unique benefits that should be considered. Media interventions and self-help groups represent effective methods of reaching thousands of smokers. The media has the additional benefit of raising the awareness and sensitivity of the general public to the difficulties involved in quitting smoking. Incentives may increase response rates and participation rates. Groups may help participants identify coping strategies that are specifically effective for them, and provide an environment where they can prepare, practice and support each other. Smokers may benefit from access to a variety of intervention methods, as different approaches may appeal to different individuals.

Attrition rates are a limitation of this study, as well as multicomponent worksite studies in general (Klesges *et al.*, 1987a,b). If we can better understand the factors that are associated with drop-out, we can develop strategies to improve participation and long-term maintenance. Focusing more on relapse prevention in the group sessions and tailoring materials to match participants' stages of change (Prochaska and DiClemente, 1983) may have reduced recidivism rates. The challenge is for researchers to continue to think about innovative smoking cessation interventions in order to attain larger effects and reduce attrition.

Worksites provide ideal settings to test innovat-

ive interventions, understand the stages of change in the process of quitting, promote non-smoking norms and legislate for non-smoking policies. Groups conducted in the worksite may increase awareness, encourage supportive co-worker interactions and build upon the existing support networks among employees. Additionally, worksite interventions have the potential to reach many high-risk smokers (i.e. heavy smokers, women, minorities) who may not have access to traditional smoking cessation clinics. Since about one of every four Americans continues to smoke (Centers for Disease Control, 1992), the development and refinement of large-scale health promotion efforts represent an important focus for researchers, public health officials, and community leaders.

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