

PREDICTORS OF SMOKING RELAPSE AMONG SELF-QUITTERS: A REPORT FROM THE NORMATIVE AGING STUDY

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Abstract — We followed 235 adults for one year after a self-initiated attempt to stop smoking cigarettes. Relapse rates were much larger than expected in the early days and weeks after the quit attempt. Approximately 62% had relapsed by 2 weeks after their quit dates. Those who smoked any cigarettes at all in the post-cessation period (i.e., lapsed) had a 95% probability of resuming their regular pattern of smoking subsequently. Shorter periods of abstinence on prior quit attempts, greater pre-cessation consumption of alcoholic beverages, and lower pre-cessation levels of confidence in quitting were related to relapse. In addition, abstainers who reported decreased confidence after cessation concerning their ability to maintain abstinence were more likely to relapse thereafter. The presence of a greater proportion of smokers in the subjects' environment also increased the likelihood of relapse. Demographic variables such as age, gender, and education level did not predict relapse. Likewise, neither baseline psychosocial stress levels, nor post-cessation increases in stress were related prospectively to relapse. Clinical implications of findings are discussed.

Most cigarette smokers are aware of the health risks of smoking, and approximately 22 million of the nation's 54 million smokers try to quit each year (U.S. DHHS, 1983). Unfortunately, 80-90% of those who attempt to quit smoking relapse within a year of their quit dates (Garvey, Heinold, & Rosner, 1989; Hunt, Barnett, & Branch, 1971). Relatively little is known about factors that precipitate relapse (Shiffman, Shumaker, Abrams, Cohen, Garvey, Grunberg, & Swan, 1986). Prospective studies have been particularly lacking (Ossip-Klein, Bigelow, Parker, Curry, Hall, & Kirkland, 1986). Also, most studies to date have focused on the 4-5% of smokers who attend stop-smoking clinics or programs (Marlatt, Curry, & Gordon, 1988). Findings from these studies may not extrapolate well to the general smoking population. In addition, most previous studies have considered the period after cessation as a single entity. Only a few studies (Garvey et al., 1989; Marlatt et al., 1988; Swan, Denk, Parker, Carmelli, Furze, &

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Rosenman, 1988) have considered the possibility that predictors of early and later relapse may differ.

The purpose of the present study was to provide prospective information on predictors of early and later relapse for smokers who made a self-initiated quit attempt. We followed 235 adult smokers for a 1-year period. Data were obtained both prior to cessation and periodically after cessation.

METHOD

Subjects and procedures

Subjects were recruited principally from advertisements in the two major Boston daily newspapers. In addition, 15 male smokers were recruited from the Normative Aging Study, an ongoing prospective study of community-dwelling males (Garvey, Bosse, Glynn, & Rosner, 1983). A total of 251 subjects were interviewed at baseline. Sixteen subjects did not return for follow-up interviews and thus were excluded from the study. The 235 subjects included in the study initiated their quit attempts a median of 4 days after the dates of their baseline interviews (range 0–85 days).

All subjects were reinterviewed 1 month after their quit dates. Subjects who had relapsed by 1 month post-cessation, as well as those who relapsed after the first month, were subsequently telephoned approximately every 2 months to monitor possible changes in their smoking status. Those who were abstinent at the time of the 1-month interview were interviewed again in person at 3 months post-cessation. Subjects still abstinent at 3 months were interviewed briefly by telephone at 5 months to update their smoking status and to assess other variables such as difficulties experienced in maintaining abstinence. Those maintaining abstinence were phoned again at 7 and 9 months. At 12 months post-cessation, those still abstinent were interviewed again in person. Subjects were paid \$10 for each in-person interview, and \$25 at the end of the 1-year follow-up period.

Baseline measures. A structured interview schedule was used to obtain information on demographic variables, smoking history, and the subject's smoking environment and lifestyle habits. Reasons for smoking were assessed using a modified version of the Smoking Patterns Test (Russell, Peto, & Patel, 1974). Subject attitudes such as strength of motivation for quitting, and degree of confidence concerning the success of the quit attempt were assessed using Likert-scale items designed by the authors. Psychosocial stress was measured using a scale adapted from Pearlin (Pearlin & Schooler, 1978). Carbon monoxide levels (PPM) were obtained using an Ecolyzer Model 3000 (National Draeger Co., Pittsburgh, PA).

Follow-up measures. At 1 month post-cessation, information was obtained about smoking occasions (if any) in the first month post-cessation, subject attitudes such as confidence in the ability to remain abstinent (abstainers only), and changes in psychosocial stress. Changes in psychosocial stress were assessed using a 5-point Likert scale with response categories ranging from "stress greatly decreased" to "stress greatly increased." Information was also collected, for subjects still abstinent, on frequency and strength of temptations to smoke experienced in the week prior to the 1-month interview (including the day of the 1-month interview). Carbon monoxide level was assessed to verify self-reports of abstinence. For subjects who remained abstinent, all measures taken at 1-month post-cessation were repeated at the 3-month interview and at the 12-

month interview. In addition, saliva samples were obtained at the 12-month interview to provide additional verification of self-reported abstinence. Saliva samples were frozen and mailed to the Laboratory of Physiological Hygiene at the University of Minnesota where they were assayed for cotinine concentration (Verebey, DePace, Mule, Kanzler, & Jaffe, 1982).

Definition of relapse. Relapse was defined as 7 or more consecutive days of smoking, or 7 or more consecutive episodes of smoking (e.g., smoking on weekends for 7 or more consecutive weekends) (Ossip-Klein et al., 1986). Day of relapse was defined as the specific day after cessation which *began* the 7 or more consecutive days or episodes of smoking. For example, if the first day or episode leading to relapse occurred on day 3 post-cessation, subjects were credited with two days of abstinence, and their day of relapse was considered to be day 3 post-cessation.

Statistical analysis. We compared early relapsers, later relapsers, and successful abstainers using analysis of variance, chi-square analysis, and stepwise logistic regression analysis. Logarithmic transformations (base 10) were performed on variables that had pronounced positively skewed distributions. Factor analysis was used to create a reduced set of derived variables from Smoking Patterns Test items and from baseline psychosocial stress items. Baseline carbon monoxide (CO) values were adjusted, using linear regression analysis, for number of minutes elapsed since the last cigarette smoked, and time of day the CO value was obtained.

R E S U L T S

Subject characteristics are shown in Table 1. The sample contained relatively large proportions of younger and middle-aged smokers. There were more college graduates and professional degree holders in our sample compared to the prevalence of such individuals found in national samples of smokers (Pierce, 1989).

The relapse experience of the sample is presented in Figure 1, where it can be seen that relapse was very rapid after the quit attempt. Approximately 76% of subjects had

Table 1. Characteristics of study subjects (N = 235)

Variable	Category	Percent	
Age	20-39	46.0	Mean age = 42.2 yrs., SD = 12.3 (Range = 21-76)
	40-59	44.7	
	60+	9.3	
Gender	Males	47.2	
	Females	52.8	
Marital status	Single	35.7	
	Married	44.3	
	Divorced, separated, widowed	20.0	
Education	High school graduate or less	10.7	Mean education = 15.6 yrs., SD = 2.3 (Range = 10-20 yrs)
	Some college	31.1	
	College graduate	33.6	
	Post-college degree	24.6	
Cigarettes/day	1-10	11.5	Mean cigarettes = 25.5/day, SD = 13.1 (Range = 2-90)
	11-20	35.3	
	21-30	30.2	
	31+	23.0	

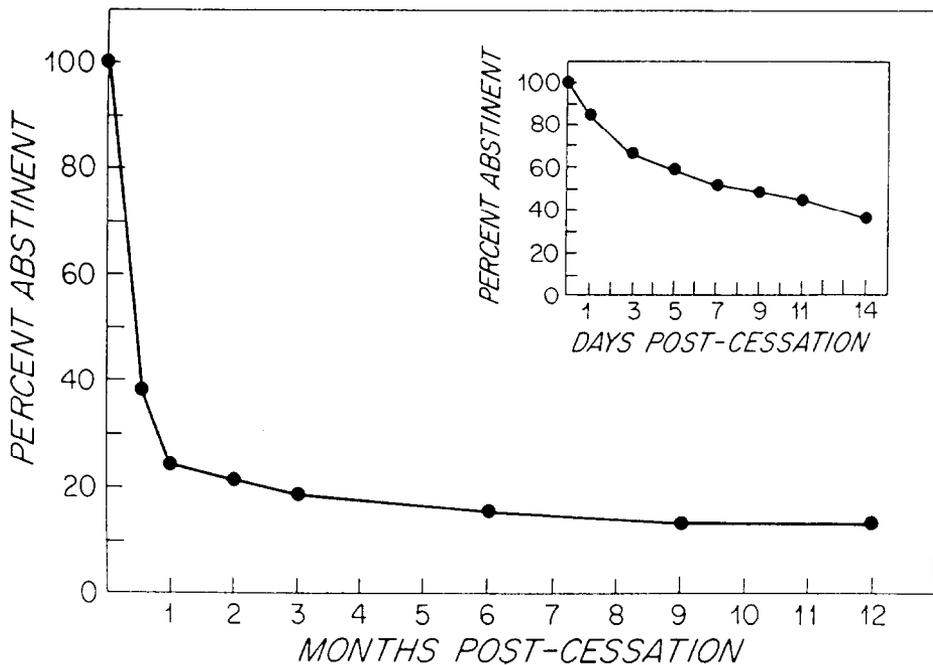


Fig. 1. Incidence rates of relapse across 1 year of follow-up of 235 subjects. The insert (upper right) presents incidence rates of relapse in greater detail for days 1-14 post-cessation.

relapsed by 1 month after quitting. Overall, 87.2% relapsed within a year of their quit dates. The insert in the upper right hand corner of Figure 1 shows that the majority of relapses occurred in the first few days and weeks post-cessation. For example, approximately 13% relapsed by 1 day after their quit dates, 32% by three days, 49% by 1 week, and 62% by 2 weeks after quitting.

Predictors of relapse: Univariate results

We divided subjects into four subgroups based on number of days abstinent (Table 2). The subgroups were chosen based on the relapse experience shown in Figure 1, considerations of sample size, and a desire for subgroups that corresponded to conventionally accepted post-cessation time periods. From Table 2, Section A, the most significant baseline predictors of relapse were a shorter period of abstinence during the most extended prior quit attempt ($p = .001$); lower motivation for quitting ($p = .006$); lower confidence in being able to abstain for 3 months (short-term confidence) ($p = .009$); having both a spouse (or significant other) a smoker and half or more of one's friends smokers ($p = .020$); and generally greater alcohol consumption ($p = .023$), though the relationship between alcohol consumption and relapse was somewhat curvilinear.

It can be noted that the effects of the weight-control smoking motive differed by gender. For women, those higher on the weight-control motive were less likely to relapse early ($p = .047$), while for men the trend was opposite, though not significant ($p = .118$). This interaction between gender and subgroup was significant when we tested its effects using linear regression analysis ($p = .0013$). Another variable related to relapse, but with no consistent trend apparent, was the pleasure smoking motive ($p = .045$).

From data collected on those still abstinent at 1-month post-cessation (Table 2, Section B), the most important predictors of subsequent relapse were lower short-term con-

fidence ($p = .014$), decrease in short-term confidence from baseline to 1-month ($p = .021$), and lower confidence in being able to abstain for 2 years (long-term confidence) ($p = .038$).

We also analyzed the predictor variables in Table 2 using other subgroupings of subjects based on time abstinent (e.g., subgroups based on those abstinent 0–3 days, 4–7 days, 8–30 days, 31–364 days, and 365 days). Results were substantively the same as those presented in Table 2. In addition, we repeated statistical analyses of ordinal-scale variables (e.g., motivation, confidence, reasons for smoking) using the non-parametric Kruskal-Wallis Test. Resulting p -values differed only minimally from those shown in Table 2. We also analyzed relationships of predictor variables to relapse separately for men and women. Except for the interaction between gender and the weight-control smoking motive shown in Table 2, relationships between predictor variables and relapse did not differ significantly by gender.

Predictors of relapse: Multivariate results

We used stepwise logistic regression analysis to compare each of the three subgroups of relapsers shown in Table 2 with the subgroup of successful abstainers (i.e., those abstinent 365 days). It should be noted that one significant univariate predictor, spouse (or significant other) a smoker and half or more of one's friends smokers, could not be entered as a predictor in the logistic regression models. This was because none of the subjects in the successful abstainer group had both a spouse (or significant other) who was a smoker and half or more of their friends as smokers. Hence, standard errors of regression weights for this variable could not be computed.

Table 3 (Part A) compares those who relapsed in the first week post-cessation with those abstinent for the entire 1-year follow-up period. Three variables were significant: short-term confidence in maintaining abstinence, length of longest prior abstinence, and the interaction of gender and the weight-control smoking motive. With regard to short-term confidence, for 2 subjects who differed by a standard deviation on this variable, the odds of relapsing for the subject one standard deviation higher on short-term confidence were only 0.55 times those of the person lower in confidence. That is, the subject one standard deviation higher in confidence was only about half as likely to relapse. The odds in favor of relapse for a subject one standard deviation higher than another person on length of longest prior abstinence were only 0.52 times those of the lower person. The significant interaction of weight control by gender indicated that women higher on the weight-control smoking motive were less likely to relapse, while men higher on the weight-control smoking motive were more likely to relapse.

Table 3 (Part B) compares subjects who relapsed in the "intermediate" period of 8–30 days post-cessation with those abstinent for the entire year. It can be seen that two variables, length of longest prior abstinence and baseline alcohol consumption, were significant. Table 3 (Part C) contains variables differentiating those who relapsed 31–364 days post-cessation from the successful abstainers. Two variables were significant: short-term confidence (assessed at 1-month post-cessation) and baseline alcohol consumption.

DISCUSSION

We found relapse rates for self-quitters in the early days and weeks after cessation to be much higher than those reported in the literature based on smokers who attend special stop-smoking clinics or programs. For example, by 2 weeks post-cessation, 62% of our sample of self-quitters had relapsed, compared to only 10% of subjects who attend

Table 2. Comparison of early relapsers, later relapsers, and successful abstainers

Variable	Relapsers			Abstainers	<i>p</i> -value ^a	<i>p</i> -value (linear trend) ^b
	Abstinent 0-7 days (N = 114)	Abstinent 8-30 days (N = 64)	Abstinent 31-364 days (N = 27)	Abstinent 365 days (N = 30)		
	(A) Baseline data					
Age ^c	43.1	38.8	45.0	43.3	.062	.392
Carbon monoxide ^d	31.0	26.3	25.3	28.0	.069	.265
Habit ^e	1.8	1.6	1.8	2.0	.139	.114
Weight control ^e (Total sample)	1.9	2.0	2.1	1.9	.637	.620
Men ^f	1.9	1.6	1.5	1.6	.238	.118
Women	1.9	2.3	2.6	2.4	.020*	.047*
Pleasure ^e	2.4	2.5	2.8	2.3	.045*	.815
Days abstinent on longest prior quit attempt ^g	91.2	85.1	138.0	363.1	.011*	.001***
Drinks of alcohol per week ^{g,h}	4.7	6.6	6.3	3.3	.023*	.138
Motivation ⁱ	2.5	2.5	3.0	2.9	.016*	.006**
Confidence in abstaining for 3 months ^j	2.8	3.3	3.2	3.5	.003**	.009**
% With a spouse or significant other who smokes	29.8	23.4	22.2	13.3	.287	.058
% With spouse (or significant other) a smoker and ≥ half of friends smokers	15.8	9.4	11.1	0.0	NA ^k	.020*
	(B) Data collected at 1-month post-cessation					
Difficulty remaining abstinent ^l			3.7	3.2	.122	NA ^m
% Reporting increase in stress (baseline to 1 month post-cessation)			18.5	36.7	.128	
Confidence in abstaining for 3 months ^j			3.0	3.8	.014*	
Change in 3-month confidence (1-month value minus baseline value) ⁿ			-0.3	-0.4	.021*	
Confidence in abstaining for 2 years ^j			3.4	4.1	.038*	

Note: Only variables significant at the $p < .15$ level were entered in this Table. Other variables considered, but not significant at the $p < .15$ level were gender, marital status, education, and daily cigarette consumption. The following reasons for smoking were also considered: negative affect reduction, addiction, stimulation, and facilitation of social interactions. Additional variables analyzed were: number of serious prior quit attempts, coffee consumption, difficulty expected in quitting, confidence in abstaining for 2 years, percent of smokers with half or more of their friends as cigarette smokers, support expected from family, support expected from friends, perceived stress, frequency and strength of temptations to smoke (both assessed at 1 month post-cessation), and change from baseline to 1-month in long-term confidence in maintaining abstinence.

* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

^aAnalysis of variance was used for continuous and ordinal-scale variables. Chi-Square test was used for categorical variables.

^bT-test for linear contrast in one-way analysis of variance was used for continuous and ordinal-scale variables (Rosner, 1986, p. 456). Chi-Square test for trend in binomial proportions was used for categorical variables (Rosner, 1986, p. 343).

^cMean values are shown for continuous and ordinal-scale variables.

^dCarbon Monoxide (CO) values (PPM) were adjusted for minutes elapsed since the last cigarette smoked and time of day the assessment was taken using linear regression analysis. Only those subjects who had smoked within 3 hours of the CO assessment were included. The numbers of subjects in each subgroup were: Absti-

stop-smoking clinics. By 1 month post-cessation, 76% of our sample had relapsed compared to 20% in stop-smoking clinics (Hunt et al., 1971). There is recent corroborating evidence that relapse rates for self-quitters are indeed much higher in the early post-cessation period compared to rates for those attending special stop-smoking programs (Garvey et al., 1989; Kottke, Brekke, Solberg, & Hughes, 1989).

Given the very large early relapse rates for self-quitters, and that approximately 95% of those who attempt to quit smoking each year are self-quitters (Davis, Faust, & Ordentlich, 1984; Fiore, Novotny, Pierce, Giovino, Hatziandreu, Newcomb, Surawicz, & Davis, 1990), it seems essential that future prospective studies of self-quitters be undertaken to examine biological and behavioral factors (e.g., withdrawal severity) which may precipitate relapse in the early days and weeks after cessation.

The *number* of quit attempts a subject had made prior to enrolling in our study had no significant relationship to relapse. However, one of our most significant predictors of relapse was *length* of the subject's longest prior quit attempt (Table 2). It is likely that a relatively long period of success on a prior quit attempt has motivational, confidence-building, and learning effects. Prior successful abstinence of an extended nature may reflect the development of cognitive and behavioral coping methods (perhaps through trial-and-error learning) helpful for maintaining abstinence on a future quit attempt.

We also found strong evidence that the attitude of the subject prior to quitting was related to the outcome of the quit attempt. Baseline motivation and short-term confidence levels, for example, were significantly related to relapse in univariate analyses, as was short-term confidence in multivariate analyses. Hall, Havassy, and Wasserman (1990) and others (Baer, Holt, & Lichtenstein, 1986; Marlatt et al., 1988) have found, similarly, that the degree of commitment, motivation, and confidence brought to the quit attempt significantly impacts relapse. Future studies need to determine how high levels of commitment, motivation and confidence develop in the pre-cessation period.

Study of post-cessation variance in confidence is also needed because these shifts were significantly related to relapse in our study. Those who decreased in confidence from

ment 0-7 days (N = 102); 8-30 days (N = 46); 31-364 days (N = 18); 365 days (N = 21). CO values were adjusted to the mean time elapsed since the last cigarette smoked and the mean time of day assessments were taken. The formula was $CO(\text{Adjusted}) = CO - (-0.063)(\text{Min} - 70.22) - 0.011(\text{Time} - 1329.84)$, where Min is the number of minutes elapsed since the last cigarette, and Time is the time of day (using a 24-hour clock) the assessment was taken.

^eObtained from a factor analysis of items on the Smoking Patterns Test (Russell, et al., 1974). Subjects rated the degree to which each reason for smoking applied to them. Response categories were: 1 = Not at all, 2 = Somewhat, 3 = Quite a bit, 4 = Definitely. Factor scores were the means of the items loading on a factor.

^fFor men, 0-7 Day Abstainers, N = 51; 8-30 Day Abstainers, N = 32; 31-364 Day Abstainers, N = 12; 365 Day Abstainers, N = 16. For women, subject totals in each category were 63, 32, 15, and 14, respectively.

^gSince this variable had a positively skewed distribution, logarithms (base 10) were used to normalize the distribution. To avoid taking the logarithm of 0 (undefined), the number 1 was added to each value of the variable prior to obtaining logarithms. The anti-log of the mean logarithm was then obtained to place the variable back in its original units.

^hDrinks of alcohol per week was the sum of beer (number of bottles and/or cans), wine (number of glasses), and hard liquor (number of mixed drinks) consumption (Glynn, DeLabry, & Hou, 1988).

ⁱResponse categories were: 1 = None, Small, or Moderate, 2 = large, 3 = Very large, 4 = Extremely large.

^jResponse categories were: 1 = None or Small, 2 = Moderate, 3 = Large, 4 = Very large, 5 = Extremely large.

^kChi-Square test could not be computed because of small expected values in some cells.

^lResponse categories were: 1 = None, 2 = Small, 3 = Moderate, 4 = Large, 5 = Very large, 6 = Extremely large.

^mIn the two group case, tests for linear trend give the same results as Analysis of Variance or Chi-Square tests. Hence *p*-values in the linear trend column are omitted.

ⁿChange scores were adjusted for initial level using linear regression analysis (James, 1973).

Table 3. Logistic regression coefficients comparing subjects abstinent 0–7 days, 8–30 days, and 31–364 days with those abstinent for 365 days

Variable	Logistic coefficient ^a	Standard error of coefficient	Standard deviation of variable	Standardized odds ratio	p-value
(A) 0–7 Day abstainers vs. subjects abstinent 365 days					
Confidence in abstaining for 3-months	–0.521	0.220	1.14	0.55	.018
Days abstinent on longest prior quit attempt ^b	–0.660	0.299	1.00	0.52	.027
Gender (women = 0, men = 1)	–0.356	0.480		0.70	.458
Weight control ^c	–0.505	0.354	0.82	0.66	.154
Interaction (gender × weight control)	1.413	0.623			.023
Constant	4.833				
(B) 8–30 Day abstainers vs. subjects abstinent 365 days					
Days abstinent on longest prior quit attempt ^b	–0.930	0.318	0.90	0.43	.003
Drinks of alcohol per week ^{b,d}	1.647	0.571	0.44	2.06	.004
Constant	1.729				
(C) 31–364 Day abstainers vs. subjects abstinent 365 days					
Confidence in abstaining for 3-months (assessed at 1-month post-cessation)	–0.737	0.279	1.18	0.42	.008
Drinks of alcohol per week ^{b,d}	1.465	0.628	0.53	2.17	.020
Constant	1.482				

^aAbstainers coded as 0, Relapsers as 1.

^bSince this variable had a positively skewed distribution, logarithms (base 10) were used to normalize the distribution. To avoid taking the logarithm of 0 (undefined), the number 1 was added to each value of the variable prior to obtaining logarithms.

^cWeight control was mean-centered for this analysis (i.e., mean-centered weight control = weight control – mean weight control). This was done so that other coefficients could be interpreted in relation to subjects with average values on the weight-control smoking motive.

^dDrinks of alcohol per week was the sum of beer (number of bottles and/or cans), wine (number of glasses), and hard liquor (number of mixed drinks) consumption (Glynn, DeLabry, & Hou, 1988).

baseline to 1-month post-cessation were more likely to relapse subsequently. Additional prospective studies, involving close monitoring of subjects' experiences after cessation, are needed to determine the reasons for changes in confidence after cessation of smoking.

We should briefly mention a methodological issue regarding confidence as a predictor. We had two confidence variables in our study. One, which we labelled "short-term confidence," was based on a question which asked subjects to rate how confident they were in abstaining for the next 3 months. The second variable, labelled "long-term confidence," asked subjects how confident they were in abstaining for the next 2 years. Pre-cessation short-term confidence was a much stronger predictor of relapse than was pre-cessation long-term confidence (which was unrelated to relapse). It may be useful when assessing *pre-cessation* confidence to give subjects a reasonable time frame, such as 3 months or less, so that they may give a more valid and reliable assessment of their pre-cessation confidence level.

Baseline alcohol consumption was significantly greater for relapsers compared to successful abstainers. Similar findings have been reported in other studies (U.S. DHHS, 1979). A plausible hypothesis is that those who consume more alcohol have more cues and temptations for smoking in the post-cessation period which may "wear-down" resolve over time. An alternative but related hypothesis is that a greater frequency of drinking may more often place people in a less vigilant state, whereby they are less likely to cope with temptations to smoke (Tiffany, 1990; O'Connell, Cook, Gerkovich, Potocky, & Swan, 1990).

Women who rated themselves higher on the weight-control smoking motive were less likely to relapse compared to women who rated themselves lower on this motive. For men, the reverse was true. This significant interaction is difficult to interpret in a substantive sense. First, the overall mean for the weight-control smoking motive was only 2.0 on a scale whose values ranged from 1 to 4. Thus, on average, weight control was rated only "somewhat" important by subjects as a motive for smoking.

Second, the inverse relationship for women between values on the weight-control smoking motive and relapse was unexpected. Women tend to gain more weight than men on average after cessation of smoking (Williamson, Madans, Anda, Kleinman, Giovino, & Byers, 1991), and women in our study rated themselves more likely to smoke for weight-control reasons than did men ($\bar{X}_{\text{women}} = 2.1$; $\bar{X}_{\text{men}} = 1.7$, $p < .0001$). However, Hall, Ginsberg, and Jones (1986) found, also unexpectedly, that those who gained more weight in the first 6 months after cessation were more likely to be abstinent at 1 year post-cessation. It may be that concerns about weight gain do not lead to relapse. More research is clearly needed on the issues of gender differences in weight gain after smoking cessation and their relationship to relapse, and gender differences in use of smoking for weight-control purposes.

The social environment of the smoker also played a role in relapse among our sample of self-quitters. One variable, spouse (or significant other) a smoker and half or more of friends smokers, was significantly related to relapse in univariate analyses (Table 2). We could not enter this variable in multivariate analyses because *none* of the successful quitters had both a spouse (or significant other) a smoker and half or more of their friends as smokers. The importance of the social environment has also been established in other recent work (Marlatt et al., 1988; Brandon, Zelman, & Baker, 1987). Presumably, being around other smokers provides more cues or temptations to smoke, and less social support for quitting.

We should mention that any smoking (i.e., a lapse) after the subject's quit date was an extremely strong predictor of subsequent relapse. Only 10 (4.7%) of the 215 subjects who lapsed regained abstinence and went on to be successful abstainers at 1-year post-cessation, while 205 (95.3%) of the 215 subjects who smoked went on to a full-blown relapse. There is a growing body of evidence confirming the high likelihood of a lapse leading to subsequent relapse (e.g., Marlatt et al., 1988).

It should also be noted that some putative predictors of relapse were not significantly related to relapse in our study of self-quitters. We found no evidence, for example, of age or gender main effects on relapse in our study. Neither were level of education nor amount smoked substantially related to relapse. In addition, social support expected from family and friends in quitting did not significantly relate to relapse, nor did level of psychosocial stress reported at baseline. Self-reported increases in psychosocial stress from baseline to 1-month post-cessation, likewise, did not predict subsequent relapse. The failure of stress to predict relapse is similar to a recent finding by Hall et al. (1990), and casts further doubt on the widely-held belief that psychosocial stress levels are more

severe among those who relapse. Other studies, involving shorter intervals between follow-up assessments, are needed however to determine whether acute stress can predict relapse.

With regard to possible clinical implications of our findings, those planning to make an unaided quit attempt should definitely be warned about the large risk of relapse in the first few days and weeks after their quit dates. Special vigilance should be urged for this early post-cessation period when relapse is especially likely. Smokers contemplating quitting should clearly be told about the 95% likelihood of relapse if they smoke any cigarettes at all in the post-cessation period. Potential quitters should also be encouraged to get to the proper frame of mind as they approach the quit attempt. Some studies have indicated that such increased motivational and confidence-building efforts can have a positive effect on the outcome of the quit attempt (Fisher, Levenkron, Lowe, Loro, & Green, 1982). Those who have been able to abstain only for brief periods on prior quit attempts may need special support during their quit attempts. At the very least, they should be informed that they are definitely at higher risk for relapse. It may also be useful to suggest that potential quitters avoid situations where they are around friends and family who are smoking, and limit their consumption of alcoholic beverages.

REFERENCES

- Baer, J. S., Holt, C. S., & Lichtenstein, E. (1986). Self-efficacy and smoking reexamined: Construct validity and clinical utility. *Journal of Consulting and Clinical Psychology*, *54*, 846-852.
- Brandon, T. H., Zelman, D. C., & Baker, T. B. (1987). Effects of maintenance sessions on relapse: Delaying the inevitable? *Journal of Consulting and Clinical Psychology*, *55*, 780-82.
- Davis, A. L., Faust, R., & Ordentlich, M. (1984). Self-help smoking cessation and maintenance programs: A comparative study with 12-month follow-up by the American Lung Association. *American Journal of Public Health*, *74*, 1212-1217.
- Fiore, M. C., Novotny, T. E., Pierce, J. P., Giovino, G. A., Hatziaendreu, E. J., Newcomb, P. A., Surawicz, T. S., & Davis, R. M. (1990). Methods used to quit smoking in the United States. Do cessation programs help? *Journal of the American Medical Association*, *263*, 2760-2765.
- Fisher, E. B., Jr., Levenkron, J. C., Lowe, M. R., Loro, A. D., Jr., & Green, L. (1982). Self-initiated self-control in risk reduction. In: R. Stuart (Ed.), *Adherence, generalization, and maintenance in behavioral medicine*. New York: Brunner/Mazel.
- Garvey, A. J., Bosse, R., Glynn, R. J., & Rosner, B. (1983). Smoking cessation in a prospective study of healthy adult males: Effects of age, time period, and amount smoked. *American Journal of Public Health*, *73*, 446-450.
- Garvey, A. J., Heinold, J. W., & Rosner, B. (1989). Self-help approaches to smoking cessation: A report from the Normative Aging Study. *Addictive Behaviors*, *14*, 23-33.
- Glynn, R. J., DeLabry, L. O., & Hou, D. M. (1988). Alcohol consumption, type A behavior, and demographic variables. *American Journal of Epidemiology*, *127*, 310-320.
- Hall, S. M., Ginsberg, D., & Jones, J. T. (1986). Smoking cessation and weight gain. *Journal of Consulting and Clinical Psychology*, *54*, 342-346.
- Hall, S. M., Havassy, B. E., & Wasserman, D. (1990). Commitment to abstinence and acute stress in relapse to alcohol, opiates, and nicotine. *Journal of Consulting and Clinical Psychology*, *58*, 175-181.
- Hunt, W. A., Barnett, L. W., & Branch, L. G. (1971). Relapse rates in addiction programs. *Journal of Clinical Psychology*, *27*, 455-456.
- James, K. E. (1973). Regression toward the mean in uncontrolled clinical trials. *Biometrics*, *29*, 121-130.
- Kottke, T. E., Brekke, M. L., Solberg, L. I., & Hughes, J. R. (1989). A randomized trial to increase smoking intervention by physicians. *Journal of the American Medical Association*, *261*, 2101-2106.
- Marlatt, G. A., Curry, S., & Gordon, J. R. (1988). A longitudinal analysis of unaided smoking cessation. *Journal of Consulting and Clinical Psychology*, *56*, 715-720.
- O'Connell, K. A., Cook, M. R., Gerkovich, M. M., Potocky, M., & Swan, G. E. (1990). Reversal theory and smoking: A state-based approach to ex-smokers' highly tempting situations. *Journal of Consulting and Clinical Psychology*, *58*, 489-494.
- Ossip-Klein, D. J., Bigelow, G., Parker, S. R., Curry, S., Hall, S., & Kirkland, S. (1986). Classification and assessment of smoking behavior. *Journal of Health Psychology*, *5*, 3-11.

- Pearlin, L. I., & Schooler, C. (1978). The structure of coping. *Journal of Health and Social Behavior*, *19*, 2–21.
- Pierce, J. P. (1989). International comparisons of trends in cigarette smoking prevalence. *American Journal of Public Health*, *79*, 152–157.
- Rosner, B. (1986). *Fundamentals of Biostatistics* (2nd Ed.). Boston, MA: Duxbury Press.
- Russell, M. A. H., Peto, J., & Patel, U. A. (1974). The classification of smoking by a factorial structure of motives. *Journal of the Royal Statistical Society*, *137*, 313–346.
- Shiffman, S., Shumaker, S. A., Abrams, D. B., Cohen, S., Garvey, A. J., Grunberg, N. E., & Swan, G. E. (1986). Models of smoking relapse. *Journal of Health Psychology*, *5*, 13–27.
- Swan, G. E., Denk, C. E., Parker, S. D., Carmelli, D., Furze, C. T., & Rosenman, R. H. (1988). Risk factors for late relapse in male and female ex-smokers. *Addictive Behaviors*, *13*, 253–266.
- Tiffany, S. T. (1990). A cognitive model of drug urges and drug-use behaviors: Role of automatic and non-automatic processes. *Psychological Review*, *97*(2), 147–168.
- U.S. Department of Health and Human Services (1979). *Smoking and health: A report of the Surgeon General* (DHEW pub. no. 79-50066). Washington, DC: U.S. Government Printing Office.
- U.S. Department of Health and Human Services (1983). *The health consequences of smoking: Cardiovascular diseases. A report of the Surgeon General* (DHHS pub. no. 84-50204). Washington, DC: U.S. Government Printing Office.
- Verebey, K. G., DePace, A., Mule, S. J., Kanzler, M., & Jaffe, J. H. (1982). A rapid quantitative GLC method for the simultaneous determination of nicotine and cotinine. *Journal of Analytical Toxicology*, *6*, 294–296.
- Williamson, D. F., Madans, J., Anda, R. F., Kleinman, J. C., Giovino, G. A., & Byers, T. (1991). Smoking cessation and severity of weight gain in a national cohort. *New England Journal of Medicine*, *324*, 739–745.