

Perceived Stress, Quitting Smoking, and Smoking Relapse

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Assessed perceptions of stress prior to quitting and at 1, 3, and 6 months following quit date. Self-reported smoking status was augmented by a bogus pipeline procedure at each interview, and abstinence at 6 months was verified by carbon monoxide and saliva cotinine. The analyses provide strong evidence for a relation between changes in stress levels and changes in smoking status. Those who failed to quit smoking for more than 24 hr maintained a relatively high and consistent level of stress over the entire 6-month period. For those remaining continuously abstinent over the course of the study, stress decreased as duration of abstinence increased. Increases in stress with relapse were found across all three panel lags (prequit to 1 month, 1 to 3 months, and 3 to 6 months), and decreases in stress with quitting were found across the two lags where that comparison was possible. The possibility that the relation between smoking and stress is bidirectional is discussed as a possible interpretation of the results.

Key words: stress, smoking, relapse, abstinence

Persons who quit smoking and subsequently relapse often report that their return to smoking was triggered by a stressful experience or negative affective state (Baer & Lichtenstein, 1988; Cummings, Jaen, & Giovino, 1985; Shiffman, 1982; U.S. Department of Health and Human Services [USDHHS], 1988). This effect is generally interpreted as supportive of the hypothesis that stress triggers smoking relapse. These studies, however, are primarily retrospective. It may be that relapsing itself is what is stressful, and reports of relapsed smokers confuse cause and effect, or that retrospective stress attributions provide a convenient justification for relapsing.

Do feelings of stress trigger relapse? Smokers often view smoking as an effective means of coping with the emotions elicited by stressful events and are presumed to have strong urges to return to such a well-established response when confronted with stressors (J. K. Ockene, Nuttall, Benfari, Hurwitz, & I. S. Ockene, 1981; Wills & Shiffman, 1985). Although there is some prospective data linking stress, negative affect, or psychological distress to smoking relapse (Benfari, Eaker, J. Ockene, & McIntyre, 1982;

Hall, Bachman, Henderson, Barstow, & Jones, 1983; J. K. Ockene, Benfari, Nuttall, Hurwitz, & I. S. Ockene, 1982), all these studies predicted later relapse from "trait-like" (i.e., stable over long periods of time) distress measured at baseline. Hence, they may be identifying a type of person who is susceptible to relapse rather than providing evidence for acute stress triggering relapse. Studies using repeated measures of stress that are sensitive to acute changes and that are linked more closely to the time of relapse would help clarify whether stress operates as an acute trigger of relapse.

Does quitting smoking decrease feelings of stress, and does relapsing after quitting increase these feelings? It is generally assumed that giving up smoking is an emotionally wrenching experience. During the first few weeks of abstinence, persons often report withdrawal symptoms including intense feelings of anxiety and irritability (Shiffman, 1979; USDHHS, 1988). Once over the initial withdrawal period, however, it seems likely that the success of quitting would have beneficial influences on the quitter, including increased feelings of personal efficacy and self-esteem and decreased perceptions of stress. A subsequent return to smoking would then be expected to have the reverse effect, decreasing feelings of efficacy and esteem and increasing feelings of stress.

This study was designed to examine the dynamic relations between self-reported (perceived) stress and smoking status through the use of (a) a stress measure sensitive to changes in state, (b) repeated measures of both perceived stress and smoking status, and (c) relatively short periods of time (1 to 3 months) between panel lags. Persons planning to quit smoking by themselves were interviewed before they started to quit and at 1, 3, and 6 months following their quit date. Perceptions of stress and smoking status were assessed by telephone interviews at all panels. Longitudinal analyses explored the stress levels of successful and unsuccessful quitters and the relation between changes in smoking status and changes in stress that occurred between panels. This design provided the opportunity for internal replication by comparing the relation between changes in stress and changes in smoking status for each of the three panel lags (prequit to 1 month, 1 to 3 months, and 3 to 6 months). Our major hypotheses were that changes from smoking to abstinence would be associated with decreased feelings of stress, whereas changes from abstinence to smoking would be associated with increased stress.

METHOD

Subjects

Subjects were solicited for participation if they either called the American Lung Association to request a self-quit manual or responded to newspaper

and radio advertisements seeking persons planning to quit smoking by themselves. To qualify for participation, a subject needed to be 18 or older, smoke at least 10 cigarettes a day, have decided to make a serious attempt to quit smoking in the next month, and have not yet begun the quitting process.

This study was designed to address the predictors of quitting and relapsing over the course of 1 year for persons who take action toward quitting or significantly reducing smoking. As a consequence, to be eligible for full participation (follow-ups at all panels) in the study, subjects had to quit smoking for at least 24 hr within 1 month of their expected quit dates or report at the 1-month follow-up that they had reduced their smoking rate by at least 50% from prequit levels. Two hundred sixty of the persons completing prequit interviews met the eligibility requirement; 69 did not. Seventy-one percent of the eligible subjects were women (mean age = 40 years). Fourteen percent had previously tried to quit through a formal program. The mean baseline smoking rate was 27.4 cigarettes per day, mean minutes before first cigarette in the morning was 28.3, and mean longest period without a cigarette in the last year was 12.1 days.

Subjects were told that the investigators were interested in studying the responses to the experience of self-quitting and that they could not provide any aid in the quitting process. They were paid \$15 for the prequit interview, \$15 for the 6-month interview, \$5 for the 1-month telephone interview, and \$5 for the 3-month telephone interview. Those who completed all interviews were also eligible to win a videotape recorder in a drawing.

The 260 eligible subjects were given a prequit interview and follow-up interviews 1, 3, and 6 months following their expected quit date.¹ All interviews were conducted over the telephone and included both an assessment of smoking status and the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). Slight variation in sample size for different lag analyses are due to different numbers of persons with complete data at both panels in a lag. Of the 260 persons, data at both prequit and 1 month were available for 248 subjects, at both 1 and 3 months for 228 subjects, and at both 3 and 6 months for 214 subjects. Two hundred eleven subjects had data available at all four points.

All these samples were examined for attrition bias by comparing prequit data (on age, sex, perceived stress, and number of cigarettes smoked) of subjects for whom data were available at all relevant panels and of subjects

¹Two- and 12-month follow-ups were included in the original design. The 2-month follow-up was not included in our analyses because there were too few transitions in smoking status between 1 and 2 months to make an analysis feasible. The 12-month data were not included because perceived stress was not assessed at that point.

for whom data were not (e.g., 214 included vs. 46 not included in the 3- to 6-month lag). Those without both 3- and 6-month data were more likely to be men (41%) than those with 3- and 6-month data (27%). Because 29% of the 260 people in the entire sample were men, this difference appears trivial. Otherwise, there were no differences between those included and those not included in any of the analyses and, hence, no attrition biases influencing either representativeness of validity or prediction.

Although no subject quit at more than one of the lags, 5 subjects who relapsed during the prequit to 1-month lag also relapsed during the 3- to 6-month lag. This creates a problem in terms of independence of the three relapse replications. As a consequence, separate analyses – in which these 5 subjects were dropped from the samples in both these lags – are presented in the Results section.

Biochemical Verification

At each interview, subjects were reminded that, at an undetermined point in the study, the investigators would biochemically verify their smoking status. All persons who reported abstinence at 6 months were scheduled for verification with both carbon monoxide (CO) and saliva cotinine and received \$10 for their time and effort. Abstinent persons refusing verification were considered smokers. All but 1 subject who was verified had both CO and cotinine levels that were consistent with their abstinent status.

Smoking Status

Subjects were considered “24-hr quitters” if they reported at 1 month that they had stopped smoking at some point since their prequit interview for at least one 24-hr period. Subjects were considered “point-prevalent abstinent” at a panel if they were not currently smoking and had not smoked “even a puff” during the last week. Subjects were considered “6-month continuous abstinent” if they were point-prevalent abstinent at all the follow-up interviews and had not smoked more than 3 days since quitting.

PSS

We used the four-item version of the PSS (PSS-4) designed for use in telephone follow-up interviews. The PSS is designed to tap the degree to which respondents find their lives unpredictable, uncontrollable, and overloading. These three issues have been repeatedly found to be central components of the experience of stress. An example of an item is “How often have you felt difficulties piling up so high that you could not overcome them?” For each item, respondents indicate on a scale ranging

from *never* (0) to *very often* (5) how often they have felt this way during the last month. High scores on the PSS-4 have been associated with elevated life events, psychological distress, physical symptomatology, and use of health services (Cohen & Williamson, 1988). Stress as assessed by the PSS has also been found to prospectively predict less quitting of smoking (Glasgow, Klesges, Mizes, & Pechacek, 1985) and less maintenance of smoking reduction (Cohen et al., 1983). At prequit, the Cronbach alpha coefficient for the PSS-4 in the current study was .74.

PSS-4 norms are available from a probability sample of the United States ($N = 2,387$) collected by the Harris Poll in 1983 (Cohen & Williamson, 1988). The mean level for men in the national sample was 4.2, whereas the mean level for women was 4.7. Current smokers in the national sample had slightly (but significantly) elevated mean PSS-4 scores (4.8) compared to people who had never smoked (4.5) and people who had once smoked but quit (4.2). The mean prequit level in this study was 5.9, with scores ranging from 0 to 14. The mean scores for men and women were 5.2 and 6.2, respectively. The sample mean is elevated relative to the normative data for smokers but is similar to the mean of 5.6 on the PSS-4 found for 64 persons participating in a smoking-cessation program (Cohen et al., 1983). The relatively elevated stress level in both samples may be because they were just about to attempt to quit smoking. However, it may also reflect special characteristics of persons who take part in smoking-cessation studies. A study including a control group of smokers who are not in the process of quitting would be necessary to distinguish between these interpretations.

RESULTS

PSS, Smoking Demographics, and Psychological Variables

To assess the possibility that the PSS might act as a proxy for some other smoking or psychologic variable, we correlated baseline PSS scores with a series of other measures collected at baseline. The PSS was not significantly correlated with smoking rate ($r = .04$), with number of minutes in the morning before smoking the first cigarette ($r = -.01$), with number of previous quit attempts ($r = .05$), with length of the longest successful quit ($r = .05$), with nicotine content of the cigarette brand ($r = .04$), or with either negative ($r = .06$) or positive ($r = -.13$) cessation-relevant behaviors on the part of a spouse or living partner as measured by the Partner Interaction Questionnaire (Cohen & Lichtenstein, in press; Mermelstein, Lichtenstein, & McIntyre, 1983).

Continuous Abstainers Versus Persons Unable to Quit for More Than 24 Hours

Figure 1 presents PSS scores over the course of the study for persons who never quit smoking ($n = 57$), persons who quit for 24 hr but who were smoking at all other follow-ups ($n = 81$), and persons who were continuously abstinent through the 6-month follow-up ($n = 12$). As apparent from the figure, those who never quit and those who quit for 24 hr but who were smoking at all other follow-ups maintained a stress level of approximately 6 over the course of the entire study. On the other hand, continuous quitters started at a slightly (but not significantly) lower PSS level and declined precipitously over the 6-month period, ending with a mean PSS of 2.9. A 3 (between groups) \times 4 (within subject) repeated-measures analysis of variance (ANOVA) indicated a Group \times Panel interaction, $F(6, 441) = 2.96$, $p < .01$, but no main effect. This interaction reflects the different slopes of the groups—specifically, the decrease in stress among the continuously abstinent group as opposed to the unchanging levels among the persons failing to quit for more than 24 hr.

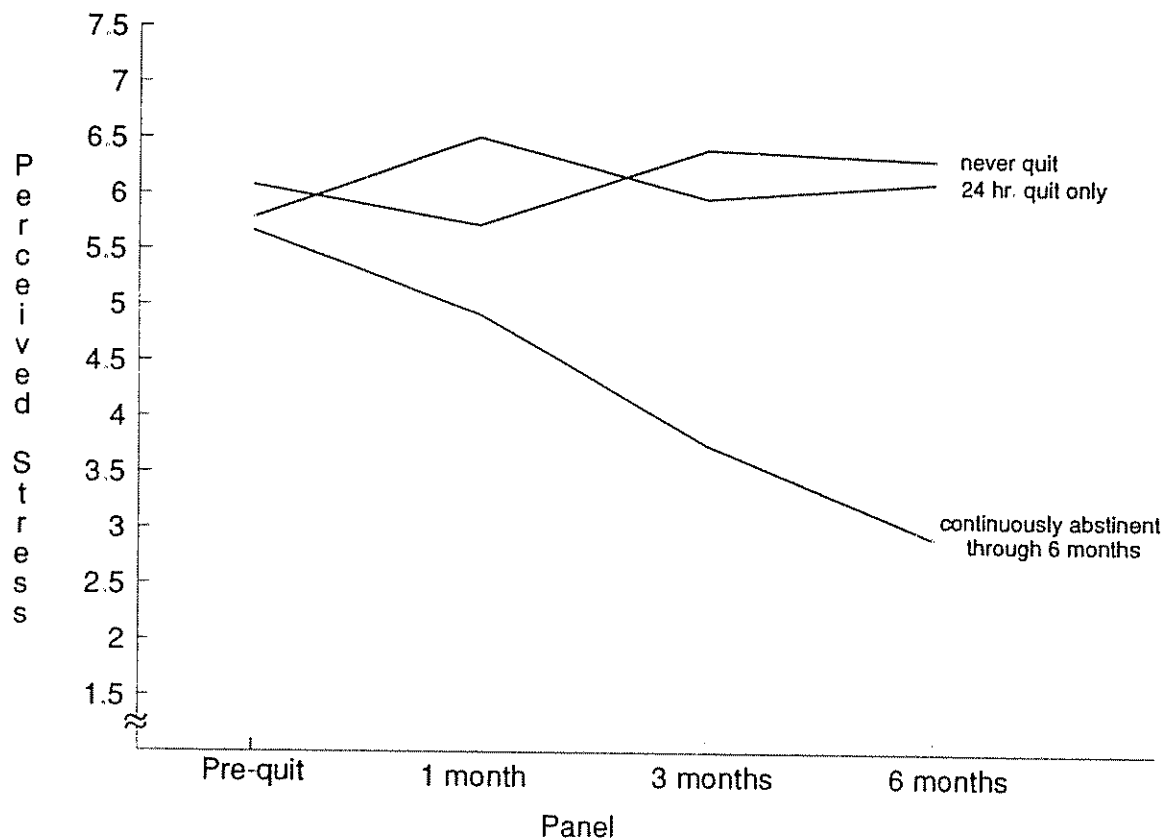


FIGURE 1 Mean perceived stress scores at each panel for continuous abstainers and for continuous smokers.

Changes in Smoking Status and Changes in Stress

The following analyses examine the relations between changes in smoking status from one follow-up to the next and changes in stress levels in the same lag. In these analyses, groups were formed based on point-prevalence smoking status at current and previous panels. For example, in studying smoking status at 1 and 3 months, subjects were assigned to one of four groups, depending on whether they were (a) abstinent at 1 month and at 3 months, (b) abstinent at 1 month but smoking at 3 months, (c) smoking at 1 month but abstinent at 3 months, or (d) smoking at 1 month and smoking at 3 months.

The data from the prequit to 1-month lag differs slightly from the 1- to 3-month and the 3- to 6-month lags in two ways. First, the initial stress level and smoking status were not measured at the same point in this lag; initial stress level was collected at prequit (when everyone was smoking), whereas initial smoking status in this lag was based on 1-month retrospective reports of whether or not they had quit for any 24-hr period during the lag. Second, because anyone who was abstinent at 1 month was also considered a 24-hr quitter (quit for at least 24 hr within 1 month), the prequit to 1-month lag did not include a group that went from smoking to abstinence.

We individually analyzed data from each lag to determine whether changes in stress levels were related to transitions in smoking status when controlling for initial levels of stress. These were analyses of covariance (ANCOVAs), with stress at the initial panel as the covariate, type of transition as the independent variable (3 levels, 4 levels, and 4 levels for the three respective lags), and stress at the latter panel as the dependent variable. Second-panel means adjusted for first-panel scores for each lag are presented in Table 1. Observed means for both panels in each lag are also presented. The ANCOVA indicated main effects for type of transition in the prequit to 1-month lag, $F(2, 244) = 7.51, p < .001$, in the 1- to 3-month lag, $F(3, 223) = 3.27, p < .022$, and in the 3- to 6-month lag, $F(3, 209) = 3.52, p < .02$.

We expected that persons who relapsed (abstinent-smoking) would have higher stress scores than persons remaining abstinent (abstinent-abstinent) and that quitters (smoking-abstinent) would have lower stress scores than continuous smokers (smoking-smoking). In all cases, relapsers had the highest adjusted mean stress scores, and quitters had the lowest (see Table 1). Preplanned contrasts comparing the adjusted group means indicated that relapsers had higher stress levels than those remaining abstinent from the prequit to 1-month lag, $t(251) = 3.52, p < .001$, from the 1- to 3-month lag, $t(227) = 1.88, p < .06$, and from the 3- to 6-month lag, $t(213) = 1.81, p < .07$. Quitters had lower stress levels than those who continued to smoke

TABLE 1
Mean Scores on the PSS at the Initial (First) and Latter (Second) Panels of
Each Lag for the Four Smoking-Status Groups

Smoking Status	Transition Period (Lag)		
	24 hr to 1 Month	1 Month to 3 Months	3 Months to 6 Months
Abstinent-abstinent			
Second-panel adjusted <i>M</i>	4.63	5.33	5.58
<i>n</i>	34	22	21
First-panel observed <i>M</i>	6.07	4.59	4.24
Second-panel observed <i>M</i>	4.74	4.59	4.71
Abstinent-smoking			
Second-panel adjusted <i>M</i>	6.50	7.74	7.51
<i>n</i>	135	11	11
First-panel observed <i>M</i>	5.79	5.46	4.55
Second-panel observed <i>M</i>	6.44	7.46	6.82
Smoking-abstinent			
Second-panel adjusted <i>M</i>	—	4.23	2.84
<i>n</i>	—	11	6
First-panel observed <i>M</i>	—	6.09	4.00
Second-panel observed <i>M</i>	—	4.27	1.83
Smoking-smoking			
Second-panel adjusted <i>M</i>	5.53	5.83	5.90
<i>n</i>	79	184	176
First-panel observed <i>M</i>	5.99	6.21	6.10
Second-panel observed <i>M</i>	5.58	5.94	6.09

Note. Adjusted means are second-panel means adjusted for first-panel means in each respective lag.

for both the 1- to 3-month lag, $t(227) = 2.38, p < .02$, and the 3- to 6-month lag, $t(213) = 2.56, p < .001$. As mentioned earlier, no prequit to 1-month comparison was possible.

Although our analyses were based on adjusted mean stress scores at the latter panel in each lag, it is informative to provide a pictorial representation of the changes that occurred. Figure 2 provides a dynamic view of observed mean changes from 3 to 6 months for each smoking-status group. Although not presented here (see observed means in Table 1), the patterns are strikingly similar for the 1- to 3-month and prequit to 1-month lags. As apparent from Figure 2, changes from smoking to abstinence were associated with decreased feelings of stress, whereas changes from abstinence to smoking were associated with increased feelings of stress. Stress levels did not change for subjects whose smoking status did not change. An alternative statistical analysis, a repeated-measures ANOVA of the observed means—3 (Group) \times 2 (Repetition) for the first lag and 4 (Group) \times 2 (Repetition) for the remaining two lags—resulted in effects consistent with

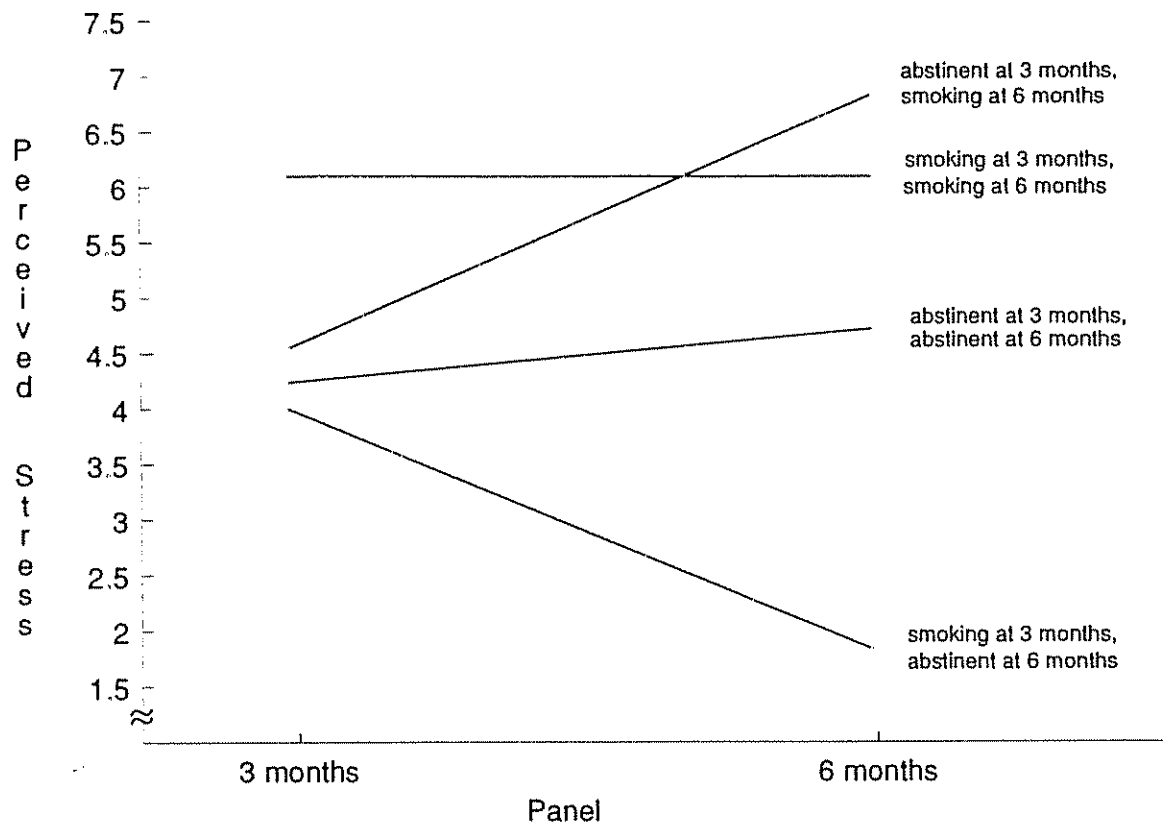


FIGURE 2 Mean perceived stress scores at 3- to 6-month follow-ups as a function of smoking status at 3 and 6 months.

those found in the ANCOVA; significant Group \times Panel interactions were observed in all three lags, $F(2, 245) = 7.20, p < .001$ (prequit to 1 month), $F(3, 224) = 2.84, p < .04$ (1 to 3 months), and $F(3, 210) = 2.91, p < .04$ (3 to 6 months).

Altering Samples for Independence

As discussed earlier, 5 subjects relapsed at two lags. Because dropping these subjects from the overall analysis would bias the sample, we included them in the main analyses reported earlier. To be sure that each lag provided an independent evaluation of relapse, however, we reanalyzed the data, dropping those 5 subjects from the sample at both lags. The results of the analyses were similar to those including the 5 overlapping subjects. The F statistics for the main effects in the ANCOVAs were $F(2, 239) = 7.69, p < .001$ (prequit to 1 month) and $F(3, 204) = 3.35, p < .02$ (3 to 6 months).

* Clarifying Causal Inference

Finally, because the lag analyses described earlier examined changes in smoking status as they relate to changes in stress levels, they may be

interpreted as shifts in stress causing shifts in smoking status, as shifts in smoking status causing shifts in stress, or as a combination of both. To eliminate reverse causality as an interpretation of these data, we needed to examine how a predictor variable from an initial panel in a lag predicted change from the initial panel to the latter panel in an outcome variable. For example, would stress at 1 month predict a change in smoking status from 1 to 3 months, or would a change in smoking status from 1 to 3 months predict a change in stress from 3 to 6 months? Hence, we conducted two other series of lag analyses. In the first, stress at the initial panel in a lag was used to predict a subsequent change in smoking status. In the second, transition status (e.g., smoking-abstinent) at the initial panel in a lag was related to subsequent changes in stress. Unfortunately, none of these analyses provided statistically significant indications of the influence of stress on change in smoking status or change in smoking status on stress, and, therefore, none provided clarification of the direction of causality.

Our inability to detect effects in these analyses may be attributable to bidirectional effects (both hypotheses being partly true). They may also be attributable to the time between lags. Lags of 1 month or more are probably considerably longer than the time required for stress to trigger changes in smoking status or for smoking status transitions to trigger changes in stress.

DISCUSSION

Data from this study indicate a strong relation between perceived stress and smoking. Those who failed to quit smoking for more than 24 hr maintained a relatively high and consistent level of stress over the entire 6-month period. For those remaining continuously abstinent over the course of the study, stress decreased as duration of abstinence increased. Increases in stress with relapse were found across all three panel lags, and decreases in stress with quitting were found across the two lags where that comparison was possible.

Occasionally, individual cell sizes for a specific transition were small. For example, there were 6 persons in transition from smoking to abstinence between 3 and 6 months. Each relation between change in smoking status and in perceived stress, however, was replicated in at least one other lag! Hence, these transition effects are reliable.

Unfortunately, we were not able to distinguish whether the relations found in this study occurred because stress caused failure to quit smoking and relapse, because relapse and failure to quit caused stress, or because both directions of causality operated simultaneously. Of course, it is also possible that some third factor influenced changes in both stress and smoking status. However, an examination of the possible relations between

the PSS and a series of likely predictors of smoking transitions—smoking rate, number of minutes in the morning before smoking the first cigarette, number of previous quit attempts, length of the longest successful quit, nicotine content of the cigarette brand, and cessation-relevant social support behaviors—indicates that none of these variables can provide a third-factor explanation.

Stress as a Justification for Relapse

It could be argued that reports of increased stress with relapse may be attributable to subjects using stress as a justification for their failure to remain off cigarettes—either an intentional justification for the sake of the experimenter or as an automatic or unconscious mechanism to help them cope with their own failure. Intentional justification seems unlikely in this study. First, unlike most cessation research, the experimenter was not a helping agent. As a result, this study lacked the development of a relationship between the investigator (interviewers) and subject, which can lead to misreporting in evaluations of cessation programs. Second, upon entering the study and at the onset of each interview, subjects were told that the study was not intended to evaluate subject performance. Instead, it was emphasized that the purpose of the research was to learn more about people's attempts to quit smoking and the things they find helpful and harmful in making such attempts. As in the retrospective work, reporting stress for purposes of self-justification following relapse is a possibility. It is important, however, to emphasize that this explanation cannot account for decreased stress among quitters.

Perceived Stress and the Stress Concept

Stress is variously defined as an appraisal (perception), an aversive event, a set of biologic responses, or a set of behavioral or affective responses (e.g., Baum, Singer, & Baum, 1981; Cohen, Evans, Stokols, & Krantz, 1986; some examples in smoking research in Epstein & Jennings, 1986). Although we find clear relations between changes in perceived stress and changes in smoking status, it is important to emphasize that these various conceptions of stress are often not correlated and may represent different underlying processes. Our data reflect persons' appraisals of demands in their lives exceeding their capacity to cope (Cohen & Williamson, 1988), and only further research will allow generalization to other definitions of stress.

Smoking Status as a Predictor of Stress

Previous research has indicated that smokers report higher stress scores than nonsmokers (Cohen & Williamson, 1988; Wills, 1986). Our data

suggest the possibility of even higher scores among those persons committed to making a serious attempt to quit (means of 5.9 at prequit and 5.6 in our previous clinic cessation study as compared to 4.8 for smokers in a national sample in 1983). As apparent in Figure 1, stress levels remained elevated for those failing to quit but eventually fell below national norms for those who were successful. Although it is not possible to make causal inferences, there is a strong suggestion in these data that quitting smoking results in reduced stress (at least among persons wanting to quit). To interpret the continuous decrease in perceived stress for persons who remained abstinent (see Figure 1), as attributable to stress influences on abstinence, one must assume that continuous abstinence occurred only for those who showed an additional decrease in stress at each panel; presumably, if stress stopped decreasing, one would relapse. A more parsimonious interpretation would be that, the longer one remained continuously abstinent (at least for 6 months), the less stress they experienced. As discussed earlier, this could occur because of increased feelings of personal efficacy and self-esteem. The important point here is that the field's focus on the effects of stress on smoking status may be overly one sided, distracting us from a practically and theoretically important effect of smoking status on stress.

This study is one of the first to provide evidence of the possible role that stress plays in postwithdrawal relapse. It also adds a dynamic aspect to existing work in this field, providing the first evidence that changes in smoking status among persons trying to quit smoking are associated with changes in perceived stress levels. It is hoped that future work will be able to further clarify the causal nature of these relations.

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