

## The Influence of Weight-Related Variables on Smoking Cessation

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Recently, researchers have suggested the possible importance of weight-related variables, particularly among women, in relapse to smoking. The present study *prospectively* examined the prediction of success versus failure (both relapse and dropout) in a smoking-cessation program using several weight-related variables and gender. Weight-related variables accounted for a significant amount of variance in the prediction of dropout from a cessation program. The interaction of gender with Body Mass Index (BMI) and gender with concern about postcessation weight gain also accounted for a significant amount of variance in dropout. Particularly, women who were lower in weight and women who were concerned about postcessation weight gain were more likely to drop out of a cessation program before completion than the other participants in the study. Results also indicated that people who have chronic weight concern and gain weight during a cessation attempt were more likely to drop out of a cessation program before completion than individuals with chronic weight concern and little to no weight gain during the quit attempt. Prediction of

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relapse to smoking during the cessation program was not very revealing. One finding that did emerge was that, among those who completed the study and did not drop out, men were twice as likely to relapse as were women. These results indicate the importance of weight-related variables, particularly among women, in the prediction of success in a cessation program. Findings also suggest that dropout may be more revealing in predicting failure in a cessation program than relapse to smoking in terms of the influence of weight-related issues.

Despite the well-documented health risks of smoking, more than 26% of adults in the United States currently smoke (Centers for Disease Control, 1994). Researchers have investigated reasons for the limited effectiveness of smoking-cessation programs over the long term and various possible explanations have been suggested, such as negative emotional states (Brandon & DeMichele, 1995) and the presence of other smokers (Ginsberg, Hall, & Rosinski, 1991). The relationship between body weight and smoking is another area that has recently emerged as a possible contributing influence in relapse to smoking (for a review, see French & Jeffrey, 1995).

Weight gain has consistently been found to occur with abstinence (Grunberg, 1992). Research has also shown that individuals who relapse experience minimal or no weight gain, and that the length of the relapse is an important determinant of whether weight gain will occur (e.g., Gritz, Carr, & Marcus, 1988; Swan & Denk, 1987). Although there has been considerable controversy regarding both the magnitude and causes of postcessation weight gain (Klesges, Meyers, Klesges, & LaVasque, 1989), surveys indicate that smokers believe smoking regulates body weight and that cessation of smoking will result in weight gain (Klesges & Klesges, 1988). Moreover, women are more likely to report relapse for weight-related reasons than men (DeBon & Klesges, 1995). In addition, women are more likely than men to report using smoking as a strategy to control their weight (DeBon & Klesges).

Due to the apparent importance of weight concern among women smokers, and the reported use of smoking as a weight-control strategy, studies have examined weight concerns among smokers and the impact of smoking-related weight concern in relapse to smoking. Streater, Sargent, and Ward (1989) found that women who participated in a smoking cessation program and who remained abstinent were less concerned about postcessation weight gain at follow-up than women who dropped out of the program before completion. Prospective studies have found conflicting results. Meyers et al. (1997) found that weight-concerned smokers were more likely to relapse to smoking at the end of treatment and throughout a 1-year follow-up. In contrast, French, Jeffrey, Pirie, and McBride (1992) found that weight-concerned female smokers were as successful at smoking cessation as women who did not evidence weight concerns. Jeffrey, Boles, Strycker, and Glasgow (1997) found that weight concern did not predict smoking cessation over a 2-year period among employees in a worksite health promotion program. Unfortunately, weight change was not included in these studies; therefore, the

interaction of chronic weight concern and weight change was not able to be examined.

Although researchers have posited that women are most vulnerable to relapse to smoking due to weight concerns (Klesges & Klesges, 1988), few studies have directly examined the interactive effect of gender and weight concern in predicting relapse to smoking during a quit attempt. Jeffrey et al. (1997) did not find a significant effect of the interaction between gender and weight concern on smoking cessation. However, they did not find a significant main effect of weight concern. Of note, Meyers et al. (1997) also did not find a significant interaction between gender and weight concerns in a study where weight concerns had a highly significant effect on smoking relapse. In contrast to these two prospective studies, other research suggests the possibility that gender interacts with weight-related variables. Weekley, Klesges, and Reylea (1992) examined the use of cigarettes for weight control among men and women current smokers and ex-smokers using a random digit dialing method. Gender alone was not predictive of weight-control smoking. However, females who gained larger amounts of weight in previous quit attempts were more likely to be weight-control smokers than males who reported low weight gain during previous quit attempts. Additionally, females who were higher in relative weight were more likely to be smokers than males with less relative weight. These results suggest that gender alone may not predict weight-control smoking or current smoking status, but the interaction of gender with other variables predicts weight-control smoking, as well as current smoking status. One shortcoming of the Weekley et al. study was that it was retrospective, calling into question the validity of reported weight gain due to smoking abstinence.

In reviewing the literature on body weight and smoking cessation, Klesges and colleagues (1989) postulated that there may be subgroups of smokers who are more likely to experience even minimal weight gain as particularly aversive, resulting in relapsing to smoking. As an example of possible subgroups, they note that underweight and normal-weight women tend to see themselves as overweight, and therefore might be at greater risk of relapse due to smoking cessation-related weight gain. These researchers also suggested that men and overweight individuals may not be as affected by the typical postcessation weight gain of 7 to 10 pounds (Grunberg, 1992). Therefore, they may be less likely to relapse to smoking. To the best of our knowledge, no study has investigated the interaction of gender and weight status in the prediction of relapse to smoking in a prospective design.

The purpose of the present study was to *prospectively* examine the prediction of smoking-cessation relapse using chronic general weight concern, concern about cessation-related weight gain, weight status, weight gain during cessation attempt, and gender as predictor variables. The present study assessed relapse in two ways. As noted previously, Streater and colleagues (1989) found that women who dropped out early from a smoking-cessation program were more concerned about postcessation weight gain. Therefore,

the present study included dropout of the cessation program, in addition to relapse to smoking (while remaining in program), in the data analysis design. In addition to primary variables, specific interaction terms were included as predictor variables. The present study assessed the interaction of chronic general weight concern and weight gain in the prediction of relapse to smoking. It was expected that individuals high in chronic general weight concern who experienced weight gain during the cessation attempt would be less successful in their cessation attempt than individuals who scored high in chronic general weight concern but who experienced minimal or no weight gain. The present study also predicted that gender alone would not predict success in the current cessation attempt, but the gender by cessation-related weight gain concern interaction was expected to predict success in the cessation attempt. Specifically, women who were concerned about weight gain due to stopping smoking were predicted to be less successful in their current quit attempt than other participants in the study. Finally, the present study included the interaction of weight status and gender in the prediction of success in the cessation attempt. It was expected that women who were of lower relative weight would be less successful in the cessation attempt than other participants in the study.

## Method

### *Participants*

Participants were 208 adult smokers (128 females, 80 males) who desired to quit and remain abstinent from smoking. They were recruited via newspaper advertisements and community referrals. All participants had been smoking daily for at least 1 year, had a salivary cotinine level greater than 10 ng/ml upon entering the study, and were evaluated as physically healthy by a physician.

### *Procedure*

The present study is part of a larger, double-blind study examining the effectiveness of fluoxetine as an adjunct to behavioral smoking-cessation treatment. Participants were randomly assigned to three levels of fluoxetine: 60 mg, 30 mg, and placebo. Three of the larger study's 16 sites participated in the present study.

The protocol involved 9 visits, with the quit smoking date occurring at Visit 3. Except for visits 3 and 4, which occurred within 2 to 3 days of each other, the first 6 visits occurred week by week. Two weeks elapsed between each of visits 7 to 9. After signing an informed consent form at Visit 1, participants completed a full medical history, the Mizes Anorectic Cognitions questionnaire (Mizes & Klesges, 1989), concerns about the present cessation attempt (i.e., postcessation weight-gain concern), and several questionnaires pertaining to their smoking history. Participants were also screened for clinical

depression using the Hamilton Depression Rating Scale (Hamilton, 1960). Individuals scoring higher than 14 on the Hamilton Depression Rating Scale were excluded from participation.

All subjects participated individually in a smoking-cessation behavior modification program that continued through Visit 9. The program provided three behavior modification sessions prior to and including the quit date, during which participants focused on what they had learned from previous quit attempts. Prior to the quit date, patients reviewed their reasons for smoking as well as their reasons for quitting. Patients completed self-monitoring of their smoking in order to assess situational and emotional triggers to smoking and to assist in developing individualized intervention plans. Intervention plans included strategies such as stimulus control procedures, alternative behaviors to replace smoking (i.e., chewing gum, taking a walk), social support via a buddy, cognitive strategies, and self-reward. Participants signed a stop smoking contract and made a \$25 deposit refundable upon completing the study. After the quit date, participants addressed the role of stress on relapse in order to predict potential relapse situations, and coping with "slips" so that complete relapse to smoking did not occur. Patients were encouraged to self-reinforce for not smoking. A formal weight-control intervention was not part of the intervention. However, therapists could encourage general strategies for weight gain experienced, such as increasing exercise and reducing caloric intake. Therapists were available for phone calls from participants who needed additional support between visits.

### Measures

The Mizes Anorectic Cognitions questionnaire (MAC; Mizes & Klesges, 1989) was included in the study to examine the influence of generalized chronic weight concern on relapse to smoking. The MAC is a 33-item questionnaire that measures three dimensions of pathological eating attitudes: strict weight regulation (i.e., chronic weight concern), self-control as a basis of self-esteem, and weight and eating behavior as the basis of approval. The items on the MAC are rated using a 5-point Likert-type scale (1 = *strongly disagree*, 5 = *strongly agree*). The MAC subscales and the total score reveal moderate to high internal consistency, ranging from .75 to .91 (Mizes & Klesges) and acceptable discriminant and concurrent validity (Mizes & Christiano, 1995). Research on the MAC has shown it to be associated with weight concerns and behavior in a nonclinical population (Mizes, 1990). Only the strict weight-regulation subscale of the MAC was included in the present study. This subscale measures a variety of inaccurate nutritional beliefs that lead people to conclude that weight gain will occur very easily. Individuals scoring high on this subscale believe that they must regulate their weight tightly to prevent feared weight gain from occurring. Illustrative items of the MAC rigid weight-regulation subscale include, "If I don't have a specific routine for my daily eating, I'll lose all control and I'll gain weight"; "When I feel very hungry, I can't give into that hunger. If I do I'll never stop eating

and I'll soon be fat"; and "If I gain one pound, I'll go on and gain a hundred pounds, so I must keep precise control of my weight, food, and exercise."

The Hamilton Depression Rating Scale (HDRS) was included as a requirement of the larger protocol to exclude individuals who were clinically depressed. The exclusion existed to eliminate possible success in smoking cessation as a result of improvement in depressed mood. The HDRS is a 21-item clinician-rated inventory for depression, scored on the basis of a structured interview with participants. The HDRS has shown acceptable levels of validity and interrater reliability (Bech, Bolwig, Kramp, & Rafaelsen, 1979).

Additional self-report measures that were collected at the initial visit included participants' greatest concern regarding the present quit attempt (e.g., postcessation weight-gain, others smoking, stress), the number of cigarettes they smoked on average per day, and how many years they had smoked. Each participant's weight and height were taken at their initial visit and their weight was taken at each subsequent visit throughout the study. Initial weight and height were converted to Quintelet's body mass index (BMI; weight in kg/height in meters<sup>2</sup>; Williamson, 1990) for each participant.

Definitions of successful continuously abstinent nonsmokers and relapsed smokers were specified by the larger protocol. Continuously abstinent nonsmokers were defined as those who indicated zero cigarettes smoked by self-report diaries and who had saliva cotinine levels < 10 ng/ml for a minimum of 1 month. Persons not meeting these criteria were considered to be relapsed smokers. These definitions were selected to be similar to those used most commonly in large epidemiologic studies of smoking, such as the National Teenage Tobacco Survey, the 1989 Teenage Attitudes and Practices Survey, the National Household Surveys on Drug Abuse, and the Monitoring the Future Project (U.S. Department of Health and Human Services, 1994). "Current smoker" in these studies was defined as *any* smoking in the past 30 days; status as a "former smoker" was defined as no smoking within the past 30 days among persons who have been regular smokers. The definition of continuously abstinent nonsmoker used in the current study is similar to that used by Meyers et al. (1997), who also specified that a nonsmoker had experienced no smoking since the quit date.

## Results

### *Demographic Characteristics*

Table 1 presents demographic characteristics and mean scores on the predictor variables for the participants in the study, separately for men and women. Participants ( $N = 208$ ) ranged in age from 18 to 66 ( $M = 41$ ,  $SD = 9.3$ ). Ninety-nine percent of the participants had at least a high school education and 34% had at least a 4-year college degree. Participants were predominately Caucasian ( $n = 203$ ) and married ( $n = 129$ ). Average BMI for the group was 25 ( $SD = 4.3$ ).

TABLE 1  
 DEMOGRAPHIC CHARACTERISTICS AND DESCRIPTIVE STATISTICS  
 FOR PREDICTOR VARIABLES AS A FUNCTION OF GENDER

| Variable                                | Men<br>( <i>N</i> = 84) | Women<br>( <i>N</i> = 124) |
|---|-------------------------|----------------------------|
| Age                                     | 40.8 (12.0)             | 41.4 (9.5)                 |
| Caucasian                               | 100                     | 94                         |
| Married                                 | 75                      | 53                         |
| Number of cigarettes smoked per day     | 31.1 (14.6)             | 25.8 (9.1)                 |
| Baseline BMI                            | 26.11 (4.2)             | 24.2 (4.2)                 |
| Baseline weight                         | 184.5 (33.8)            | 149.0 (31.1)               |
| Smoking cessation weight gain concern   | 23                      | 38                         |
| Weight change                           | 2.1 (5.6)               | 2.2 (5.2)                  |
| Strict weight regulation subscale score | 39.3 (10.6)             | 40.6 (12.0)                |

Note: Caucasian, married, and weight gain concern in percentages and standard deviations in parentheses.

### Statistical Analyses

Prior studies have typically defined relapse in terms of both relapse to smoking while remaining in the cessation program and drop out from the cessation program. Dropout is included within relapse because it is logically assumed that individuals are dropping out because they have returned to smoking. However, one study (Streater et al., 1989) separately examined individuals who relapsed while remaining in the cessation program and individuals who dropped out of the cessation program. This study found that dropout from a cessation program was related to smoking-related weight gain concern while relapse was not. Therefore, analyses in the present study separately examined participants who dropped out of the study (i.e., attrition) and participants who relapsed but remained in the study.

Because participants were also receiving fluoxetine, preliminary analyses were conducted to examine the effect of treatment group (i.e., 60 mg, 30 mg, and placebo) on dropout and relapse to smoking. These analyses revealed that treatment group did not significantly affect either dropout ( $R^2 = .001$ ,  $p > .60$ ) or relapse to smoking (Odds Ratio = .84,  $p > .30$ ). Consequently, treatment group was not included in subsequent analyses.

The predictor variables for both dropout and relapse analyses were BMI, cessation-related weight gain concern, gender, weight change (baseline weight—weight at last visit), and the strict weight-regulation subscale of the MAC. Gender was predicted to impact both weight status and BMI; therefore, interaction variables were created with gender and cessation-related weight gain concern, and gender and BMI. Weight change was predicted to interact with scores on the strict weight regulation subscale of the MAC; thus, an interaction variable was also created with these two variables. Base-

line number of average cigarettes smoked per day was entered in the first step of the regression models to control for baseline level of nicotine dependence.

*Dropout from the cessation program.* A hierarchical multiple-regression model was used to predict dropout. This approach was employed for two reasons. First, a number of studies (e.g., Nides et al., 1995) have demonstrated that baseline smoking impacts successful completion of a cessation program. Therefore, we wanted to control for the effect of baseline number of cigarettes smoked. Second, the effect of interaction variables can only be meaningfully interpreted when entered separately into a multiple regression design (Tabachnick & Fidell, 1989).

*Relapse to smoking.* To investigate the variables that discriminated between participants who relapsed (i.e., relapsed to smoking during the cessation attempt but remained in the study) and participants who remained abstinent, a multiple logistic regression was conducted using relapse as the dependent variable. A logistic regression model was employed due to the non-parametric nature of the relapse variable. Similar to the analysis of dropout, baseline cigarettes smoked per day was entered into the first step of the logistic regression model. All other predictor variables were entered into the second step of the analysis.

Table 2 presents the correlation matrix for the predictor variables. As can be seen in Table 2, collinearity was not present, therefore, regression analyses were able to be performed.

#### *Dropout From the Cessation Program*

Table 3 presents the  $R^2$ ,  $R^2$  change, and beta weights for the regression model. Since the interactions were computed from predictor variables previously entered into the regression model, beta weights for interaction variables are not included in Table 3 because they are not meaningful. The

TABLE 2  
INTERCORRELATIONS OF PREDICTOR VARIABLES

| 1.                 | 2.   | 3.                  | 4.            | 5.                | 6.     | 7.             | 8.                     | 9.                             |
|--------------------|------|---------------------|---------------|-------------------|--------|----------------|------------------------|--------------------------------|
| Baseline cigarette | BMI  | weight gain concern | weight change | strict regulation | gender | *gender by BMI | *gender by wt. concern | *strict wt. reg. by wt. change |
| 1.00               |      |                     |               |                   |        |                |                        |                                |
| .04                | 1.00 |                     |               |                   |        |                |                        |                                |
| -.11               | -.11 | 1.00                |               |                   |        |                |                        |                                |
| -.06               | .02  | -.15                | 1.00          |                   |        |                |                        |                                |
| -.11               | .29  | .13                 | .17           | 1.00              |        |                |                        |                                |
| -.24               | -.20 | .16                 | .01           | .06               | 1.00   |                |                        |                                |
| -.20               | .33  | .07                 | .03           | .22               | .85    | 1.00           |                        |                                |
| -.12               | -.16 | .95                 | -.12          | .10               | .31    | .19            | 1.00                   |                                |
| -.08               | .05  | -.12                | .94           | .32               | .01    | .04            | -.11                   | 1.00                           |

\* computed interaction variables.

TABLE 3  
 PREDICTORS OF DROP DATE FROM SMOKING CESSATION PROGRAM

| Variable                                  | R <sup>2</sup> | R <sup>2</sup> change | Beta  |
|---|----------------|-----------------------|-------|
| First block                               |                |                       |       |
| Baseline cigarettes                       | .01            |                       | .12   |
| Second block                              | .21            | .20**                 |       |
| BMI                                       |                |                       | .18*  |
| Postcessation weight concern              |                |                       | -.35* |
| Gender                                    |                |                       | -.02  |
| Strict weight regulation subscale         |                |                       | .04   |
| Weight change                             |                |                       | .12   |
| Third Block                               |                |                       |       |
| Gender by BMI                             | .22            | .01*                  |       |
| Fourth Block                              |                |                       |       |
| Gender by postcessation weight concern    | .23            | .01*                  |       |
| Fifth Block                               |                |                       |       |
| Strict weight regulation by weight change | .24            | .01*                  |       |

\*  $p < .01$ . \*\*  $p < .001$ .

significance of the interaction predictor variables is determined by the significance of  $R^2$  change.

As can be seen in Table 3, predictor variables entered into the second block accounted for a significant amount of variance in dropout visit. However, the only significant beta weights were found for BMI and cessation-related weight gain concern. Consistent with hypotheses of the present study, individuals with lower BMIs were more likely to drop out of the cessation program ( $r = .23$ ). Average dropout visit for those with a BMI of less than 25 was 6.4 ( $SD = 3.4$ ), compared to average dropout visit of 7.6 ( $SD = 3.6$ ) for those with a BMI over 25. Also consistent with predictions, individuals who were concerned about cessation-related weight gain were more likely to drop out of the cessation program ( $r = -.48$ ). Average dropout visit for individuals who were concerned about cessation-related weight gain was 5.1 ( $SD = 3.1$ ) compared to the average dropout visit of 8.8 ( $SD = 2.9$ ) for individuals who did not report being concerned about cessation-related weight gain. This indicates that individuals who were concerned about cessation-related weight gain, on average, dropped out of the program after their second visit in the cessation phase. In contrast, individuals who did not report concern about cessation-related weight gain, on average, remained in the program for the duration. As expected, gender alone was not predictive of early dropout. However, both gender by BMI and gender by postcessation weight-gain concern interaction variables accounted for a significant amount of variance in dropout visit. The weight change by strict weight regulation subscale interaction variable also accounted for a significant amount of variance in dropout visit.

To explore the significant interaction variables further, three analyses of covariance (ANCOVAs) were performed using dropout visit as the dependent variable, the interaction variables as the between-subjects variables, and the variables entered into the hierarchical multiple regression analysis prior to the interaction variables as the covariates. Scheffe post-hoc tests were then performed to examine the significant interactions effects. The variables of BMI, strict weight-regulation subscale, and postcessation weight change were computed into dichotomous variables using a median split approach. For the significant interaction effect of gender by BMI, post-hoc tests revealed that females with BMIs less than 25 dropped out of the cessation phase earlier (dropout visit  $M = 6.6$ ,  $SD = 3.2$ ) than the other male and female participants in the study,  $M = 8.4$ ,  $SD = 3.2$ ;  $t(206) = 2.36$ ,  $p < .03$ . Post-hoc tests of the interaction variable of gender by postcessation weight gain concern revealed that females who were concerned about postcessation weight gain average dropout visit was earlier ( $M = 4.8$ ,  $SD = 2.9$ ) than the other male and female participants in the study,  $M = 8.8$ ,  $SD = 2.9$ ;  $t(206) = 5.64$ ,  $p < .01$ . In considering these interactions, it appears that BMI and weight concerns are not confounded. For persons with a BMI less than 25, 36% indicated high cessation-related weight-gain concern. For those over a BMI of 25, 32% indicated weight-gain concern. As predicted, participants who scored high on the strict weight-regulation subscale of the MAC at pre-test and gained weight during the cessation attempt dropped out of the cessation phase earlier ( $M = 6.7$ ,  $SD = 3.2$ ) than the other male and female participants in the study,  $M = 8.9$ ,  $SD = 2.8$ ;  $t(206) = 2.09$ ,  $p < .03$ .

### *Relapse to Smoking*

The multiple logistic regression analysis yielded a Goodness-of-Fit chi square of 121.83 ( $df = 114$ ,  $p = .33$ , total  $N = 122$ ), which suggests that the model was a good fit to the data. Results of the multiple logistic regression analysis revealed that gender was a significant predictor of relapse (Odds Ratio = .26,  $p < .01$ ; males = 1, females = 2), with males being nearly twice as likely to relapse to smoking during the cessation attempt than females. No other predictor variables were significant.

Of the 122 participants who remained in the cessation program until completion, only 25 relapsed to smoking. Therefore, the significant result of the logistic multiple regression should be considered tentative.

## Discussion

The results of the present study indicate that, although weight-related variables are important in predicting success in a smoking-cessation program overall, body weight status and concern about weight gain due to stopping smoking are of particular importance. Individuals who reported being concerned about postcessation weight gain, on average, dropped out of the program at the second session of the cessation phase. Thus, individuals con-

cerned about weight gain may drop out of a cessation program before any weight gain occurs. Our findings are consistent with those of Meyers et al. (1997), but inconsistent with those studies that did not find a significant effect of weight gain concerns on smoking cessation. Cessation programs may be more efficacious with individuals experiencing smoking-specific weight gain concerns by addressing their concerns prior to initiation of smoking cessation. Participants with lower BMIs were also likely to drop out of the cessation program before the completion of the program. Only 36% of the participants who dropped out of the study and had BMIs less than 25 reported being concerned about postcessation weight gain. Thus, it does not appear that individuals with low body weight status dropped out solely because of fear of weight gain. The present study, however, did not examine this possibility directly and it needs to be addressed in future research.

As expected, results of the study indicate that gender alone is not predictive of early dropout from a smoking cessation attempt. However, the interaction of gender and other weight-related variables was predictive of failure to quit smoking. Klesges and colleagues (1989) postulated that there may be subgroups of smokers who would find even minimal weight gain as aversive, and therefore be more likely to return to smoking. The present study found that the interaction of BMI and gender was predictive of dropout from the cessation program, with lower-weight women dropping out of the program earlier than other participants in the study. This result adds support to the suggestions of Klesges and colleagues. Future research should further explore the hypothesis of Klesges et al. by examining the perception of experienced weight gain among men and women of varying weight status during a cessation attempt.

Gender was also found to interact significantly with smoking-specific weight concern in the prediction of dropout from the smoking-cessation program. Results showed that females who were concerned about postcessation weight gain dropped out of the program earlier than the other male and female participants in the study. These findings are in contrast to Meyers et al. (1997) and Jeffrey et al. (1997), neither of which found a significant effect of the interaction of gender and weight concerns. Thus, the current findings should be viewed as tentative until they are replicated.

French and colleagues (1992) found that individuals who scored high on a chronic weight-concern measure (i.e., dietary restraint) were marginally more likely to remain abstinent during a cessation attempt. This finding was unexpected. These researchers postulated that individuals who evidenced chronic weight concern may be less likely to gain weight and, thus, less likely to relapse to smoking. The exclusion of interaction variables in their study precluded examination of this hypothesis. However, the present study included the interaction of chronic weight concern and weight change in the prediction of dropout from the cessation program. Results indicate that individuals who scored high on the subscale and gained minimal to no weight, on average, remained in the cessation program for the duration. In contrast,

individuals who scored high on chronic weight concern but did experience weight gain dropped out of the program before completion. Therefore, it would appear that individuals who have chronic weight concern but are able to maintain their weight are most likely to be successful in a cessation attempt. Cessation programs should be sensitive to individuals with chronic weight concerns and monitor their weight change during a cessation attempt.

The interaction effects observed in this study accounted for a relatively small percent of the variance, in comparison to the individual effects of relative body weight and smoking-specific weight concerns. As seen in Table 3, the increase in  $R^2$  for all the interaction variables was .01, which may not initially seem impressive. Thus, these interaction effects should be viewed conservatively. However, as Rosenthal (1995) has pointed out,  $R^2$ 's of the magnitude obtained in the present study are substantial for social science.

Analyses of relapse (i.e., relapse to smoking while remaining in the program) were not very revealing in terms of our weight-related hypotheses. This could have been due to a small sample size relative to the number of predictor variables. A much larger number of relapsed smokers who remained in the program would be needed in order to have stable findings for the predictor variables (Tabachnick & Fidell, 1989). Another possibility is the separation of participants who dropped out of the cessation program. Using a definition of relapse that included dropout from the cessation program might have produced different results. However, as stated previously, prior research (Weekley et al., 1992) has shown that separately examining relapse and dropout period (or visit) from a cessation program is more revealing in terms of predicting relapse due to weight related variables. Therefore, dropout visit may be a better variable to employ when investigating which individuals are most vulnerable to relapse to smoking due to weight-related concerns and changes.

In interpreting the findings of this study, a few cautions are suggested. First, the relative importance of the predictor variables are influenced by the relative sensitivity of the specific measures used for specific predictor variables. Thus, it is necessary to replicate the current study's findings using different measures of the same constructs in order to obtain a clearer picture of the relative importance of weight-related predictor variables. In that regard, the specific method of assessing smoking-specific weight gain concerns may have influenced the results of this study. Our participants indicated what concerned them most about quitting by choosing one of six alternatives, of which weight gain was one choice. Those persons selecting weight gain as their greatest concern constituted our weight-gain-concerned smokers group in a dichotomous fashion. This is different from other studies that used a continuous measure of smoking-specific weight gain concerns. The relative sensitivity and validity of various approaches to measuring smoking-specific weight gain concerns merits further investigation.

The present study had several limitations. Participants from the present study were primarily college-educated, Caucasian women. Results from prior

studies (e.g., Ogen & Fox, 1994; Rauh, Nicholson, Lamke, & Matloff, 1990) suggest that it is unlikely that the findings of the present study are attributable to the population examined in the study. Nevertheless, future studies should employ a more diverse sample to examine whether the results of the present study are replicated using other ethnic groups and individuals with less education. Different ethnic and racial groups may have different social norms and expectations regarding relative weight, thereby possibly influencing the extent to which weight-related concerns and actual weight gain are barriers to smoking cessation for various groups. Additionally, all participants were self-selected to participate in a cessation program, so it is possible that the present study included a select group of individuals who were motivated to quit smoking. Although this study provided information on weight-related variables and concerns among those willing to at least start a program to stop smoking, it did not provide information on the influence of weight-related concerns and variables in terms of being a barrier to even attempting smoking cessation. Future studies should examine a more diverse sample that is randomly selected from the general population. Some potentially important predictor variables (such as demographics and other interaction variables) were not included in the data analysis design in order to avoid Type I errors. A larger sample size would allow for a more thorough examination of varied predictor variables. In addition to these shortcomings, it would have been of interest to examine relapse to smoking over a longer period of time. Although maintenance visits were offered to participants, too few participants returned for these visits to permit meaningful statistical analyses. Finally, it is an assumption that people who dropped out of the study prematurely returned to smoking. In future studies it would be useful to verify the smoking status of individuals who left the study prematurely and did not complete treatment.

In summary, the present study illustrates the multiple and complex reasons why individuals drop out or relapse in smoking-cessation attempts. Although the available research is at present contradictory, the current results suggest that further research into the role of weight concerns and weight-related variables in smoking cessation is warranted. These results demonstrate the need for each individual to be thoroughly assessed prior to initiating a cessation attempt to determine what factors may be most predictive of dropout or relapse for the individual. Unfortunately, it is not clear what treatments to recommend for persons who are at greater risk of relapse due to weight concerns or other weight-related issues. Treatments that integrate weight control treatment and smoking interventions have largely been unsuccessful in reducing postcessation smoking or increasing cessation rates (Hall, Tunstall, Vila, & Duffy, 1992; Pirie et al., 1992). Rather than reducing postcessation weight gain, it may be more realistic to reduce weight concerns by using cognitive behavioral treatments for body image dissatisfaction that have been recently developed for overweight persons (Rosen, Orosan, & Reiter, 1995).

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