

WHEN DOES CIGARETTE FADING INCREASE THE LIKELIHOOD OF FUTURE CESSATION?

Arthur J. Farkas, Ph.D.
University of California, San Diego

ABSTRACT

Objective: To determine which smokers report cigarette fading, how much they fade, when fading leads to quitting, and, if not, whether it can be maintained. Methods: Subjects were 1,682 adult smokers interviewed by telephone in 1990 and 1992 as part of the California Tobacco Survey. Data from three timepoints in the same subjects were compared. At Time 1 (one year before the baseline survey), all respondents were daily smokers who recalled their average daily cigarette consumption retrospectively at baseline. At Time 2 (baseline survey), all respondents were current smokers who provided concurrent data on their average daily cigarette consumption. At Time 3 (follow-up), smoking status and current cigarette consumption among nonabstinent respondents were assessed. Results: Nearly 18% of smokers reduced consumption between Times 1 and 2. The mean reduction was 13 cigarettes per day. Only moderate to heavy smokers who reduced consumption to below 15 cigarettes per day were more likely to be in cessation at Time 3 (24.9% versus 5.8%, respectively). The cessation rate for moderate to heavy smokers that became light smokers by baseline was similar to that for smokers who were already light smokers 1 year before baseline. Continuing smokers who reduced consumption between Times 1 and 2 maintained a mean reduction of 11.4 cigarettes per day. Conclusions: Cigarette fading increases cessation among moderate to heavy smokers who become light smokers.

(Ann Behav Med 1999, 21(1):71-76)

INTRODUCTION

According to the nicotine regulation hypothesis, smokers work to maintain a steady level of nicotine exposure (1). Smokers are able to maintain exquisite control of their nicotine exposure by controlling the number of cigarettes smoked, nicotine yield of the cigarette, as well as their smoking topography (2-5). According to the compensation hypothesis, a reduction in any of the parameters that determine the level of nicotine exposure (e.g. yield) will lead to compensatory increases in the remaining parameters (e.g. number of cigarettes smoked) (1,6).

When smokers are allowed to smoke their usual brand of cigarettes *ad libitum*, they extract, on average, about 1.0 mg of nicotine per cigarette (7,8). Even after adjustments for age, gender, nicotine yield per cigarette, and filtering, the number of cigarettes smoked per day was the only significant predictor of diurnal nicotine exposure (8). A subsequent study, which controlled both cigarette number and yield, showed that when smokers of 1.0-mg

cigarettes reduced consumption from 20 to 10 cigarettes per day they experienced a 50% drop in their exposure to nicotine (9).

Smokers who switch to a cigarette brand with a lower nicotine yield, as measured by a standardized *in vitro* machine smoking procedure (10), tend to show less exposure to nicotine, as measured by the biochemical assay of body fluids (11). Due to compensatory changes in the way people smoke lower yield cigarettes, reductions in yield overestimate reductions in actual nicotine exposure (3-5,11,12). Because of compensatory smoking, modest reductions in yield (e.g. from 1.0 to 0.7 mg) produce much smaller reductions in nicotine exposure than expected (11,12). Larger reductions in yield (e.g. from 1.0 to 0.1 mg) tend to reduce exposure by about 40% even in the face of considerable compensatory smoking (e.g. increasing the number of cigarettes by 20%) (12).

Nicotine addiction is the major impediment to successful smoking cessation (13). It has been repeatedly shown in a variety of contexts that lighter smokers are more likely to achieve cessation in the near term than are heavier smokers. Studies of formal treatment programs (14), epidemiological studies (15-17), as well as studies of self-quitting have all shown a strong association between lighter consumption and higher rates of successful cessation (18-20).

Studies have shown that reducing nicotine exposure can increase the likelihood of cessation (21-35). The main methods for reducing exposure to nicotine has been brand switching (23-30,32,33) and reducing the number of cigarettes smoked (21,22,26,30,31,34,35). Two additional methods for reducing nicotine exposure are smoking less of each cigarette (36,37) and smoke dilution (38,39). Although some studies use a single fading method, multicomponent interventions frequently employ two or more of the methods described above.

The present study used longitudinal data from the California Tobacco Survey (CTS) to determine the extent to which California smokers fade cigarettes and to examine the effects of fading on cessation and consumption. The study addressed four questions: (a) Is cigarette fading observed in all demographic subgroups?; (b) When smokers fade cigarettes, how large is the typical reduction?; (c) What is the best way to measure effective fading when the likelihood of successful cessation is the criterion?; and (d) Can smokers who fade, but do not quit, maintain their reduced consumption levels?

METHODS

Sample

A modified Waksberg random-digit-dialed telephone methodology (40) and a two-stage sampling design were used in the 1990 California Tobacco Survey. A 25-minute computer-assisted telephone interview (CATI) was conducted on 24,296 adults and addressed multiple issues relating to tobacco use (41). Fieldwork was completed by Westat, Inc., following a protocol aimed at maximizing response rates and data quality (42,43). All data were

Reprint Address: A. J. Farkas, Ph.D., Cancer Prevention and Control Program, Cancer Center, Mail Code 0645, University of California, San Diego, La Jolla, CA 92093-0645.

weighted to account for the study design, as well as to ensure that estimates were representative of the California population by age, sex, race/ethnicity, education, and geographical region.

A stratified random sample of respondents to the 1990 survey was reinterviewed in 1992. The probability of selection for reinterview was much higher for anyone reporting smoking within 5 years of the 1990 interview. The interval between baseline and follow-up surveys ranged from 437–751 days with a median of 608 days. To determine whether the longitudinal panel was representative of the California population of smokers, their demographic characteristics were compared with those for all participants eligible for selection from the 1990 California Tobacco Survey. Demographic differences between the final sample and the initial sampling frame (CTS 1990) were less than 5% for any subcategory of age, gender, race/ethnicity, or educational level attained (44).

The present analysis included 1,682 current smokers from the longitudinal sample who answered "Yes" to the following questions in 1990: "Have you smoked at least 100 cigarettes in your entire life?"; "Do you smoke cigarettes now?"; and "Were you smoking at all around this time 12 months ago?". They also answered "Everyday" to the question: "Did you smoke everyday or some days at this time 12 months ago?"

Measures of Cigarette Fading and Smoking Status

The study examined cigarette consumption and smoking status from three time periods: (a) one year prior to the baseline interview (Time 1); (b) baseline (Time 2); and (c) follow-up (Time 3). The data collected at Time 2 consisted of concurrent data on consumption in 1990, retrospective reports of quit attempts in the previous year, and retrospective reports of consumption in 1989. The data at Time 3 consisted of concurrent data on consumption and cessation in 1992.

Cigarette consumption at Time 1 was ascertained by the question, "How many cigarettes were you smoking per day at this time 12 months ago?" At Times 2 and 3, cigarette consumption for daily smokers was ascertained by the question, "How many cigarettes on average do you smoke per day?" At Times 2 and 3, cigarette consumption for occasional smokers was ascertained by two questions, "On how many of the past 30 days did you smoke cigarettes?" and "During the past 30 days, on the days that you did smoke, about how many cigarettes did you usually smoke per day?" For the nondaily smokers, the product of the number of cigarettes smoked per day by the number of days smoked, divided by 30, and rounded to the nearest whole cigarette was used as their estimated daily cigarette consumption. Finally, smokers who answered "No" to "Do you smoke cigarettes now?" at Time 3 were classified as being in cessation.

Four measures of cigarette fading between Times 1 and 2 were calculated. The first measure (ANY FADING) divided smokers into two groups based on whether they reduced consumption by at least one cigarette (i.e. no reduction versus at least one cigarette). The second measure (ABSOLUTE REDUCTION) divided smokers into five groups on the basis of the number of cigarettes reduced (i.e. no reduction, 1 to 9 cigarettes, 10 to 14 cigarettes, 15 to 19 cigarettes, or 20+ cigarettes). The third measure (PERCENT REDUCTION) divided smokers into five groups on the basis of the percentage of cigarettes reduced (i.e. no reduction, 1% to 33%, 34% to 49%, 50% to 66%, or more than 66%). The fourth measure (CONSUMPTION AFTER FADING) divided smokers into three groups based on their consumption level after fading (i.e. no reduction, 15+ cigarettes, or <15 cigarettes).

TABLE 1

The Likelihood of a Self-Reported Reduction of at Least One Cigarette per Day during the Previous 12 Months Among California Smokers Interviewed in 1990 as Part of the California Tobacco Survey (N = 1,682)

Variable	N	% Smokers Reporting a Reduction		
		OR ^a	CI ^b	
Gender				
Male	826	18.7	1.00	—
Female	856	17.8	1.25	0.79–1.97
Age Group (Years)				
18 to 24	126	25.4	1.00	—
25 to 44	808	16.7	0.58	0.27–1.25
45 to 64	562	15.7	0.50	0.22–1.11
65+	186	21.4	0.85	0.37–1.96
Ethnicity				
Non-Hispanic White	1376	16.4	1.00	—
African-American	86	21.3	1.60	0.71–3.60
Hispanic	141	23.8	2.27	1.08–4.76
Asian-Other	79	23.9	1.98	0.69–5.67
Education				
High School or less	771	18.0	1.00	—
More than High School	911	18.8	1.32	0.85–2.07
Recent Quitting History (Days)				
0	995	13.1	1.00	—
1 to 6	364	20.2	1.88	1.04–3.38
7+	323	28.4	3.16	1.66–6.03
Daily Cigarette Consumption				
<15	362	15.3	1.00	—
15 to 24	805	12.8	1.32	0.64–2.75
25+	515	31.5	5.50	2.58–11.61

a = Odds ratios adjusted for the other variables in the multiple logistic regression; b = 95% Confidence Interval.

Data Analysis

Weighted percentages, means, odds ratios, and 95% confidence intervals (CIs) are reported. Differences in percentages were evaluated by use of a special chi-square procedure for complex sample designs (45). The CIs were based on variance estimates derived by the statistical analysis package, WesVarPC, that used a jackknife procedure (43,46,47).

RESULTS

Demographic Characteristics of Smokers Who Report Cigarette Fading

Table 1 shows the results of a logistic regression to predict which daily smokers at Time 1 would fade cigarettes by Time 2. Nearly one smoker in five faded at least one cigarette (18.3% ± 3.0%). Hispanic smokers were more likely than Non-Hispanic Whites to fade cigarettes (OR_{adj} = 2.27). The results suggest that with a larger sample of African-Americans and Asian-Others, these minority groups might also be more likely the Non-Hispanic Whites to fade cigarettes. In contrast, gender, age, and level of education were not significant predictors of fading.

In addition, consumption at Time 1 and quitting history between Times 1 and 2 were also significant predictors of cigarette fading. In contrast with light and moderate smokers, heavy smokers (i.e. those who smoked 25+ cigarettes per day) were more than five times more likely to report cigarette fading (OR_{adj} = 5.50). Smokers who reported making a longer quit attempt (i.e. a week or more) were three times more likely to report cigarette fading (OR_{adj} = 3.16) than those who reported making no

TABLE 2

Consumption at Time 2 Among Smokers Who Faded Cigarettes
($N = 305$) Regressed on Time 1 Consumption and Demographics

Variable	Standardized β	Zero-Order Correlation
Consumption Time 1	.77*	.78
Recent Quitting History	-.02	-.17
Age	.04	.12
Gender	-.05	-.07
Ethnicity	.01	.22
Education	.06	.00
$F(6,298)$	77.11*	
Adjusted R^2	.60	

Note: Predictors include consumption at Time 1, age and dummy variables for gender (male versus female), ethnicity (Non-Hispanic White versus other), and education (high school or less versus more than high school).

* $p < .01$.

quit attempts in the previous year. Similarly, those who reported making a shorter quit attempt (i.e. < a week) were nearly twice as likely to report cigarette fading ($OR_{adj} = 1.88$) than those who reported making no quit attempts.

Number of Cigarettes Faded

Table 2 contains the multiple regression of consumption at Time 2 on consumption at Time 1 and demographic variables among the smokers who faded cigarettes. The 305 smokers who faded reduced their average consumption from 25.7 ± 3.1 cigarettes at Time 1 to 12.7 ± 1.9 cigarettes at Time 2. Of the variables included in the regression analysis, only consumption at Time 1 was a significant predictor of consumption at Time 2 (Adjusted $R^2 = 0.60$; $F(6, 298) = 77.11$, $p < 0.001$). While all of these smokers reduced their level of consumption between Times 1 and 2, they tended to maintain their relative position in the distribution (i.e. heavier smokers at Time 1 tended to remain in the upper half of the distribution at Time 2, while lighter smokers at Time 1 tended to remain in the lower half of the distribution at Time 2).

Comparison of Four Definitions of Cigarette Fading

Table 3 shows the results of four logistic regressions to predict cessation at Time 3. These analyses have been restricted to 1,320 moderate to heavy smokers at Time 1. Each of the logistic regressions used a different measure of cigarette fading. In all four analyses, the 1,075 smokers who had not reduced consumption between Times 1 and 2 served as the reference group. At Time 3, $9.1\% \pm 2.7\%$ of the smokers in the reference group were in cessation. The odds ratios shown in Table 2 have all been adjusted for age, gender, ethnicity, education, and recent quitting history.

The 245 moderate to heavy smokers who faded cigarettes reduced their average consumption from 30.6 ± 2.8 cigarettes at Time 1 to 15.2 ± 2.1 cigarettes at Time 2. In the first multiple logistic regression, the smokers were divided into two groups based on whether they reported any fading between Times 1 and 2. Of the 245 moderate to heavy smokers who reported any fading between Times 1 and 2, $15.9\% \pm 5.6\%$ were in cessation at Time 3. Although this rate was significantly higher than that observed for the reference group ($X^2 = 5.13$; $df = 1.00$; $p < 0.03$), the adjusted odds ratio for the group that faded ($OR_{adj} = 1.54$) was not significantly greater than 1.00.

TABLE 3

Comparison of Four Definitions of Cigarette Fading and the Likelihood of Cessation Among Moderate to Heavy Smokers Drawn from the 1990–1992 Longitudinal Sample of the California Tobacco Survey
($N = 1,320$)

Definition of Cigarette Fading	N	Quit %	OR^a	CI^b
Any Fading				
None	1,075	9.1	1.00	—
At least one cigarette	245	15.9	1.54	0.87–2.73
Absolute Number of Cigarettes Reduced				
1 to 9	47	7.3	0.74	0.18–3.03
10 to 14	97	14.7	1.37	0.53–3.50
15 to 19	31	23.2	2.16	0.45–10.40
20+	70	19.2	2.04	0.84–4.95
Percentage Reduction in Cigarettes				
1% to 33%	79	7.8	0.79	0.24–2.55
34% to 49%	22	2.4	0.21	0.02–2.61
50% to 66%	92	14.4	1.34	0.61–3.01
67+%	52	31.7	3.85	1.46–10.18
Consumption Level after Fading (cigarettes)				
15+	123	5.8	0.57	0.21–1.52
<15	122	24.9	2.62	1.32–5.18

a = Odds ratios adjusted for age, gender, ethnicity, education, and recent quitting history; b = 95% Confidence Interval.

In the second multiple logistic regression, the 245 smokers who faded were divided into four groups depending on their absolute reduction in number of cigarettes. The rates of cessation observed for the reference group and these four groups did not differ significantly ($X^2 = 5.87$; $df = 3.13$; $p < 0.13$). None of the adjusted odds ratios for the four levels of fading were significantly greater than 1.00.

In the third multiple logistic regression, the 245 smokers who reported any fading were divided into three groups depending on their percentage reduction in cigarettes. In contrast with the previous analysis, the rates of cessation observed for the reference group and these three groups differed significantly ($X^2 = 12.67$; $df = 2.20$; $p < 0.003$). However, only the adjusted odds ratio for the 52 smokers who reduced their consumption by two-thirds or more was significantly greater than 1.00 ($OR_{adj} = 3.85$).

In the final multiple logistic regression, the 245 smokers who faded were divided into two groups depending on their consumption level after fading. The rates of cessation observed for the reference group and these two groups differed significantly ($X^2 = 14.50$; $df = 1.57$; $p < 0.001$). However, only the adjusted odds ratio for the 122 smokers who reduced their consumption to less than 15 cigarettes per day was significantly greater than 1.00 ($OR_{adj} = 2.62$).

Initial Consumption, Fading History, and Cessation

Table 4 shows the relationship of initial consumption level, fading history, and subsequent cessation. Of the 362 light smokers identified at Time 1, the 60 light smokers who faded cigarettes reduced their average consumption from 8.8 ± 1.4 cigarettes at Time 1 to 4.1 ± 1.5 cigarettes at Time 2. The cessation rates for the 302 light smokers who did not fade ($20.4\% \pm 8.7\%$) and the 60 light smokers who did ($28.1\% \pm 28.4\%$) were not significantly different ($X^2 = 0.29$; $df = 1.00$; $p < 0.59$).

TABLE 4
Consumption Level at Times 1 and 2, Fading Status at Time 2, and Cessation at Time 3 for Light, Moderate, and Heavy Smokers

Consumption Level at Time 1	Light		Moderate Faded to			Heavy Faded to			
	No Fading	Faded	No Fading	15+	<15	No Fading	25+	15-24	<15
Fading Status at Time 2									
<i>N</i>	302	60	700	17	88	375	31	75	34
Cigarettes per day at Time 1	8.4	8.8	18.9	20.3	19.3	35.2	50.8	35.0	35.7
Cigarettes per day at Time 2	10.1	4.1	19.5	15.4	8.5	36.0	34.8	18.9	8.3
%Quit at Time 3	20.4	28.1	9.5	1.6	22.2	8.3	7.9	5.9	30.2

Of the 805 moderate smokers identified at Time 1, 105 reported some cigarette fading between Times 1 and 2. The 17 who remained moderate smokers after fading reduced their average consumption from 20.3 ± 0.5 cigarettes at Time 1 to 15.4 ± 0.8 cigarettes at Time 2. The 88 who became light smokers reduced their average consumption from 19.3 ± 0.5 cigarettes at Time 1 to 8.5 ± 0.9 cigarettes at Time 2. The cessation rates for the 17 who remained moderate smokers after fading ($1.6\% \pm 2.5\%$) were significantly worse than those observed for the 700 moderate smokers who did not fade ($9.5\% \pm 3.2\%$) ($X^2 = 5.13$; $df = 1.00$; $p < 0.03$). The cessation rate for the 88 who became light smokers ($22.2\% \pm 11.1\%$) was significantly better ($X^2 = 4.96$; $df = 1.00$; $p < 0.03$).

Of the 515 heavy smokers identified at Time 1, 140 reported some cigarette fading between Times 1 and 2. The 31 who remained heavy smokers after fading reduced their average consumption from 50.8 ± 11.0 cigarettes at Time 1 to 34.8 ± 4.4 cigarettes at Time 2. The 75 who became moderate smokers reduced their average consumption from 35.0 ± 2.3 cigarettes at Time 1 to 18.9 ± 0.6 cigarettes at Time 2. The 34 who became light smokers reduced their average consumption from 35.7 ± 4.5 cigarettes at Time 1 to 8.3 ± 1.4 cigarettes at Time 2. The cessation rates for the heavy smokers who faded without becoming light smokers ($7.9\% \pm 13.5\%$ and $5.9\% \pm 4.4\%$) did not differ significantly from the rate for those who did not fade ($8.3\% \pm 3.8\%$) ($X^2 = 0.28$; $df = 1.57$; $p < 0.80$). The cessation rate for the 34 who became light smokers ($30.2\% \pm 22.2\%$) was significantly better ($X^2 = 4.96$; $df = 1.00$; $p < 0.03$).

Figure 1 shows the cessation rates at follow-up for four groups of smokers. The first group consisted of moderate to heavy smokers who did not fade cigarettes. The second group consisted of moderate to heavy smokers who faded cigarettes but remained moderate to heavy smokers. The third group consisted of moderate to heavy smokers who faded cigarettes to become light smokers. The fourth group consisted of the remaining smokers who were all light smokers at Time 1. The rates of cessation observed for the first ($9.1\% \pm 2.7\%$) and second groups ($5.8\% \pm 4.4\%$) did not differ significantly ($X^2 = 1.45$; $df = 1.00$; $p < 0.23$). Similarly, the rates of cessation observed for the third ($24.9\% \pm 9.9\%$) and fourth groups ($21.5\% \pm 8.9\%$) did not differ significantly ($X^2 = 0.25$; $df = 1.00$; $p < 0.62$). The rates of cessation observed for the first two groups were significantly lower than those observed for the last two groups ($X^2 = 11.97$; $df = 1.85$; $p < 0.003$).

Maintenance of Cigarette Fading

Table 5 contains the regression of consumption at Time 3 on consumption at Times 1 and 2 and the demographic variables. Of the 305 smokers who faded cigarettes between Times 1 and 2, 242

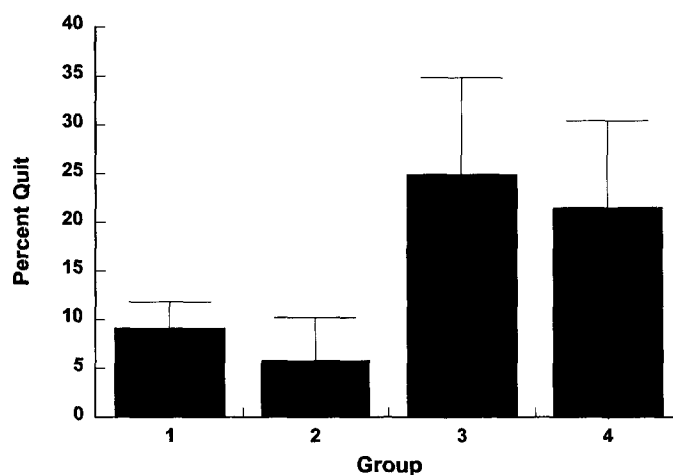


FIGURE 1: Four groups of smokers: (1) moderate-to-heavy smokers at baseline who did not fade cigarettes, (2) moderate-to-heavy smokers who faded cigarettes but remained moderate-to-heavy smokers at baseline, (3) moderate-to-heavy smokers who faded cigarettes to become light smokers at baseline, and (4) the remaining light smokers at baseline.

TABLE 5
Consumption at Time 3 Among Smokers Who Faded Cigarettes ($n = 242$) Regressed on Consumption at Times 1 and 2 and Demographics

Variable	Standardized β	Zero-Order Correlation
Consumption Time 1	.29*	.71
Consumption Time 2	.46*	.74
Recent Quitting History	.02	-.18
Age	.02	.11
Gender	-.07	-.13
Ethnicity	.14*	.32
Education	-.01	-.01
F(7,234)	50.63*	
Adjusted R^2	.59	

Note: Predictors include consumption at Time 1 and Time 2, age and dummy variables for gender (male versus female), ethnicity (Non-Hispanic White versus other), and education (high school or less versus more than high school).

* $p < .01$.

were still smokers at Time 3. At Time 1, their average consumption was 26.4 ± 3.2 cigarettes. They reduced their consumption to 13.6 ± 2.1 cigarettes by Time 2. At Time 3, their average consumption was 15.0 ± 1.9 cigarettes. Of the variables included in the regression analysis, only consumption at Times 1 and 2 and

ethnicity were significant predictors of consumption at Time 3 (adjusted $R^2 = 0.59$; $F(7, 234) = 50.63$, $p < 0.001$).

DISCUSSION

Cigarette fading appears to increase the likelihood of cessation only among smokers who shift from moderate to heavy to light smoking. Light smokers who faded cigarettes to even lower levels of consumption were as likely to be in cessation at follow-up as light smokers who did not fade. Similarly, moderate to heavy smokers who faded but remained moderate to heavy smokers were no more likely to be in cessation at follow-up than were the moderate to heavy smokers that did not fade. This finding suggests that the relation between consumption level and the likelihood of cessation may best be construed as a threshold effect. Future studies should use the transition to light smoking rather than other measures (i.e. any, absolute, or percent reduction) as the measure of effective cigarette fading.

Compensatory smoking may explain why cigarette fading only increases the likelihood of cessation for some smokers. Moderate to heavy smokers who fade but fail to become light smokers should be able to alter their smoking topography to compensate for the reduction in number of cigarettes smoked. If the smoker's usual brand of cigarettes is of medium (i.e. 0.8 mg to 1.2 mg) rather than ultralight yield (i.e. 0.1 mg to 0.2 mg), the smoker may be able to compensate completely for the reduced number of cigarettes.

Smokers who reported making a quit attempt in the previous year were also more likely to report cigarette fading in the previous year than were those who had not made a quit attempt. This finding suggests that cigarette fading in the general population may be a cessation rather than a harm-reduction strategy. This conclusion is in line with evidence from another population study where about 30% of smokers reported that they cut consumption as a prelude to making a serious quit attempt (48).

The present study has several limitations. First, smoking status is based solely on self-reports that lack biochemical validation. However, previous research has shown that in minimal intervention studies self-reported smoking status is quite accurate, which has led some researchers to question the utility of biochemical validation in these settings (49,50). Furthermore, the magnitude of the effects observed in the present study are similar to those demonstrated in other population and experimental studies which supports the validity of these results (48,51). The second potential limitation is the reliance on self-reported cigarette consumption as the only measure used to assess nicotine exposure. The inclusion of yield information might identify more light smokers. The present study provides some guidance for the more effective matching of smokers to cessation treatments. In the present study, cigarette fading did not appear to increase the cessation rate for light smokers. Other studies have shown that light smokers who received nicotine replacement therapy experienced lower rates of cessation than light smokers who did not receive nicotine replacement therapy (52,53). These findings suggest that light smoking may be a contraindication for nicotine replacement therapy. Light smokers may instead benefit from fixed-interval scheduling of cigarettes (34,35) and/or relapse-sensitive scheduling of postcessation telephone counseling (54,55). These results suggest that cessation programs should give all moderate to heavy smokers a trial of cigarette fading. The moderate to heavy smokers who can make the transition to light smoking through cigarette fading are probably poor candidates for nicotine replacement, but should benefit from fixed-interval scheduling and/or relapse-sensitive

counseling. Moderate to heavy smokers who fail to become light smokers through cigarette fading may be the ideal candidates for nicotine replacement. Nevertheless, even these smokers would probably benefit from fixed-interval scheduling and/or relapse-sensitive counseling. These results also suggest that media campaigns directed at smokers should inform them that reducing consumption to less than 15 cigarettes per day effectively doubles their chances of cessation in the near-term. The wide dissemination of this finding might lead to a significant improvement in the cessation rate observed among self-quitters.

REFERENCES

- (1) McMorrow MJ, Foxx RM: Nicotine's role in smoking: An analysis of nicotine regulation. *Psychological Bulletin*. 1983, 93:302-327.
- (2) Frederiksen LW, Martin JE, Webster JS: Assessment of smoking behavior. *Journal of Applied Behavior Analysis*. 1979, 12:653-664.
- (3) Sutton SR, Russell MAH, Iyer R, Feyerabend C, Salooyee Y: Relationship between cigarette yields, puffing patterns, and smoke intake. Evidence for tar compensation. *British Medical Journal*. 1982, 285:600-603.
- (4) Ebert RV, McNabb E, McCusker K, Snow S: Amount of nicotine and carbon monoxide inhaled by smokers of low-tar, low-nicotine cigarettes. *Journal of the American Medical Association*. 1983, 250:2840-2842.
- (5) Bridges RB, Combs JG, Humble JW, et al: Puffing topography as a determinant of smoke exposure. *Pharmacology Biochemistry and Behavior*. 1990, 37:29-39.
- (6) Djordjevic MV, Fan J, Ferguson S, Hoffman D: Self-regulation of smoking intensity. Smoke yields of the low-nicotine, low-'tar' cigarettes. *Carcinogenesis*. 1995, 16:2015-2021.
- (7) Gori GB, Lynch CJ: Analytical cigarette yields as predictors of smoke bioavailability. *Regulatory Toxicology and Pharmacology*. 1985, 5:314.
- (8) Benowitz NL, Jacob P: Daily intake of nicotine during cigarette smoking. *Clinical Pharmacology and Therapeutics*. 1984, 35:499-504.
- (9) Kolonen S, Tuomisto J, Puustinen P, Airaksinen MM: Effects of smoking abstinence and chain-smoking on puffing topography and diurnal nicotine exposure. *Pharmacology Biochemistry and Behavior*. 1992, 42:327-332.
- (10) U.S. Department of Health, Education, and Welfare: *Smoking and Health. A Report of the Surgeon General, 1979*, DHEW Publication No. (PHS) 79-50066. Washington, DC: U.S. Government Printing Office, 1979.
- (11) Frost C, Fullerton FM, Stephen AM, et al: The tar reduction study: Randomized trial of the effect of cigarette tar yield reduction on compensatory smoking. *Thorax*. 1995, 50:1038-1043.
- (12) Zacny JP, Stitzer ML: Cigarette brand-switching: Effects on smoke exposure and smoking behavior. *Journal of Pharmacology and Experimental Therapeutics*. 1988, 246:619-627.
- (13) U.S. Department of Health and Human Services: *The Health Consequences of Smoking: Nicotine Addiction. A Report of the Surgeon General, 1988*, DHHS Publication No. (CDC) 88-8406. Washington, DC: U.S. Government Printing Office, 1988.
- (14) U.S. Department of Health and Human Services: *Reducing the Health Consequences of Smoking: 25 Years of Progress. A Report of the Surgeon General, 1989*, DHHS Publication No. (CDC) 89-8411. Washington, DC: U.S. Government Printing Office, 1989.
- (15) McWhorter WP, Boyd GM, Mattson ME: Predictors of quitting smoking: The NHANES I follow-up experience. *Journal of Clinical Epidemiology*. 1990, 43:1399-1405.
- (16) Freund KM, D Agostino RB, Belanger AJ, Kannel WB, Stokes J: Predictors of smoking cessation: The Framingham Study. *American Journal of Epidemiology*. 1992, 135:957-964.
- (17) Rose JS, Chassin L, Presson CC, Sherman SJ: Prospective predictors of quit attempts and smoking cessation in young adults. *Health Psychology*. 1996, 15:261-268.

- (18) Marlatt GA, Curry S, Gordon JR: A longitudinal analysis of unaided smoking cessation. *Journal of Consulting and Clinical Psychology*. 1988, 56:715-720.
- (19) Cohen S, Lichtenstein E, Prochaska JO, et al: Debunking myths about self-quitting: Evidence from ten prospective studies of persons who attempt to quit by themselves. *American Psychologist*. 1989, 44:1355-1365.
- (20) Farkas AJ, Pierce JP, Zhu S-H, et al: Addiction versus stages of change models in predicting smoking cessation. *Addiction*. 1996, 91:1271-1280.
- (21) Levinson BL, Shapiro D, Schwartz GE, Tursky B: Smoking elimination by gradual reduction. *Behavior Therapy*. 1971, 2:477-487.
- (22) Flaxman J: Quitting smoking now or later: Gradual, abrupt, immediate, and delayed quitting. *Behavior Therapy*. 1978, 9:260-270.
- (23) Foxx RM, Brown RA: Nicotine fading and self-monitoring for cigarette abstinence or controlled smoking. *Journal of Applied Behavior Analysis*. 1979, 12:111-125.
- (24) Foxx RM, Brown RA, Katz I: Nicotine fading and self-monitoring for cigarette abstinence or controlled smoking: A two and one-half year follow-up. *Behavior Therapist*. 1981, 4:21-23.
- (25) Beaver C, Brown RA, Lichtenstein E: Effects of monitored nicotine fading and anxiety management training on smoking reduction. *Addictive Behaviors*. 1981, 6:301-305.
- (26) Foxx RM, Axelrod E: Nicotine fading, self-monitoring and cigarette to produce cigarette abstinence or controlled smoking. *Behavior Therapist*. 1983, 21:17-27.
- (27) Prue DM, Davis CJ, Martin JE, Moss RA: An investigation of a minimal contact brand fading program for smoking treatment. *Addictive Behaviors*. 1983, 8:307-310.
- (28) Brown RS, Lichtenstein E, McIntyre KO, Harrington-Kostur J: Effects of nicotine fading and relapse prevention on smoking cessation. *Journal of Consulting and Clinical Psychology*. 1984, 52:307-308.
- (29) Lando HA, McGovern PG: Nicotine fading as a nonaversive alternative in a broad spectrum treatment for eliminating smoking. *Addictive Behaviors*. 1985, 10:153-161.
- (30) Scott RR, Prue DM, Denier CA, King AC: Worksite smoking intervention with nursing professionals: Long-term outcome and relapse assessment. *Journal of Consulting and Clinical Psychology*. 1986, 54:809-813.
- (31) Singh NN, Leung J-P: Smoking cessation through cigarette-fading, self-recording, and contracting: Treatment, maintenance and long-term follow-up. *Addictive Behaviors*. 1988, 13:101-105.
- (32) Decker BD, Evans RG: Efficacy of a minimal contact version of a multimodal smoking cessation program. *Addictive Behaviors*. 1989, 14:487-491.
- (33) McGovern PG, Lando HA: Reduced nicotine exposure and abstinence outcome in two nicotine fading methods. *Addictive Behaviors*. 1991, 16:11-20.
- (34) Cinciripini PM, Lapitsky LG, Wallfish A, et al: An evaluation of a multicomponent treatment program involving scheduled smoking and relapse prevention procedures: Initial findings. *Addictive Behaviors*. 1994, 19:13-22.
- (35) Cinciripini PM, Lapitsky L, Seay S, et al: The effects of smoking schedules on cessation outcome: Can we improve on common methods of gradual and abrupt nicotine withdrawal? *Journal of Consulting and Clinical Psychology*. 1995, 63:388-399.
- (36) Russell MAH, Sutton SR, Feyerabend C, Saloojee Y: Smoker's response to shortened cigarettes: Dose reduction without dilution of tobacco smoke. *Clinical Pharmacology and Therapeutics*. 1980, 27:210-218.
- (37) Glasgow RE, Klesges RC, Vasey MW: Controlled smoking for chronic smokers: An extension and replication. *Addictive Behaviors*. 1983, 8:143-150.
- (38) Sutton SR, Feyerabend C, Cole PV, Russell MAH: Adjustment of smokers to dilution of tobacco smoke by ventilated cigarette holders. *Clinical Pharmacology and Therapeutics*. 1978, 24:395-405.
- (39) Stitzer ML, Brigham J, Felch LJ: Phase-out filter perforation: Effects on human tobacco smoke exposure. *Pharmacology Biochemistry and Behavior*. 1992, 41:749-754.
- (40) Waksberg J: Sampling methods of random digit dialing. *Journal of the American Statistical Association*. 1978, 73:40-46.
- (41) Borland R, Pierce JP, Burns DM, et al: Protection from environmental tobacco smoke in California: The case for a smoke-free workplace. *Journal of the American Medical Association*. 1992, 268(6):749-752.
- (42) Pierce JP, Goodman J, Gilpin EA, Berry C: *Technical Report on Analytic Methods and Approaches Used in the Tobacco Use in California, 1990-1991 Report*. Sacramento, CA: California Department of Health Services, 1992.
- (43) Pierce JP, Cavin SW, Macky C, et al: *Technical Report on Analytic Methods and Approaches Used in the 1992 California Tobacco Survey Analysis*. Sacramento, CA: California Department of Health Services, 1994.
- (44) Pierce JP, Evans N, Farkas AJ, et al: *Tobacco Use in California. An Evaluation of the Tobacco Control Program, 1989-1993*. La Jolla, CA: University of California, San Diego, 1994.
- (45) Rao JN, Scott AJ: On chi-squared tests for multiway contingency tables with cell proportions estimated from survey data. *Archives of Statistics*. 1984, 12:46-60.
- (46) Westat, Inc.: *A User's Guide to WesVarPC. Version 2.0*. Rockville, MD: Westat, Inc., 1996.
- (47) Efron B: *The Jackknife, the Bootstrap and Other Resampling Plans. CBMS Regional Conference Series in Applied Mathematics, 38*. Philadelphia, PA: Society for Industrial and Applied Mathematics, 1982.
- (48) Pierce JP, Hatziandreu E, Flyer P, et al: *Report of the 1986 Adult Use of Tobacco Survey*. Atlanta, GA: Office of Smoking and Health, Centers for Disease Control, 1987.
- (49) Lichtenstein E, Glasgow RE: Smoking cessation: What have we learned over the past decade? *Journal of Consulting and Clinical Psychology*. 1992, 60:518-527.
- (50) Glasgow RE, Mullooly JP, Vogt TM: Biochemical validation of smoking status: Pros, cons, and data from four low-intensity intervention trials. *Addictive Behaviors*. 1993, 18:511-527.
- (51) Glasgow RE, Klesges RC, Klesges LM, Vasey MW, Gunnarson DF: Long-term effects of a controlled smoking program: A 2-year follow-up. *Behavior Therapy*. 1985, 16:303-307.
- (52) Jarvik ME, Schneider NG: Degree of addiction and effectiveness of nicotine gum therapy for smoking. *American Journal of Psychiatry*. 1984, 141:790-791.
- (53) Niaura R, Goldstein MG, Abrams DB: Matching high- and low-dependence smokers to self-help treatment with or without nicotine replacement. *Preventive Medicine*. 1994, 23:70-77.
- (54) Zhu S-H, Pierce JP: A new scheduling method for time-limited counseling. *Professional Psychology: Research and Practice*. 1995, 26:624-625.
- (55) Zhu S-H, Stretch V, Balabanis M, et al: Telephone counseling for smoking cessation: Effects of single-session and multiple-session interventions. *Journal of Consulting and Clinical Psychology*. 1995, 64:202-211.