Smoker Characteristics and Smoking-Cessation Milestones

Sandra J. Japuntich, PhD, Adam M. Leventhal, PhD, Megan E. Piper, PhD, Daniel M. Bolt, PhD, Linda J. Roberts, PhD, Michael C. Fiore, MD, MPH, MBA, Timothy B. Baker, PhD

Background: Contextual variables often predict long-term abstinence, but little is known about how these variables exert their effects. These variables could influence abstinence by affecting the ability to quit at all, or by altering risk of lapsing, or progressing from a lapse to relapse.

Purpose: To examine the effect of common predictors of smoking-cessation failure on smoking-cessation processes.

Methods: The current study (N=1504, 58% female, 84% Caucasian; recruited from January 2005 to June 2007; data analyzed in 2009) uses the approach advocated by Shiffman et al. (2006), which measures cessation outcomes on three different cessation milestones (achieving initial abstinence, lapse risk, and the lapse–relapse transition) to examine relationships of smoker characteristics (dependence, contextual and demographic factors) with smoking-cessation process.

Results: High nicotine dependence strongly predicted all milestones: not achieving initial abstinence, and a higher risk of both lapse and transitioning from lapse to complete relapse. Numerous contextual and demographic variables were associated with higher initial cessation rates and/or decreased lapse risk at 6 months post-quit (e.g., ethnicity, gender, marital status, education, smoking in the workplace, number of smokers in the social network, and number of supportive others). However, aside from nicotine dependence, only gender significantly predicted the risk of transition from lapse to relapse.

Conclusions: These findings demonstrate that (1) higher nicotine dependence predicted worse outcomes across every cessation milestone; (2) demographic and contextual variables are generally associated with initial abstinence rates and lapse risk and not the lapse–relapse transition. These results identify groups who are at risk for failure at specific stages of the smoking-cessation process, and this may have implications for treatment.

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Introduction

Smoking-cessation research generally uses long-term abstinence to index the characteristics of a person associated with quitting success. However, Shiffman and colleagues[1] suggested that long-term abstinence reflects multiple cessation processes,[2,3] and successful cessation may depend on several components ("milestones"): achievement of short-term abstinence, avoidance of lapse, and if lapse occurs, avoidance of relapse.[1] Parsing this multicomponent process into meaningful subunits may provide insight into the cessation process. The current study aims to advance understanding of the critical determinants of abstinence by relating smoker characteristics to cessation milestones.

Smoking-Cessation Milestones

Shiffman and colleagues[1] argued that smoking-cessation milestones may reflect different causal instigators and mechanisms. For instance, initial cessation may reflect the severity of the nicotine withdrawal syndrome.[4] Lapsing often occurs in the presence of smoking cues and stressors, and it may reflect the strength of associative

From the Mongan Institute for Health Policy and Tobacco Research and Treatment Center, Massachusetts General Hospital, Harvard Medical School (Japuntich), Boston, Massachusetts; Department of Preventive Medicine, Keck School of Medicine, University of Southern California (Leventhal), Los Angeles, California; Center for Tobacco Research and Intervention, Department of Medicine, School of Medicine and Public Health (Japuntich, Piper, Fiore, Baker), Department of Educational Psychology (Bolt), and Department of Human Development and Family Studies (Roberts), University of Wisconsin-Madison, Madison, Wisconsin

Address correspondence to: Sandra J. Japuntich, PhD, Mongan Institute for Health Policy, Massachusetts General Hospital, 50 Staniford Street, 9th Floor, Boston MA 02114. E-mail: sjapuntich@partners.org.

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processes or coping skills.[4–9] The lapse–relapse transition may reflect nicotine dependence processes being primed or reinstated following a lapse.[10–12]

Research has not systematically explored how smoker characteristics relate to cessation processes. The relationships between risk factors and milestones could provide insight into causes of cessation failure and suggest treatment strategies (e.g., by addressing risk factors for lapse–relapse progression for smokers who have lapsed).

Risk Factors for Cessation Failure

Research[13–16] shows that cessation outcomes are affected by smoker characteristics and life context variables. Theory and multivariate studies[13–16] of relapse risk identified nicotine dependence, demographic, and life context variables as likely influences on cessation milestones.

Predicted Relationships

Based on research relating smoker characteristics with long-term abstinence, five contextual and five demographic variables were selected for analysis (*contextual* variables: home and work smoking bans,[17–21] smokers in the social network,[22–25] social support,[24,26–29] and stress[27,30–34]; *demographic* variables: marital status,[35] gender,[36] SES,[37–39] ethnicity,[40–42] and age[14,15,43]). Many of the contextual and demographic variables used in the present study predict encounters with key contexts, cues, and episodic events (stressors, strength of phasic affective reactions). For instance, the probability of exposure to smoking cues may be related to home and work smoking bans and smokers in the social network.[4,44–48] Other variables may predict exacerbation or buffering of episodic events such as stressor occurrence or affective reactions (e.g., social support[24,26]). Finally, several demographic variables may affect relapse because they are catch-all indicators of both contextual risk and stress (e.g., SES, ethnicity[19,27,33,39,49,50]). Because previous research[4–9] has linked lapses with particular contexts (e.g., social situations) and with episodic environmental challenges such as smoking cues, negative affect, and stressors,[7] it was predicted that the contextual and demographic variables would be consistently associated with lapse likelihood. A further prediction was that nicotine dependence would be especially associated with initial cessation and the risk of lapse–relapse transition. This could be due, respectively, to dependence-related withdrawal[2,4,51] and lapse-induced priming of dependence processes.[11,52]

The Current Study

The current study uses clinical trial data[53] to determine the relationship between smoker characteristics (nicotine dependence, demographics, and life context) and the achievement of smoking-cessation milestones.

Methods

Participants

Participants were 1504 smokers (58% female, 83% Caucasian; Table 1) from southeastern Wisconsin, participating in a clinical trial.[53] Participants were recruited January 2005–June 2007; data were analyzed in 2009. Inclusion criteria were daily smoking (>9 cigarettes/day) and being motivated to quit. Exclusion criteria included medical contraindications to study medications; heavy alcohol consumption (≥6 drinks 6 days per week); or self-reported history of seizure, schizophrenia, psychosis, eating disorder, or bipolar disorder. Participants could not be pregnant or breastfeeding and agreed to use contraception. The present study was approved by the University of Wisconsin IRB.

Procedure

Potential participants completed a phone screen. Those eligible attended an information session where they provided written, informed consent. Next, participants attended a screening visit to evaluate exclusion criteria. Additionally, participants completed demographic, smoking history, and tobacco dependence questionnaires. Eligible participants completed three baseline sessions occurring between 8 and 15 days pre-quit. Study visits occurred on the quit day and at 1, 2, 4, and 8 weeks post-quit.

Treatment. Double-blinded randomization, blocked on gender and ethnicity (Caucasian/non-Caucasian), assigned participants to one of six treatment conditions administered according to FDA guidelines: (1) bupropion SR (150 mg bid for 9 weeks); (2) nicotine lozenge (2 or 4 mg for 12 weeks); (3) nicotine patch (21, 14, and 7 mg; titrated down over 8 weeks post-quit); (4) nicotine patch + nicotine lozenge combination therapy; (5) bupropion SR + nicotine lozenge combination therapy; or (6) placebo. There were five placebo conditions, matched to the active treatment conditions (e.g., placebo bupropion, lozenge, patch, patch + lozenge, and bupropion + lozenge) that each constituted one fifth of the placebo control group. All participants received six brief individual counseling sessions.

Smoking status. Daily smoking data were collected with a smoking calendar using timeline follow-back.[54,55] The maximum amount of time for recall was 6 weeks. Seven-day point-prevalence abstinence was assessed during a 6-month follow-up call and biochemically confirmed (CO<10 parts per million).

Milestone variables (Table 2). The three milestone variables were computed using smoking calendar data. The initial abstinence variable indicated whether participants reported smoking zero cigarettes on at least 1 day in the first 14 days of the study. The lapse variable, coded for those who achieved initial abstinence, was the number of days between the first day where participants smoked zero cigarettes and the first day where they smoked any amount.[1] Finally, the relapse variable, computed for participants who lapsed, was defined as the number of days from the lapse day until relapse (the first of 7 consecutive days of smoking).[1] If participants did not reach a milestone (e.g., lapse/relapse), their milestone variable indicated the number of days from their last mile-

Table 1. Demographics and descriptive statistics, % or M (SD)

Measure	Total (included in initial abstinence analyses)	Achieved initial abstinence (included in lapse analyses)	Lapsed (included in relapse analyses)
Gender (female)	58.2	57.7	60.4
Education			
<High school	5.6	4.7	5.3
High school	23.6	23.3	29.2
Some college	48.4	48.3	50.1
≥College	21.9	26.6	20.7
Marital status			
Married/live-in partner/widowed	56.8	57.7	55.7
Divorced/separated	24.2	23.7	24.9
Never married	18.6	18.6	19.4
Ethnicity (Caucasian)	83.9	85.5	83.9
Smoking permitted in the home	52.8	48.9	53.1
Smoking permitted at work	48.6	47.3	49.6
Age (years)	44.7 (11.1)	44.8 (11.0)	44.9 (10.8)
Cigarettes per day	21.4 (8.9)	21.2 (8.9)	21.3 (8.6)
FTND score	5.4 (2.1)	5.3 (2.1)	5.4 (2.1)
SRRS score	167.0 (116.2)	163.8 (114.2)	164.4 (114.2)
No. in social network	7.8 (2.2)	7.8 (2.2)	7.8 (2.3)
No. of smokers in social network	3.0 (1.9)	3.0 (1.9)	3.0 (1.9)
No. in network providing social support	7.0 (2.3)	7.1 (2.3)	7.0 (2.3)

FTND, Fagerström Test of Nicotine Dependence; SRRS, Social Readjustment Rating Scale

stone until the end of follow-up. If they withdrew from the study before reaching a milestone, their milestone variable indicated the number of days from their last milestone until their withdrawal date.

Demographics and smoking history. A demographics questionnaire measured gender; ethnicity (Caucasian vs non-Caucasian); marital status (married/domestic partner vs divorced/separated/widowed/never married); educational attainment (<4-year vs ≥4-year college degree); and age. A smoking-history questionnaire assessed smoking restrictions at home (yes versus no) and work (total work smoking ban vs partial ban/no ban/not working outside the home).

The Fagerström test of nicotine dependence. The FTND[56] is made up of six items with scores ranging from 0 to 10; higher scores indicate greater dependence.

Social network interview. Participants listed up to nine people who provided emotional support, instrumental support, or who were "important" to them over the past year. One additional name was allowed if participants had a romantic partner. Network sizes varied from zero to ten. The interview assessed the amount of emotional support network members provided, the amount of stress they caused, and their smoking. The number of smokers in the network included daily or social smokers. The number of network members providing social support included members who provided a little, a medium amount, or a lot of support.

Table 2. Definition of milestones and descriptive statistics

Milestone[a]	Definition	Percentage achieved (of those who reached previous milestone)	Median days to milestone
Initial abstinence (n=1429)	1 day, during first 14 days where participant smoked 0 cigarettes	88.1	0
Lapse (n=1259)	After a period of initial abstinence, smoking at least 1 cigarette	73.9	7
Relapse (n=930)	The first day of 7 consecutive days of smoking	63.9	38
Point-prevalence abstinence (n=1504)	Smoking on 1 or more days during the 7 days preceding the day of the 6-month follow-up phone call	33.0	n/a

[a]Milestone variables were computed for only those with complete calendar data who have achieved the previous milestone.

Social Readjustment Rating Scale (SRRS). The SRRS is a life events checklist of the number of stressful life events reported in the past year.[57]

Data Analysis

Tests of milestones. Analyses were conducted using SAS, version 9.2, controlling for treatment. Treatment was dummy-coded with placebo as the comparison group. Analyses of initial and point-prevalence abstinence used logistic regression (abstinence=0). Analyses of lapse and relapse used Cox proportional hazards regression survival analysis. Individuals were censored at the time of their last contact if they did not have an event (e.g., lapse, relapse). In the survival analyses, having an event (e.g., lapse, relapse) was coded as 0. Analyses (except initial abstinence) were conducted using the 6-month follow-up period. Unless otherwise noted, results were significant after a Holm alpha correction.[58] Models were examined for multicollinearity.

Interactions with treatment period. To determine whether the effects of smoker characteristics varied throughout the quit attempt, interactions with treatment period (8 weeks) were examined for survival analyses. For the lapse analyses, the results of the hazard function during treatment versus after treatment were compared by computing the interaction between the independent variable and a variable representing during versus after treatment. For the relapse analyses, the effects of treatment in individuals who had and had not relapsed during treatment were compared by computing a variable signifying relapsing during treatment (relapse during treatment = 1). Then a model was tested that included the independent variable, the relapsed during treatment variable, and the product of the two. Only significant interactions with treatment period are reported.

Interactions with treatment condition. Interactions between risk variables and medication condition were examined: none was significant after alpha correction (main effects of treatment on milestones are presented in a separate paper[59]).

Results

Achievement of Milestones

Of the 1504 smokers in the study, 1429 (95.0%) had complete calendar data for the first 14 days. Of those 1429, a total of 1259 achieved initial abstinence (88.1%; median=0 days). Of the 1259 who achieved initial abstinence, 930 lapsed (73.9%; median=7 days). Of those 930 who lapsed, 585 relapsed (62.9%; median days to relapse=38; median days from lapse to relapse=15; Table 2).

Reporting of Results

Main effects and alpha-corrected significance levels are presented in Table 3.

Table 3. Univariate analyses (controlling for treatment) of dependence, context, and demographic variables predicting smoking-cessation milestones

	Failure to reach initial abstinence[a] (*n*=1429)		Lapse[b,c] (*n*=1259)		Relapse[c,d] (*n*=930)		Point-prevalence abstinence[a] (*n*=1504)	
Measure	**OR (95% CI)**	***p*-value**	**HR (95% CI)**	***p*-value**	**HR (95% CI)**	***p*-value**	**OR (95% CI)**	***p*-value**
FTND score	1.12 (1.04, 1.21)	0.001	1.05 (1.02, 1.08)	0.003	1.08 (1.04, 1.12)	<0.001	1.17[e] (1.11, 1.23)	<0.001
Education	0.59 (0.38, 0.92)	0.02	0.72[e] (0.62, 0.85)	<0.001	0.83 (0.68, 1.03)	0.09	0.57[e] (0.44, 0.73)	<0.001
Marital status	0.69[e] (0.48, 0.98)	0.01	0.76[e] (0.66, 0.87)	<0.001	0.98 (0.83, 1.17)	0.86	0.64[e] (0.51, 0.81)	<0.001
Gender	1.13 (0.81, 1.58)	0.47	1.21[e] (1.06, 1.38)	0.005	1.24[e] (1.05, 1.47)	0.01	1.30[e] (1.05, 1.62)	0.02
Age	1.01 (0.99, 1.02)	0.41	1.00 (0.99, 1.01)	0.97	1.00 (1.00, 1.01)	0.36	0.99 (0.98, 1.00)	0.08
Ethnicity	0.34[e] (0.23, 0.49)	<0.001	0.75[e] (0.63, 0.90)	0.001	1.02 (0.81, 1.27)	0.10	0.59[e] (0.43, 0.80)	<0.001
Smoking in the home	2.40[e] (1.67, 3.43)	<0.001	1.18[e] (1.04, 1.35)	0.01	1.02 (0.86, 1.20)	0.85	1.35[e] (1.09, 1.68)	<0.001
Smoking at work	1.24 (0.90, 1.72)	0.19	1.23[e] (1.08, 1.40)	0.002	0.95 (0.81, 1.12)	0.55	1.11 (0.89, 1.37)	0.37
SRRS	1.001 (1.00, 1.003)	0.048	1.00 (1.00, 1.001)	0.26	1.00 (1.00, 1.001)	0.29	1.001 (1.001, 1.002)	0.11
Proportion of smokers in the social network	0.99 (0.90, 1.10)	0.24	1.05[e] (1.01, 1.09)	0.02	1.01 (0.96, 1.06)	0.71	1.07 (1.01, 1.14)	0.03
No. of supportive individuals in the social network[f]	0.92[e] (0.86, 0.98)	0.01	0.96[e] (0.93, 0.98)	0.002	0.99 (0.96, 1.03)	0.63	0.97 (0.92, 1.02)	0.19

[a]Conducted using logistic regression
[b]Excludes individuals who did not achieve initial abstinence
[c]Conducted using proportional hazards survival analysis
[d]Excludes individuals who did not lapse
[e]Denotes context variables that are significant after a Holm correction for familywise type 1 error[58]
[f]Results do not include interaction with treatment period.
FTND, Fagerström Test of Nicotine Dependence; HR, hazard ratio; SRRS, Social Readjustment Rating Scale

Nicotine Dependence

Those with higher FTND scores were less likely to be abstinent at 6-month follow-up, achieve initial abstinence, and had higher lapse and lapse–relapse risk.

Demographics

Education. College-educated individuals were more likely to be abstinent at 6-month follow-up, achieve initial abstinence, and have lower lapse risk than those without a college education. Education was not significantly associated with lapse–relapse risk.

Marital status. Marital status analyses controlled for partner smoking status. Those who were partnered were more likely to be abstinent at 6-month follow-up and had a lower lapse risk. Marital status was not significantly associated with initial abstinence or lapse–relapse risk.

Gender. Women were less likely to be abstinent at 6-month follow-up and had higher lapse and lapse–relapse risk. Gender was not associated with initial abstinence. Gender was more strongly related to the lapse–relapse risk after treatment than during treatment (hazard ratio [HR]=1.64, p=0.01, 95% CI=1.11, 2.42).

Age. Age did not predict point-prevalence abstinence or milestones.

Ethnicity. Caucasians had higher abstinence rates at 6-month follow-up and higher initial abstinence rates and a lower lapse risk than did non-Caucasians. Ethnicity was not significantly associated with lapse–relapse risk.

Contextual Variables

Smoking in the home. Those without a home smoking ban were less likely to achieve initial abstinence, had lower abstinence rates at 6-month follow-up, and higher lapse risk than those with a ban. Home smoking bans were not associated with lapse–relapse risk.

Smoking at work. Those without work smoking bans were less likely to be abstinent at 6-month follow-up and had higher lapse risk than those with bans. Work smoking bans were not significantly associated with initial abstinence or lapse–relapse risk.

Stress Response Rating Scale. Those with higher scores on this scale were less likely to achieve initial abstinence (not significant after alpha correction). The stress response rating was not significantly associated with 6-month abstinence, lapse risk, or lapse–relapse risk.

Proportion of smokers in the social network. These analyses controlled for the total network size. Those with a larger proportion of smokers in the social network were less likely to be abstinent at the 6-month follow-up (not significant after alpha correction) and had a higher lapse risk. The proportion of smokers in the social network was not significantly associated with achievement of initial abstinence or lapse–relapse risk.

Number of supportive individuals in the social network. The number of supportive individuals in the social network was not corrected for network size. Those with more supportive individuals were more likely to achieve initial abstinence. Number of supportive individuals was not significantly associated with 6-month abstinence, lapse risk, or lapse–relapse risk. The number of supportive individuals was more strongly related to lapse–relapse risk during the 8-week treatment period than during the posttreatment period (HR=1.12, p=0.01, 95% CI=1.03, 1.22); number of supportive individuals predicted lapse–relapse risk during the treatment period (HR=0.92, p=0.002, 95% CI=0.88, 0.97) but not during the follow-up period ($p>0.05$).

Multiple Regression Models

Multivariable models were tested where all dependence, demographic, and contextual variables were entered into multivariable logistic regressions and survival analyses (controlling for treatment; see Table 4).

Point-prevalence abstinence. Significant predictors of 6-month point-prevalence abstinence were FTND score, age, gender, and education.

Initial abstinence. Significant predictors of initial abstinence were FTND score, ethnicity, and smoking in the home.

Lapse. Significant predictors of lapse risk were ethnicity, gender, marital status, education, smoking at work, number of smokers in the social network, and number of supportive individuals in the social network.

Lapse–relapse transition. Significant predictors of lapse–relapse risk were: FTND score and gender.

Discussion

Consistent with hypotheses, nicotine dependence was associated with decreased rates of initial cessation and higher risk of transitioning from lapse to relapse, independent of demographic and life context factors. This is consistent with Edwards' (1975) theory[60] that rapid reinstatement of drug use is a hallmark of dependence. Nicotine dependence was related to lapse risk when tested alone, but not in multivariate models. This suggests that nicotine dependence has some relationship to the lapsing process (e.g., perhaps indexing conditioned responses to smoking cues) but does not have unique predictive validity (Table 4). Thus, the data suggest that dependence

Table 4. Multiple regression models including dependence, demographic, and contextual variables and treatment

	Failure to reach initial abstinence[a] (*n*=1429)		Lapse[b,c] (*n*=1259)		Relapse[c,d] (*n*=930)		Point-prevalence abstinence[a] (*n*=1504)	
Measure	**OR (95% CI)**	***p*-value**	**HR (95% CI)**	***p*-value**	**HR (95% CI)**	***p*-value**	**OR (95% CI)**	***p*-value**
FTND score	1.11* (1.02, 1.21)	0.02	1.03 (1.00, 1.06)	0.08	1.08* (1.04, 1.13)	<0.001	1.16* (1.10, 1.23)	<0.001
Education	0.79 (0.50, 1.24)	0.30	0.80* (0.67, 0.94)	0.01	0.91 (0.73, 1.14)	0.41	0.69* (0.53, 0.90)	0.01
Marital status	1.18 (0.82, 1.70)	0.36	0.87* (0.76, 1.00)	0.05	1.02 (0.86, 1.22)	0.81	0.78* (0.61, 1.00)	0.04
Gender	1.13 (0.79, 1.62)	0.51	1.24* (1.08, 1.42)	0.003	1.29* (1.07, 1.54)	0.01	1.29* (1.01, 1.62)	0.04
Age	1.00 (0.98, 1.01)	0.73	1.00 (0.99, 1.01)	0.87	1.00 (0.99, 1.01)	0.51	0.99* (0.98, 1.00)	0.02
Ethnicity	0.41* (0.28, 0.62)	<0.001	0.80* (0.67, 0.96)	0.02	1.00 (0.79, 1.28)	0.98	0.64 (0.46, 0.90)	0.10
Smoking in the home	2.00* (1.34, 2.98)	<0.001	0.99 (0.86, 1.15)	0.93	0.92 (0.77, 1.10)	0.37	1.03 (0.80, 1.32)	0.82
Smoking at work	1.05 (0.74, 1.49)	0.78	1.15* (1.01, 1.32)	0.04	0.93 (0.79, 1.11)	0.43	0.99 (0.78, 1.24)	0.91
SRRS	1.001 (1.000, 1.003)	0.09	1.00 (1.00, 1.00)	0.65	1.00 (1.00, 1.00)	0.28	1.00 (1.00, 1.00)	0.76
Proportion of smokers in the social network	0.98 (0.88, 1.09)	0.73	1.05* (1.01, 1.09)	0.03	1.02 (0.97, 1.08)	0.35	1.05 (0.98, 1.12)	0.17
No. of supportive individuals in the social network[e]	0.96 (0.88, 1.09)	0.27	0.94* (0.91, 0.98)	<0.001	0.91* (0.86, 0.97)	0.003	0.96 (0.91, 1.01)	0.10

[a]Conducted using logistic regression
[b]Excludes individuals who did not achieve initial abstinence
[c]Conducted using proportional hazards survival analysis
[d]Excludes individuals who did not lapse
[e]Results do not include interaction with treatment period.
*$p<0.05$
FTND, Fagerström Test of Nicotine Dependence; HR, hazard ratio; SRRS, Social Readjustment Rating Scale

influences ultimate cessation outcome because it affects withdrawal, which in turn thwarts initial abstinence, and because lapses deliver priming doses of nicotine, which reinstate important dependence processes and spur relapse.[52,61]

Demographic and Contextual Variables

Although not predicted, many of the demographic and contextual variables predicted the achievement of initial abstinence, with ethnicity and smoking in the home making unique contributions. Consistent with predictions, all of the demographic and contextual variables were significantly related to lapse risk, with the exception of smoking in the home and life stress. Smoking in the home, however, was found to have a very strong relationship with initial abstinence. Therefore, it is possible that those at greatest risk due to smoking in the home failed to quit and were unavailable to lapse. Stress may have been unrelated to lapse risk because the measure of stress (SSRS[57]) was retrospective, and therefore insensitive to stress during the quit attempt.[7] To the extent that the demographic and contextual variables coded for greater exposure to high-risk contexts and phasic events (e.g., smoking cues, stressors, negative affect), the current findings are generally consistent with previous research that characterizes the episodic and contextual nature of such risk.[7] The results also show that contextual and demographic variables tend to decrease the likelihood of initial abstinence. The current data do not suggest a mechanism for these effects, but candidates could be cue-induced conditioned reactions, which might be exacerbated by withdrawal.[4,5,9,62]

Surprisingly, gender was the only demographic or contextual variable to make a significant and unique contribution to risk of relapse (with women having a 29% greater risk of relapse than men; Table 3). Gender effects on long-term abstinence have been reported frequently, but little is known about how or when such effects are manifested. These results suggest that women quit at the same rate as men but are more likely than men to sample cigarettes and thereafter escalate their use. It was predicted that social support would predict relapse risk. Although social support was related to initial abstinence and lapse risk, it was significantly associated with relapse risk only during treatment. Marital status, a less-direct measure of social support, failed to predict relapse.

There could be several reasons for the failure of contextual and demographic factors to predict relapse. It may be that the motivational forces unleashed by a lapse dwarf the importance of contextual and demographic influences. Previous research[51] has found that the vast majority of individuals who lapse eventually relapse; perhaps severe dependence renders relapse, given a lapse, almost

inevitable. It could also be that contextual and demographic predictors of the risk of progressing from lapse to relapse exist and were not adequately sampled in this research.

Summary and Implications

Nicotine dependence appeared to affect all cessation milestones, and especially initial abstinence and the transition from lapse to relapse. Thus, the treatments most likely to reduce lapse–relapse transitions might be those that counter dependence-related mechanisms unleashed by lapse cigarettes (e.g., increasing nicotine replacement dose after lapse).

Most demographic and contextual variables appeared to affect early milestones such as achievement of initial abstinence and lapse, but not the lapse–relapse transition. This may explain why the two most effective counseling elements are cue avoidance/coping training and intratreatment support,[63] as these treatment elements may address threats to initial abstinence and lapse occurrence. These treatments may be less effective for relapse prevention,[3] to the extent that the nature of the risks changes after a lapse being more associated with gender and dependence.

These findings identify populations at risk for failure at each of the cessation milestones. Contextual and demographic variables reflecting environmental smoking exposure (smoking in the home), life stress, and low levels of social support seem particularly detrimental for individuals trying to achieve initial abstinence and avoid lapsing. Therefore, treatments focusing on such risk variables could be offered to these populations at elevated risk[24] Finally, among the demographic and contextual variables, gender was uniquely and strongly related to lapse–relapse transition. This should encourage research to uncover causes or mediators of the extra risk experienced by women.[27]

Limitations and Future Directions

One limitation of this research is that contextual variables were measured via retrospective questionnaires rather than real-time data acquisition methods. Future research could use these methods to examine whether stronger relationships are found between context and milestones when contextual features are measured in real time (but this would lack some clinical utility for risk assessment). In addition, real-time data could be used to test the mechanisms by which smoker characteristics affect milestone outcomes. Second, the method of examining milestones for only those individuals who reached a previous milestone certainly affects the variables that are related to later milestones. For instance, the rate of lapsing affects the type of smoker who is "available" for relapse, which no doubt affects patterns of relationships with relapse predictors. In addition, this group is somewhat unrepresentative of the general population, limiting generalizability.

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