



PSYCHOSOCIAL CONSTRUCTS RELATED TO LIGHT SMOKING REDUCTION IN A PREDOMINATELY HISPANIC SAMPLE

Thom Taylor, B.A.S., Ashley A. Murray, B.A., Nora Y. Hernandez, B.S.,
Denise Rodríguez, M.A., Jennifer Venegas, M.A., & Theodore V. Cooper, Ph.D.



Abstract

Understanding psychosocial influences on light smoking is critical to the development and refinement of tailored cessation interventions. This study examined potential psychosocial influences on smoking rates among a sample of predominately Hispanic light smokers participating in a brief cessation intervention. At baseline and a one month follow-up, light smokers ($n=152$) completed measures assessing tobacco use and Transtheoretical Model (TTM) constructs, including Decisional Balance and Processes of Change measures. Following completion of baseline questionnaires, student smokers participated in a brief 45-minute intervention consisting of carbon monoxide feedback, motivational enhancement, the promotion of accessing social support, brief health education via costs of smoking and benefits of quitting smoking handouts, and when feasible setting a quit date. One month follow-up reports of average number of cigarettes smoked per day were regressed on the residual variances (i.e., unexplained variance) that represent the change between baseline and the one month follow-up. After adjusting for baseline levels of smoking, the residual variance from baseline to follow-up for environmental reevaluation, $IRR = .80, p < .05$ (95% CI: .65 - .99), and stimulus control residual variance, $IRR = .78, p < .05$ (95% CI: .62 - .99), had a significant effect on cigarettes per day (CPD) reduction at the one month follow-up. Other processes of change and smoking pros and cons were not significantly related to CPD at follow-up. Still, the intervention appears to have had an effect on calling attention to smoking as a social concern and on one's ability to control environmental triggers of smoking. Both attention to environmental experiences of smokers and behaviorally oriented activities such as trigger management may thereby be the most potent considerations in aiding light smokers to reduce CPD, potentially enabling quitting in the long term.

Introduction

Light Smoking
Light smoking is a pattern of smoking that involves smoking fewer cigarettes per day than a typical smoker (in the current study defined as between 1 cigarette a month and fewer than 10 per day). The smoking pattern of light smokers is generally more sporadic than that of a typical smoker, eliciting lower rates of withdrawal symptoms and a markedly decreased tolerance for smoking (Shiffman, Paty, Kassel, Gnys, & Zettler-Segal, 1994). However, over the course of a lifetime, light smoking increases the risk of lung cancer (National Cancer Institute, 1998) and heart disease (Prescott, Scharling, Osler, & Schnohr, 2002) which indicates that even light smoking has health consequences.

Smoking Reduction
Some interventions and treatment programs focus on reducing the amount of cigarettes a person smokes while promoting future smoking cessation (e.g., O'Connor & Langlois, 1998; Prochaska et al., 2001). Spontaneous reduction without specific reduction intervention can also occur (Hatsukami & Lando, 1993; U.S. Department of Health and Human Services [USDHHS], 1988). Furthermore, a number of studies have demonstrated that smoking reduction increases the probability of smoking cessation in individuals (Hughes & Carpenter, 2006). Hence, for those who have yet to quit, consideration of smoking reductions may enable enhanced understanding of those who do not immediately quit smoking, but have an increased probability of doing so in the future.

Transtheoretical Model (TTM)
The TTM posits an individual's readiness to change an undesired behavior (DiClemente & Prochaska, 1982) to be in 1 of 5 stages of motivation to change: Precontemplation, Contemplation, Preparation, Action, and Maintenance of a behavior. This theoretical framework has proven useful in assessing smoking cessation and smoking behavior (Fava, Velicer, & Prochaska, 1995; Prochaska, 1994; Velicer, Norman, Fava, & Prochaska, 1999).

The TTM encompasses a variety of constructs found to be related to stage of motivation to quit smoking. The current study examined both the processes of change and the pros and cons of smoking commonly delineated in the TTM (Prochaska et al., 1994; Prochaska, Velicer, DiClemente, & Fava, 1988). Studies employing these measures have found that an individual's ability to evaluate the positive and negative aspects of smoking is an important determinant of motivation to change one's smoking behavior (King, Marcus, Pinto, Emmons, & Abrams, 1996). Additionally, the processes of change component of the TTM focuses on the experiential and behavioral aspects of smoking, such as identifying the places, activities, or events that encourage or discourage smoking (DiClemente, Prochaska, Fairhurst, Velicer, Velasquez, & Rossi, 1991). Considering TTM constructs may elucidate where interventions likely have an effect. Indeed, these constructs have been found to delineate those who have quit, have relapsed, or whom have yet to quit (Sun, Prochaska, Velicer, & Laforge, 2007). Still, no assessment of these constructs in relation to smoking reductions after intervention have occurred.

Study Aims

The present study assesses TTM constructs in relation to smoking reduction after a light smoking intervention in order to examine the most powerful aspects of the intervention for light smokers at the 1 month follow-up.

Hypotheses

- Light smoking non-quit reducers will evidence significant changes in pros and cons to smoking that will predict reductions in smoking at the 1 month follow-up.
- Light smoking non-quit reducers will evidence significant changes in both experiential and behavioral processes of change that will predict reductions in smoking at the 1 month follow-up.

Methods

Participants
242 UTEP students whose smoking frequency ranged from at least one cigarette in the past month to not more than 10 cigarettes per day were eligible to participate in this intervention targeting light smokers. Those who had not quit at the 1 month follow-up ($n=152$) were included in analyses of potential smoking reductions.

Measures and Intervention Components

- Demographic questionnaire:** Typical sociodemographic information was gathered. See Table 1.
- The CPRC Smoking: Stages of Change (SOC), Short Form:** (DiClemente et al., 1991) assesses readiness to quit along a continuum of stage constructs. This categorical measure has been reasonably employed with both adolescent and adult smokers (Aveyard, Lancashire, Almond, & Cheng, 2002; Carlson, Taenzler, Koopman, & Casebeer, 2003; Pallonen, 1998). See Table 1 for the motivational characteristics of this sample.
- Fagerström Test of Nicotine Dependence:** (FTND) Heatherton, Kozlowski, Frecker, & Fagerström, 1991) assesses the degree of psychological dependence on nicotine via 6 items. The FTND has been found to be a valid measure of heaviness of smoking compared to biochemical indices and has acceptable levels of internal consistency, which are reported at .68 (Heatherton et al., 1991). See Table 1 for participant FTND scores.
- Decisional Balance:** (DB) Velicer, DiClemente, Prochaska, & Brandenburg, 1985) assesses the degree to which participants are inclined to quit smoking. The measure consists of two scales measuring the pros and cons of smoking, which have internal consistencies of .87 and .90 respectively. The reliability coefficients for the present study can be seen in Table 2.
- Processes of Change:** (POC) Prochaska, Velicer, DiClemente, & Fava, 1988) assesses how smokers are changing their attitudes and behaviors. The 40- item questionnaire generally provides a reliable measure of ten processes of change. Internal consistencies for the ten scales range from .70 to .80. The reliability coefficients for the present study can be seen in Table 2.
- Bedfont Smokerlyzer:** assesses expired carbon monoxide (CO) with a precision of 99.8% (Hald, Overgaard, & Grau, 2003). Participants are asked to hold their breath for 15 seconds and then to breathe into the machine. The Smokerlyzer then provides a digital reading of CO in parts per million (ppm). See Table 1 for participant CO readings.

Procedure
Informed consent was obtained from each participant. Participants participated in the baseline session. Each student received feedback on his/her expired CO reading. Motivational enhancement techniques were used to elicit from the smoker costs and benefits related to maintaining one's smoking status or quitting smoking and smokers were offered handouts on the costs specific to light smoking and the benefits of quitting. Finally, in an effort to address issues specific to both light smokers and Hispanics more generally, accessing social support was also addressed in the intervention. Participants received a \$10 payment for participation. At the 1 month follow-up, participants who had not quit reported their average number of cpd, FTND, DB, and POC measures in person, by phone, or by internet response.

Approach to Analyses
Month 1 follow-up DB and POC variables were regressed on their baseline values. The residuals were saved and used to assess the impact of the light smoking intervention on these TTM constructs and their observed influence on smoking reductions for those who had yet to quit.

Reductions were assessed in a negative binomial regression due to over-dispersion of the count distribution:

- Predictors of interest included DB and POC residuals (change scores).
- Scales with reliabilities < .70 were not included in the model due to imprecise measurement.

Table 2: Cronbach Reliabilities of Subscales

	Baseline	1 Month
Decisional Balance		
Pros to smoking	.78	.83
Cons to smoking	.78	.84
Processes of Change (Experiential)		
Consciousness Raising	.78	.84
Helping Relationships	.69	.76
Environmental Reevaluation	.83	.83
Social Liberation	.44	.56
Self Reevaluation	.84	.84
Processes of Change (Behavioral)		
Self Liberation	.72	.80
Dramatic Relief	.83	.87
Counter Conditioning	.52	.74
Stimulus Control	.77	.88
Reinforcement Management	.76	.75

Scales with $\alpha < .70$ were excluded from further analyses

Table 3: Negative Binomial Regression of Cigarettes Per Day at 1 Month Follow-Up

Predictor	IRR	p <	IRR 95%CI	%Reduction
Baseline CPD	1.07	.001	1.03 - 1.10	6.6%
Residual for DB Pros	.99	ns	.84 - 1.17	-1.0%
Residual for DB Cons	1.00	ns	.82 - 1.22	.2%
Residual for Consciousness Raising	.99	ns	.81 - 1.20	-1.3%
Residual for Self Liberation	1.19	ns	.99 - 1.43	18.7%
Residual for Dramatic Relief	1.03	ns	.85 - 1.24	3.0%
Residual for Stimulus Control	.78	.05	.62 - .99	-21.7%
Residual for Environmental Reevaluation	.80	.05	.65 - .99	-19.8%
Residual for Self Reevaluation	.98	ns	.77 - 1.24	-2.1%
Residual for Reinforcement Management	1.23	ns	.97 - 1.54	22.6%

Note 1: Model $X^2 = 72.65, p < .001$; Overdisp. $X^2 = 72.65, p < .001$; Nagel. $R^2 = .26$

Note 2: Residuals represent unexplained variance in Follow-Up from Baseline

Note 3: ns = non-significant at $p < .05$ level

Note 4: % Reduction is for a 1 unit change in residual variance of the predictor

Results

For those who had yet to quit who participated in the light smoking cessation intervention, a significant reduction in reported average CPD was observed, $t(139) = 2.62, p < .01$. Month 1 follow-up reports of average CPD smoked ($M = 3.4, SD = 3.6$) were significantly lower than baseline reports of average CPD ($M = 4.5, SD = 5.1$), $Cohen's d = .25$.

The negative binomial regression predicting average number of cigarettes smoked per day at 1 month follow-up from the residual variances resulted in two significant predictors after adjusting for average number of cigarettes smoked per day at baseline. Residual variance from baseline to follow-up for environmental reevaluation had a significant effect on average number of cigarettes smoked per day at the 1 month follow-up, $IRR = .80, p < .05$ (95% CI: .65 - .99). This estimate suggests that for every unit of residual change observed in environmental reevaluation that occurs, a 20% reduction in CPD can be expected in light smokers. Stimulus Control residual variance also predicted decreases in smoking, $IRR = .78, p < .05$ (95% CI: .62 - .99), suggesting that for every unit of residual change observed in stimulus control that occurs, a 22% reduction in CPD can be expected in light smokers. More simply, more "activity" in these two constructs resulted in reports of decreased smoking at 1 month follow-up.

Discussion

The light smoking intervention showed a small to medium effect in reduction of smoking. This is meaningful as there is evidence that smoking reductions can facilitate cessation (Carpenter, Hughes, Solomon, & Callas, 2004; Hughes & Carpenter, 2006). Furthermore, for those who do not quit, some evidence suggests these reductions can be maintained over a significant amount of time (Hughes & Carpenter, 2005). Importantly, smoking reductions can be accompanied by increased self-efficacy (Carpenter et al., 2004; USDHHS, 1988) suggesting that, to the extent that these reductions promote future cessation, the individual may have more success in abstinence once quitting does occur.

Notably, those who reduce may have lower motivation to quit, may feel more peer pressure to smoke, and may feel less confident in quitting (Bolliger, 2000; Peters, Hughes, Callas, & Solomon, 2007), but, similar to observed changes in self-efficacy when reducing, some evidence suggests that successful smoking reduction increases motivation to quit (Wenike, Danielsson, Landfeldt, Westin, & Tønnesen, 2003). Within this intervention targeting light smokers, this motivational component to smoking reduction appears to be most heavily influenced by environmental reevaluation (experiential) and stimulus control (behavioral) constructs. An example item within the environmental reevaluation construct is "I am considering the idea that the world around me would be a better place without my smoking." An example item within the stimulus control construct is "I remove things from my home that remind me of smoking." The hypothesis that the DB constructs would also predict reductions was not confirmed when considering the impact of these POC variables, suggesting again that the salience of the intervention in terms of reductions was mostly due to more experiential and behavioral processes.

Given that cues reinforce the desire to smoke (Hogarth, Dickinson, & Duka, 2005), stimulus control is a reasonable intervention approach to aiding cessation (Hatsukami & Lando, 1993; USDHHS, 1988). Within the TTM, increased stimulus control (e.g., managing triggers to smoke), along with other behavioral process of change variables, has been associated with long term cessation (Sun, Prochaska, Velicer, & Laforge, 2007). The same relationships may hold for those who are able to reduce their smoking, though the relationship may be particularly strong between stimulus control and smoking reduction.

Stimulus control may tie closely with environmental reevaluation, an experiential process, as some evidence suggests that home smoking bans increase quit attempts and cessation in motivated smokers (Pizacani et al., 2004). The items that tap environmental reevaluation may broadly encompass issues such as environmental smoking restrictions and second hand smoke considerations. Indeed, adult smokers have reported awareness that their smoking behaviors are detrimental not only to themselves but also to their children and, more broadly, community members (Tingen et al., 2006). Environmental reevaluation may also arise from changes in adults' attitudes when clean indoor air regulations outside the home (e.g., bars and restaurants) are approved (Trotter, Wakefield, & Borland, 2002). For adolescent smokers, there is also some evidence that parental concerns increase the adolescents' desires to quit (Castrucci & Gerlach, 2005). This may be indirect evidence that young adults engage in environmental reevaluation when making decisions about their smoking.

Future Directions
The predominant proportion of participants were of Mexican descent, though no information on Hispanic reducers is apparent in the literature. To the extent that CPD reductions lead to cessation, tracking of Hispanic smokers' reduction patterns may enable better understanding of Hispanic smokers' pathways to successful cessation.

Future work might examine potential changes in self-efficacy that may accompany reductions; this would provide a case for improved success in remaining abstinent once the individual does quit.

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Table 1: Demographic Characteristics of Cigarette Reducers (n = 152)

	%	Median	IQR
Gender		21	19 - 24
Male	53		
Female	47		
Ethnicity		Cont.	PreC. – Cont.
Mexican National	16	Exhaled CO (ppm)	2 1 - 5
Mexican American	66	FTND	1 0 - 1
Non-Hispanic White	9	Cigarettes Per Day	3 2 - 5
Other	9		
Baseline Stage of Change		1 Month Follow-Up	
Preparation	24	Stage of Change	Cont PreC. – Cont.
Contemplation (Cont.)	38	FTND	1 0 - 1
Precontemplation (PreC.)	38	Cigarettes Per Day	2 1 - 4