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Cognitive and Affective Predictors of Smoking after a Sentinel Health Event

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Abstract

Objective—This study examined how smoking-related causal attributions, perceived illness severity, and event-related emotions relate to both intentions to quit and subsequent smoking behavior after an acute medical problem (sentinel event).

Methods—Three hundred and seventy five patients were enrolled from 10 emergency departments (EDs) across the United States and followed for 6 months. Two saturated, manifest structural equation models were performed: one predicting quit attempts and the other predicting 7-day point prevalence abstinence at 14 days, 3 months, and 6 months after the index ED visit. Stage of change was regressed onto each of the other predictor variables (causal attribution, perceived illness severity, event-related emotions) and covariates, and tobacco cessation outcomes were regressed on all of the predictor variables and covariates.

Results—Non-white race, baseline stage of change, and an interaction between causal attribution and event-related fear were the strongest predictors of quit attempt. In contrast, abstinence at six months was most strongly predicted by baseline stage of change and nicotine dependence.

Conclusion—Predictors of smoking behavior after an acute medical illness are complex and dynamic. The relations vary depending on the outcome examined (quit attempts versus

Note: A paper describing motivation predictors of short term change has been published using the dataset used for the current study. Boudreaux ED, Sullivan AF, Abar B, Bernstein SL, Ginde AA, Camargo CA, Jr, on behalf of the MARC-33 investigators. Motivation rulers for smoking cessation: A prospective, observational examination of construct and predictive validity. *Addiction Science & Clinical Practice*, 2012;7:8. doi:10.1186/1940-0640-7-8 <http://www.ascpjournals.org/content/7/1/8>

abstinence), differ based on the time that has progressed since the event, and include significant interactions.

Keywords

Tobacco; tobacco cessation; motivation; stage of change; reliability; validity

Introduction

Across many medical settings, it is quite common to observe sudden, unplanned behavior change after an acute illness or diagnosis (Boudreaux, Bock, & OHea, 2012). In a compelling exposition of the relation between medical events and smoking cessation, McBride and colleagues (2003) point out that several indirect lines of evidence converge to support the premise that sentinel health events can trigger behavior change. Using smoking as an illustrative example, they noted that patients who experience an important health event, such as pregnancy, hospitalization, or a serious disease diagnosis, have significantly higher rates of cessation than the general population, or patients simply attending an outpatient clinic appointment or well visit. Boudreaux and colleagues (2012) have also demonstrated that patients experiencing medical emergencies, like myocardial infarctions, who are assigned to control conditions in clinical trials can still exhibit long-term cessation rates. The Sentinel Event Model (SEM; Boudreaux et al., 2012) theorizes that cognitive and emotional factors interact, and change over time, after a health event and thus result in health behavior change. Specifically, when applied to smoking cessation and cardiac symptoms, the authors of the SEM have focused on causal attribution of a medical problem (to what factors a person attributes his/her present medical problem), perceived illness severity of a medical problem (how serious or life threatening a person perceives his/her medical problem), and fear secondary to an acute health event (i.e., event-related fear) and their associations with intentions to quit smoking. In one study, Boudreaux et al. (2010) found that while causal attribution of the health event and event-related fear were modestly associated with quit intentions, perceived illness severity was not. These findings were novel as they implicated a well-known cognitive predictor – causal attribution of a medical problem – and also identified an important affective predictor. In addition, it contradicted past literature that has demonstrated a link between perceived illness severity and quit intentions (Leventhal, Nerenz, & Steele, 1985; Weinstein, 2000). In order to further extend our understanding of how these constructs relate to intentions to quit *and* subsequent smoking behavior after an acute medical problem, the present study was conducted. Notably, the present paper investigates the interactions between the predictors, not just the main effects, as researchers (Weinstein et al., 2007) have suggested that they may be important in disentangling the complex relations between perceived severity and behavior.

Method

Procedures

This study was prospective in its design. Data for this study were collected in 2008-2009 using participants recruited from 10 EDs in eight geographically diverse regions of the U.S. Although the data were collected 5 years ago, we have no reason to believe the validity of

the data would be altered with the passing of time. During a 10-day enrollment period, trained research personnel staffed the EDs during the peak volume hours of 9:00 AM to midnight and screened consecutive ED patients for tobacco use. Eligible patients were 18 years or older who currently smoked cigarettes. Although they had to have smoked >100 cigarettes in their lifetime, there was no minimum smoking rate, and we enrolled both non-daily and daily smokers. Participants completed a self-report, paper-and-pencil baseline assessment in the ED with assistance from research staff when needed. Site research staff completed telephone follow-up interviews 14 days, three months, and six months after the index ED visit. A call window of seven days was used at each time-point. The study was coordinated by the Emergency Medicine Network (EMNet; www.emnet-usa.org). The institutional review boards at all 10 sites approved the study, and participants provided written informed consent.

Measures

Causal Attribution—Three questions measured the degree to which the participant viewed his or her medical problem as related to smoking: 1) *My current ER visit is due to a smoking-related health problem*, 2) *My smoking has led directly to my current health problem*, 3) *If I was not a smoker, I probably would not have had to come to the ER today*. Responses were rated using a Likert scale ranging from 1=Strongly Disagree to 7=Strongly Agree. The scale demonstrated good internal consistency (Cronbach's $\alpha = 0.80$).

Perceived Severity—Three questions measured how serious the participant perceived his or her medical condition: 1) *My current health problem will have a major impact on my life*, 2) *My current health problem is life threatening*, and 3) *My ER visit is due to a serious medical condition*. Responses were rated using a Likert scale ranging from 1=Strongly Disagree to 7=Strongly Agree. Higher scores indicated stronger belief that their current medical problem was serious. The scale demonstrated good internal consistency (Cronbach's $\alpha = 0.82$).

Event-Related Fear—Three questions measured the participant's fear related to his or her illness: 1) *My current health problem makes me afraid*, 2) *My current health problem has given me a real scare*, and 3) *When I think of my current health problem, I get afraid about what might happen to me*. Responses were rated using a Likert scale ranging from 1=Strongly Disagree to 7=Strongly Agree. The scale demonstrated good internal consistency (Cronbach's $\alpha = 0.89$).

Interaction Terms—In order to examine the potential interactions between causal attribution, perceived severity, and event-related fear, these variables were mean centered, and product terms were created for causal attribution $\times$ perceived severity and causal attribution $\times$ event-related fear. These were the two interaction terms the study team believed were most theoretically important.

Stage of Change—Stage of change (Prochaska & Velicer, 1997) was assessed by asking the participant if he or she intended to quit smoking, and, if so, when: >12 months from now, within 6 to 12 months, within 1 to 6 months, within the next 30 days, or today. In

addition, whether the individual had made a quit attempt within the past 12 months was assessed.

Tobacco Cessation Outcomes: Fourteen days, three months, and six months after the ED visit, participants were called by research staff to assess smoking behaviors and cessation efforts. Participants were asked whether they had gone 24 hours without smoking because they were trying to quit (*Quit Attempt*; coded 0 = No, 1 = Yes). Participants also reported whether they had smoked, even a puff, in the past seven days (*Seven-Day Point Prevalence Abstinence*; coded 0 = No, 1 = Yes).

Covariates

Covariates included patient demographics (age, sex, race, ethnicity, and educational level), nicotine dependence. (Heavy Smoking Index; Kozlowski, Porter, Orleans, Pope, & Heatherton, 1994), problem alcohol use (The Rapid Alcohol Problem Screen (RAPS; Cherpitel, 1995), problem drug use (RDPS; Cherpitel & Borges, 2004), and depressed mood (Patient Health Questionnaire-2; Kroenke, Spitzer, & Williams, 2003).

Results

Sample Characteristics—Three hundred and seventy five participants were successfully enrolled (see Table 1 for sample demographics). There was a 72% retention rate at the 14-day follow-up, 65% at the 3-month follow-up, and 58% at the 6-month follow-up.

Descriptive Statistics of Primary Predictors and Outcomes—Predictor, covariate, and tobacco cessation outcome descriptive statistics are presented in Table 1. Examination of the raw distributions for the causal attribution, perceived severity, and event-related fear constructs showed strong U-shaped patterns, such that there were relatively large clusters of individuals at the absolute bottom ($M = 1$) and top ($M = 7$) of the scales. In order to account for these patterns, we converted these variables into four ordered categories (1 = 1; 2 = between 1 and 3.99; 3 = between 4 and 6.99; 4 = 7), and used these relatively normally-distributed, ordinal variables as predictors. The interaction terms between these variables were created using the ordinally-transformed variables. In regard to stage of change, the largest proportion of participants was in the precontemplation stage. Results indicated that quit attempts were relatively common at each follow-up, but seven-day abstinence was much less common (e.g., roughly $\frac{1}{4}$ as frequent).

Correlations among causal attribution, perceived severity, and event-related fear were consistently positive and of moderate magnitude ($r = 0.40 - 0.69$, all $p < 0.001$). There were also significant correlations for causal attribution and event-related fear with stage of change ($r = 0.21$, $p < 0.001$, and $r = 0.11$, $p = 0.03$, respectively). The bivariate association between perceived severity and stage of change approached statistical significance ($r = 0.10$, $p = 0.07$).

Bivariate Associations between Predictors and Outcomes—Participants who attempted to quit at the 14-day follow-up displayed significantly higher causal attribution ($t_{258} = 2.48$, $p = 0.01$) and event-related fear ($t_{259} = 2.23$, $p = 0.03$) at baseline than

participants who did not attempt to quit. Quit attempters at the three-month follow-up displayed higher causal attribution ($t_{226} = 1.95, p = 0.05$), perceived severity ($t_{226} = 2.77, p < 0.01$), and event-related fear ($t_{227} = 2.86, p < 0.01$). The interaction between causal attribution and event-related fear was related to quit attempts at six months: ($t_{208} = 2.51, p = 0.01$). Causal attribution, perceived severity, event-related fear, and the interaction variables were not related to seven day abstinence at the 14 day, three month, and six month follow-ups.

Stage of change was consistently related to quit attempts *and* seven-day abstinence across 14-day, 3-month, and 6-month follow-ups (quit attempts: $\chi^2_2 > 11.27$, all $p < 0.01$; 7-day abstinence: $\chi^2_2 > 9.32$, all $p < 0.01$). Individuals in the preparation stage were more likely than individuals in the precontemplation and contemplation stages to attempt to quit and to maintain 7-day tobacco abstinence at follow-up.

Manifest Structural Equation Models

Predicting Quit Attempts: Multivariate associations were examined using saturated, manifest structural equation models. Figure 1 presents the model predicting quit attempts. A quit attempt at any of the time points was positively related to four variables (all $p < 0.05$): non-white race, stage of change, causal attribution, and causal attribution $\times$ event-related fear. Stage of change was predicted by causal attribution, age, and nicotine dependence (all $p < 0.05$).

Predicting 7-Day Abstinence: Figure 2 presents the model predicting participants' seven-day abstinence. Seven-day abstinence at any of the time points was positively related to stage of change and negatively related to nicotine dependence (both $p < 0.05$).

Discussion

Broadly, the two structural models (Figures 1 and 2) revealed that the number of factors associated with attempting to quit is greater and more complex than the number of predictors of abstinence. Having a quit attempt was predicted by four variables, with one being an interaction variable, while abstinence was predicted by two main effect variables. This suggests that a number of different factors can influence whether an individual takes the first step to make an attempt to quit smoking, but fewer factors appear to be important when evaluating whether or not this change was successful.

The present findings corroborate Rothman's (2000) point that behavioral initiation and maintenance are different and need to be investigated separately. While stage of change was a consistent predictor of both a quit attempt *and* abstinence across all three time points, the cognitive and affective variables associated with the illness, like smoking-related causal attributions and the amount of fear experienced during the illness, were only associated with quit attempts. Furthermore, the effect of several of the baseline variables on the smoking outcomes over the six months, including causal attribution, age, and nicotine dependence, appear to be at least partially mediated through stage of change. Some variables, like causal attribution, were more strongly related to motivation and to early attempts to quit, and perhaps could be prime targets for early interventions, while others, like nicotine

dependence, were most strongly related to abstinence, and may be prime targets for helping the individual to sustain change.

The present findings also highlight the importance of considering the interaction between variables when predicting health behaviors. The severity of the illness, and the fear it inspires, may be relevant to behavior change only if the individual links the illness causally to the behavior. The strongest predictor of whether an individual reported a quit attempt at the six-month follow-up was the interaction between high causal attribution and high event-related fear. It remained a moderately strong predictor even after stage of change, nicotine dependence, and other notable predictors, including substance abuse and depression, were adjusted for in the model.

In sum, there is a complex and dynamic interplay between perceptions, behaviors, behavior change, and time. What sparks behavioral change immediately after an acute health event may not be what influences behavioral change decisions as time passes, or whether this change is sustained.

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Figure 1. Predicting quit attempts with covariates

Note: Values in the figure represent standardized beta coefficients. Covariates included in the model were: age, sex, race (white/non-white), ethnicity, educational level, HSI, drug problems, alcohol problems, and depression. Only covariates with significant effects were included in the figure. All predictive paths and covariances between outcomes were modeled, but only significant effects are presented in the figure for clarity of presentation. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figure 2. Predicting 7-day abstinence with covariates

Note: Values in the figure represent standardized beta coefficients. Covariates included in the model were: age, sex, race (white/non-white), ethnicity, educational level, HSI, drug problems, alcohol problems, and depression. Only covariates with significant effects were included in the figure. All predictive paths and covariances between outcomes were modeled, but only significant effects are presented in the figure for clarity of presentation. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 1
Descriptive characteristics of predictor and outcome variables

	Frequencies (%)	Mean (S.D.)
Age (in years)		41 (12)
Sex		
Male	164 (44%)	
Female	210 (56%)	
Race		
White	173 (50%)	
Non-White	170 (50%)	
Ethnicity		
Hispanic	73 (21%)	
Non-Hispanic	273 (79%)	
Educational Status		
< High School	88 (24%)	
HS Graduate	282 (76%)	
Nicotine dependence (HSI) (0 to 4 range)		2.50 (1.62)
Problem Drug Use	59 (16%)	
Problem Alcohol Use	89 (24%)	
Depressed Mood		1.03 (0.95)
Causal Attribution ¹		3.49 (2.07)
Perceived Severity ¹		3.86 (2.25)
Event-Related Fear ¹		2.07 (1.63)
Stage of Change		
Precontemplation	166 (45%)	
Contemplation	122 (33%)	
Preparation	78 (21%)	
Quit attempt (14-Day)	118 (45%)	
Quit attempt (3-Month)	142 (61%)	
Quit attempt (6-Month)	142 (67%)	
7-Day Abstinence (14-Day)	24 (9%)	
7-Day Abstinence (3-Month)	37 (16%)	
7-Day Abstinence (6-Month)	33 (15%)	

n = 375; Percentages are based on available non-missing data.

¹These values represent the raw means before categorizing. The anchors for each item comprising these scales was 1=Strongly Disagree to 7=Strongly Agree.