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A Comparison of Autonomous Regulation and Negative Self-Evaluative Emotions as Predictors of Smoking Behavior Change among College Students

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Abstract

This study compared autonomous self-regulation and negative self-evaluative emotions as predictors of smoking behavior change in college student smokers (*N*=303) in a smoking cessation intervention study. Although the two constructs were moderately correlated, latent growth curve modeling revealed that only autonomous regulation, but not negative self-evaluative emotions, was negatively related to the number of days smoked. Results suggest that the two variables tap different aspects of motivation to change smoking behaviors, and that autonomous regulation predicts smoking behavior change better than negative self-evaluative emotions.

Keywords

Autonomous self-regulation; Negative self-evaluative emotions; Self-determination theory; Smoking; College student

Cigarette smoking remains a leading preventable cause of death (Centers for Disease Control and Prevention [CDC], 2008). To decrease smoking rates it is necessary to motivate smokers to try to quit. Theoretical approaches to motivate health behavior change vary widely (e.g., Prochaska and DiClemente, 1983; Deci and Ryan, 1985; Bandura, 1986) with important implications for how motivation is measured and enhanced.

One conceptualization of motivation that has been applied to smokers is based on Self-Determination Theory (SDT: Deci and Ryan, 1985; Ryan and Deci, 1999, 2000). According to SDT, motivation can be viewed along an “internal-external” continuum. “Autonomous self-regulation” falls toward the internal end of the continuum and refers to the degree that people perform a behavior due to a true sense of volition and act for the personal importance of the behavior. At the opposite end is “controlled regulation”, the extent that people perform a behavior because of external or intrapsychic pressures (Williams et al., 1998). “Introjected regulation” is a type of the controlled regulation in which people are motivated to change behaviors to avoid guilt or attain ego enhancements (Deci and Ryan, 1985; Ryan and Deci, 1999, 2000). According to SDT, externally motivated behaviors can be internalized to autonomously regulate as individuals feel connected with others, perceive competence, and experience autonomy. This internalization of controlled regulation to

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autonomous regulation is important because, according to SDT, autonomous regulation is the most powerful form of motivation showing better short-term and long-term prediction, increased engagement, and greater persistence in behavior change than controlled regulation (Ryan and Deci, 2000). In the smoking behavior literature higher autonomous regulation for quitting has been found to be positively associated with higher intent to quit smoking (Pavey and Sparks, 2008) and several longitudinal studies of adult smokers have shown that interventions that have enhanced autonomous regulation for smoking cessation have led to greater abstinence at long-term follow-ups (Solloway et al., 2006; Williams et al., 2002, 2006, 2009).

An alternative conceptualization of motivation that has been applied to smokers is negative self-evaluative emotions (or negative self-conscious emotions: Tracy and Robins, 2004; Tangney, 1999). This construct is derived from Bandura's Social Cognitive Theory (SCT: Bandura, 1986) which holds that discrepancies between people's ideal and actual self can cause a perceived threat to the self, which is experienced as dissatisfaction with oneself, shame, and regret. People who experience negative self-evaluative emotions may attempt to change unhealthy behaviors to restore the self (Steele, 1999) and/or to experience anticipated positive outcomes (i.e., anticipated relief from negative self-evaluative emotions or anticipated positive self-evaluative emotions) (Bandura, 1986, 1997 – see Dijkstra and Den Dijker, 2005). In the smoking literature a number of longitudinal studies of adult smokers in the Netherlands have found that negative self-evaluative emotions have been consistently, positively related to the likelihood of attempting to quit (Dijkstra and Buunk, 2008; Dijkstra and Den Dijker, 2005; Dijkstra et al., 1999).

Although research has separately examined autonomous regulation and negative self-evaluative emotions as predictors of smoking behavior these constructs have not been compared as predictors in a single study. Examining predictions of alternative theories and comparing related constructs could lead to refinements in theory and identification of more effective means to motivate smoking cessation. From an SDT perspective, motivation based on negative self-evaluative emotions would be considered introjected (i.e., motivated to avoid guilt or attain ego enhancement) rather than autonomous. Based on prior SDT research, autonomous regulation should therefore be superior to negative self-evaluative emotions for motivating smoking cessation.

In light of the lack of prior work comparing autonomous regulation to negative self-evaluative emotions, the aim of this study was to directly compare these two motivational constructs as predictors of smoking behavior change. Based on SDT, it was hypothesized that autonomous regulation would be a better predictor of smoking than negative self-evaluative emotions. We examined this hypothesis using data from a cluster-randomized trial testing Motivational Interviewing (MI: Miller and Rollnick, 2002) for smoking cessation to MI for increasing fruit and vegetable intake among college student smokers (Harris et al., 2010). College student cigarette smoking is an important concern because their smoking prevalence has not decreased as it has among the general population (Johnston et al., 2007; Rigotti et al., 2000; Thompson et al., 2007). In addition, understanding motivation to quit is particularly important among college students because they are generally low in their motivation to quit (Waters et al., 2006).

In the original study motivation and smoking were assessed at baseline, end of treatment, and follow-up, which allowed us to examine the association between changes in these variables. We anticipated that increases in motivation to quit would be related to reductions in smoking behavior and hypothesized that the relationship would be stronger for autonomous regulation than negative self-evaluative emotions. We focused on the nature of

these associations independent of the treatment group assignment, because interactions with MI treatment were not the focus of this study.

Methods

Participants

Participants in the original study (Harris et al., 2010) were 452 college students from 30 Greek chapters at one large Midwestern university. Eligibility criteria included smoking cigarettes one or more days during the past 30 days, not using medications to help quit smoking during the past 30 days, being at least 18 years old, and willing to participating in a health study.

Of the 452 enrolled, 5 participants who were eligible at screening, but smoked no cigarettes at all during the 30 days prior to the baseline survey were excluded from data analysis. Also, we excluded 120 participants who missed the assessment at 3 months and 24 who missed the assessment at 6 months, resulting in a final sample of 303 participants. The mean age of the participants was 19.5 (SD = 1.06), and 173 (57.1%) were males. A majority of the participants were Whites (N = 288, 95.0%), and participants were recruited across all school years (Freshmen: N = 65, 21.5%; Sophomores: N = 111, 36.6%; and Juniors: N = 80, 26.4%). On average they smoked 61.2 (SD = 110.02) cigarettes during 11.2 (SD = 10.20) days of the past 30 days. The mean levels of motivation to quit and reduce smoking were 5.55 (SD = 2.92) and 6.43 (SD = 3.18), respectively, when they were assessed by 0 (not at all motivated) to 10 (very motivated) scale.

Participants who were included in data analyses did not differ significantly from those excluded in terms of age ($t(450) = .167$, *ns*), gender ($\chi^2 = 2.406$, *ns*), ethnicity ($\chi^2 = 3.182$, *ns*), school years ($\chi^2 = 1.190$, *ns*), number of cigarettes ($t(450) = .451$, *ns*), number of days smoked ($t(450) = 1.299$, *ns*), baseline levels of autonomous regulation ($t(450) = -1.138$, *ns*), and negative self-evaluative emotions ($t(450) = -.961$, *ns*).

Measures

Demographics assessed included gender, age, ethnicity, and school year (freshman, sophomore, etc.).

Autonomous regulation was assessed using the Treatment Self-Regulation Questionnaire (TSRQ: Ryan and Connell, 1989; Williams et al., 1996). Participants were asked to endorse items on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree), and the means of the 6 items for the Autonomous Regulation subscale were calculated. A sample item is: “The reason I would not smoke is because I feel that I want to take responsibility for my own health”. In the present study, alpha coefficients ranged from .87 to .91 across time points.

Negative self-evaluative emotions were assessed with an 8-item instrument developed by Dijkstra and Buunk (2005). Participants were asked to endorse items on a 7-point Likert-type scale ranging from 1 (not at all) to 7 (very much), and the means of each item were calculated. A sample item is: “I blame myself for smoking”. In the original study the alpha coefficient was .94, and in the present study alpha coefficients ranged from .90 to .92 across time points.

Smoking behavior was assessed using the Timeline Follow-Back Method (TLFB: Harris et al., 2009). Participants entered a few anchoring (i.e., memory cueing) events on a calendar of the 30 days prior to the date of the assessment. They then entered the number of cigarettes smoked on each of the 30 days. Days smoked was selected as the dependent variable in this

study because it is a useful index of smoking behavior when including both daily and non-daily smokers and because it was more likely to be sensitive to motivational effects than the dichotomous variable of cessation.

Procedures

Recruitment and retention procedures are described in detail elsewhere (Davidson et al., 2010; Varvel et al., 2008), but in brief, sororities and fraternities that agreed to participate facilitated screening at a chapter meeting. Eligible students were scheduled for baseline assessment where they completed a computerized survey that included demographic, motivation, and smoking behavior measures. Participants were then randomly assigned to either MI focused on quitting smoking, or MI focused on increasing consumption of fruits and vegetables, and received up to four sessions of MI with a trained counselor. At the end of the fourth MI session (approximately 3 months after baseline assessment) and at a 6-month follow-up session, participants completed computerized surveys that included the same motivation and smoking behavior measures.

Data Analysis

Because participants in this study were clustered in chapters we examined dependencies within the data using intraclass correlation coefficients (ICC's) to determine whether multi-level modeling was necessary.

Additional preliminary analyses examined the means of the motivation variables at each time point and the changes in motivation over time using separate repeated measures analyses of variance (ANOVAs). Treatment group differences in motivation and days smoked at each time point were also tested using t-tests to determine the need to include these variables in subsequent analyses. We also examined bivariate associations between the two motivational measures at each time point as well as their respective associations with days smoked at each time point and each later time point.

The main analyses employed latent growth curve (LGC) modeling (Bollen and Curran, 2006) to assess the relationships between motivation levels and changes in motivation over time on the one hand, and number of days smoked on the other using AMOS (version 18; Arbuckle, 2007). Motivation and smoking behavior assessed at three time points were included in the analysis. To meet the assumption of univariate normality, a log transformation was performed on autonomous regulation scores and the number of days smoked.

Data analysis proceeded in several steps. First, the basic model describing the relationship between motivation and smoking behavior was tested including either autonomous regulation or negative self-evaluative emotions and number of days smoked. The model in this study tested the hypothesis that the latent growth variable of motivation (either autonomous regulation or negative self-evaluative emotions) would be significantly and inversely related to the latent growth variable of smoking behavior. In other words, the intercepts and slopes of motivation were assumed to be related to both the intercepts and slopes of smoking behavior. In the hypothesized model, the intercepts represented individual levels in motivation or smoking behavior at one of the three assessment points, and the slopes represented the trend in motivation or smoking behavior over time. The model fits and estimated parameters were then compared between the two models using the different motivation variables (autonomous regulation and negative self-evaluative emotions). It was expected that the parameters would be better in the model including autonomous regulation than in those of the model that included negative self-evaluative emotions.

Parameters in the model were estimated by the maximum-likelihood method. To judge data-model fit, chi-square to degrees of freedom ratios (χ^2/df), Bentler's comparative fit index (CFI), Bentler-Bonett's nonnormed fit index (NNFI), and root-mean-square error of approximation (RMSEA) were examined. Generally accepted criteria for model fit using these indices are χ^2/df less than 3.00, CFI and NNFI greater than .95, and RMSEA less than .05 (Hu and Bentler, 1998).

Results

Preliminary analyses

ICC's for motivation variables were close to zero across time points, ranging from .03 to .05 for autonomous regulation, and from .00 to .06 for negative self-evaluative emotions. Also, ICC's for the number of days smoked were close to zero, ranging from .07 to .12. Chapters were, therefore, not considered as a covariate in the subsequent analyses and multi-level modeling was not employed.

Means of motivation and smoking behavior at each time point are presented in Table 1. The mean for autonomous regulation appeared to increase at the end of treatment and remain high at follow-up, while the mean for negative self-evaluative emotions appeared to increase only at follow-up. Repeated measures ANOVA's revealed no significant changes over time in autonomous regulation ($F(2,602) = 1.789$, *ns*) or negative self-evaluative emotions ($F(2,602) = .652$, *ns*). The number of days smoked during the last 30 days decreased at month 3 and then slightly increased by 6 months. A repeated measures ANOVA revealed these changes were significant ($F(2,604) = 57.570$, $p < .01$).

Means of the two motivation variables were not different between treatment groups (smoking vs. fruit and vegetables) ($t(301) = -.078$ to $-.409$, *ns*, for autonomous regulation; and $t(301) = -.001$ to 1.486, *ns*, for negative self-evaluative emotions). The average number of days smoked was also not different between treatment groups ($t(301) = -.555$ to 1.141, *ns*). Since there were no significant group differences in motivation and smoking behavior, treatment group was not used as a covariate in subsequent analyses. Table 1 displays the correlations between autonomous regulation and negative self-evaluative emotions, which were positive and of moderate magnitude across time. Autonomous regulation was also significantly related to the number of days smoked at each time point and each subsequent time point. However, correlations between negative self-evaluative emotions and smoking behaviors were generally not significant across time, except for a positive association between negative self-evaluative emotions and the number of days smoked at baseline.

Autonomous regulation and negative self-evaluative emotions as predictors of smoking behavior

The results of the LGC modeling are presented in Figure 1 and 2. The two models in which either autonomous regulation or negative self-evaluative emotions is included with the number of days smoked were judged "adequate" based on the fit indices: $\chi^2/df = .995$; NNFI = 1.000; CFI = 1.000; and RMSEA = .016 (90% confidence interval = .000 to .080) for the model including autonomous regulation; and $\chi^2/df = .486$; NNFI = 1.000; CFI = 1.000; and RMSEA = .000 (90% confidence interval = .000 to .052) for the model including negative self-evaluative emotions. With respect to the relationship between autonomous regulation and level of smoking, the estimated covariances were significant between the intercept of autonomous regulation and the intercept of the number of days smoked ($-.06$ (SE = .02), $p < .01$) and between the slope of autonomous regulation and the slope of the number of days smoked ($-.01$ (SE = .01, $p < .01$). This indicated that the level of autonomous regulation was negatively related to the number of days smoked and that

changes in autonomous regulation were negatively related to changes in days smoked. With respect to the relationship between negative self-evaluative emotions and level of smoking the estimated covariances between the intercept of negative self-evaluative emotions and the intercept of the number of days smoked and between the slope of negative self-evaluative emotions and the slope of the number of days smoked were not significant (.13 (SE = .08), $p < .10$ and −.03 (SE = .02), $p < .10$). This revealed that the level of negative self-evaluative emotions was not significantly related to the number of days smoked, and that changes in negative self-evaluative emotions was not significantly related to the changes in days smoked.

Discussion

This study compared autonomous regulation and negative self-evaluative emotions, as predictors of smoking behavior. Bivariate associations revealed significant positive associations between autonomous regulation and negative self-evaluative emotions of moderate strength. This result was consistent with the distinct conceptualization of these constructs in the literature. The positive associations may be due to overlap in the strength of desire to change smoking behavior, although for different internal vs. external reasons. We examined the associations between these two constructs and smoking behavior (i.e., days smoked) through simple correlations as wells as LGC modeling.

With respect to autonomous regulation, simple correlations revealed that autonomous regulation was consistently related to days smoked and LGC modeling further revealed that changes in autonomous regulation were significantly and inversely associated with changes in the number of day smoked (i.e., increased autonomous regulation was associated with decreased days smoked). These results are consistent with previous studies that have found that increased autonomous regulation is related to smoking abstinence in samples of adult daily smokers participating in smoking cessation interventions (Williams et al., 2002, 2006, 2009). This study extends previous research by demonstrating this association in a sample of young adult college students who were predominantly non-daily smokers.

With respect to negative self-evaluative emotions, the simple correlations and LGC generally revealed almost no significant association between negative self-evaluative emotions and days smoked or changes in days smoked. This result differs from previous studies that have found that higher negative self-evaluative emotions at baseline were predictive of subsequent attempts to quit. The reason for this discrepancy is unclear, however, the result in this study should be generalized tentatively since the present study differs from prior studies in that it included U.S. college students who smoked far less frequently and were likely far less motivated to quit than the Dutch adult smokers included in earlier research. In addition, in the present study, the number of days smoked was used as the outcome variable rather than quit attempts which may also account for the discrepant findings.

Dijkstra and Den Dijker (2005) have also suggested theoretical reasons that could explain a diminished effect of negative self-evaluative emotions on smoking behavior change. For example, they have proposed that the effect may be moderated by self-efficacy because diminishing negative self-evaluative emotions through behavior change is more likely when an individual has more confidence in their ability to change behavior. Alternatively, individuals high in negative self-evaluative emotions may not have changed behavior due to differing self-evaluative outcome expectations (e.g., the expectation that an alternative behavior such as exercising more would more effectively reduce their negative self-evaluation than reducing smoking).

Regardless of these possibilities, the results are consistent with our hypothesis that autonomous regulation would be a better predictor than negative self-evaluative emotions. Our hypothesis was based on the assumption that negative self-evaluative emotions could be considered consistent with introjected regulation which according to SDT should be a less powerful predictor of behavior change than autonomous regulation. According to SDT, autonomous regulation is more powerful because it is more closely related to the satisfaction of basic needs and thus well-being than controlled regulation (Deci and Ryan, 1985; Ryan and Deci, 1999, 2000). Our results are thus consistent with extensive research on SDT confirming that autonomous regulation is a valid and distinct construct from self-evaluative emotions and that it is likely a more powerful predictor of behavior change (Ryan and Deci, 2000; Vansteenkiste et al., 2004).

These results are useful for theoretical and practical reasons. From a theoretical standpoint they suggest that social cognitive theorists may need to incorporate distinctions between autonomous and introjected regulation into their models, which might enhance predictive validity. For example, it may be possible that motivation based on negative self-evaluative emotions leads to more reliable behavior change if it becomes more integrated into the self. More comparative work is needed to either facilitate better integrated models of behavior change or, where integration is not feasible, to identify theoretical accounts that are superior. From a practical standpoint the results are also useful to clinicians and researchers. Due to time constraints researchers and clinicians frequently have to choose among a wide array of measures they believe will have the best predictive validity or utility. Our findings suggest that when choosing between autonomous regulation and negative self-evaluative emotions it may be best to use autonomous regulation as it is more likely to be related to smoking behavior change. Importantly, the results also suggest that interventions that foster autonomous regulation for change are more likely to be effective than those that foster negative self-evaluative emotions.

In interpreting the findings some limitations of this study should be considered. Although autonomous regulation was related to smoking behavior at each time point and varied together with smoking behavior, the level of autonomous regulation (intercept) was not significantly associated with subsequent change (slope) in days smoked, leaving open the question of the causal ordering of these variables. The results were nevertheless consistent with the possibility that change in autonomous regulation led to change smoking behavior as demonstrated in prior experimental studies (Williams et al., 2002, 2006, 2009).

A potential confound in this study was the MI intervention which may have fostered autonomous regulation rather than negative self-evaluative emotions. However, results revealed no significant changes over time in either autonomous regulation or negative self-evaluative emotions suggesting that treatment had no effect on these variables and there was a consistent pattern of stronger associations with smoking for autonomous regulation than negative self-evaluative emotions in the bivariate analyses.

Another limitation of this study was that data from more than 100 participants were not available at follow-up assessments. Although analyses indicated that there were no significant differences in demographics, motivation, and smoking behavior at baseline between the participants who attended all follow-ups and those who missed one or more follow-ups, smokers who drop out of studies may be different in how their motivation relates to their smoking behavior.

In spite of these limitations, this study highlights the potential benefit of comparing similar constructs from competing theories and is the first to demonstrate the relevance of autonomous regulation for changes in smoking behavior among college students. Smoking

behavior change research and practice can benefit from further research that clarifies the best approach to conceptualizing and measuring motivation to quit.

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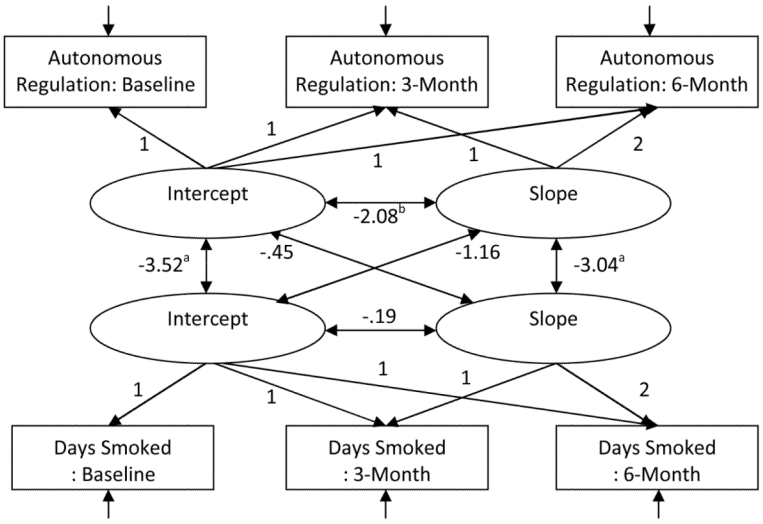

Figure 1.
Latent Growth Curve model of autonomous regulation and days smoked. Estimated parameters represent critical ratio of covariance divided by standard error. [a]$p < .05$, [b]$p < .01$

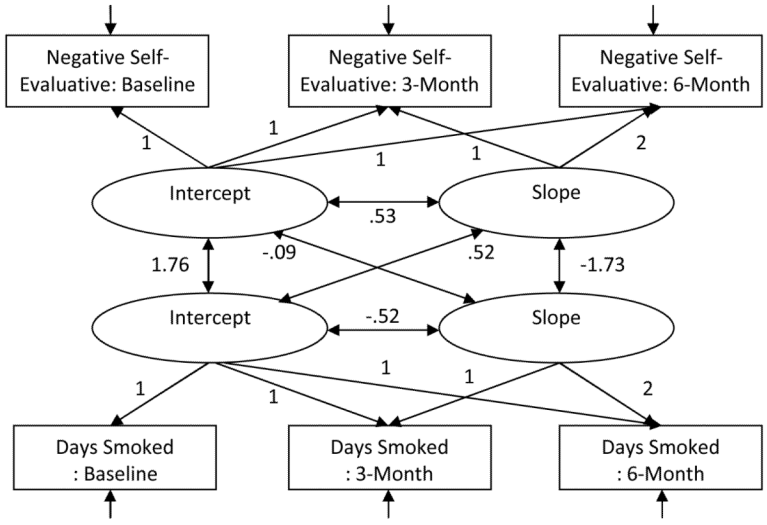

Figure 2.
Latent Growth Curve model of negative self-evaluative emotions and days smoked. Estimated parameters represent critical ratio of covariance divided by standard error. [a]$p < .05$, [b]$p < .01$

Table 1

Means and intercorrelations of motivation and smoking behavior across time (N = 303)

			Negative Self-Evaluative Emotions			Days Smoked		
Variables	**Time**	**M (SD)**	**Baseline**	**3-Month**	**6-Month**	**Baseline**	**3-Month**	**6-Month**
Autonomous	Baseline	5.05 (1.36)	.39[a]	.25[a]	.28[a]	−.18[a]	−.17[a]	−.15[a]
Regulation	3-Month	5.16 (1.41)		.43[a]	.40[a]		−.19[a]	−.16[a]
	6-Month	5.18 (1.37)			.47[a]			−.21[a]
Negative	Baseline	3.67 (1.47)				.13[b]	.06	.06
Self-Evaluative	3-Month	3.64 (1.51)					.08	.11
Emotions	6-Month	3.75 (1.54)						.05
Days Smoked	Baseline	11.22 (10.19)						
	3-Month	6.83 (9.15)						
	6-Month	7.91 (10.39)						

Note.

[a] $p < .01$

[b] $p < .05$