



## Effects of Readiness to Change, Quit History, and Health Perceptions on Depressive Symptoms among Young Adult Smokers

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### Abstract

**Background:** The current study sought to evaluate the main and interactive effect of health perceptions, smoking quit attempt history, and readiness to change with respect to depressive symptoms among college student smokers.

**Method:** The present data came from baseline data from a randomized trial and included 495 undergraduate students ( $M_{\text{age}}=23.84$ ,  $SD=4.92$ , 47.47% female) who reported smoking at least 1 cigarette per day.

**Results:** A three-way interaction emerged between smoking quit attempt history, health perceptions, and readiness to change with respect to depressive symptoms. Quit attempt history was positively associated with depressive symptoms, particularly among individuals high in readiness to change if they perceived their health as poorer relative to peers; however, quit attempt history was negatively associated with depressive symptoms, particularly among individuals high in readiness to change if they perceived their health as comparable as or better than that of their peers.

**Conclusion:** These findings support the assertion that readiness to change, quit history and perceived health interact in a dynamic way to confer greater risk for poor outcomes including smoking (e.g., cessation failure) and psychological-related outcomes (e.g., increased depressive symptoms). As such, development of informed interventions and programs targeting readiness to change to improve quit history and perceptions of health may provide unique benefit.

### Keywords

Tobacco, Decisional balance, Motivation, Smoking, Depression

### Introduction

Cigarette smoking is the leading cause of preventable death [1]. Undergraduates in particular represent a vulnerable sub-group of smokers [2]. Young adults generally do not perceive themselves as at risk for developing smoking-related illnesses [3]. Because young adult smokers have yet to establish long-standing smoking patterns, these years may be a unique opportunity to make tobacco control interventions effective and lasting, which may prevent establishment of life-long smoking and related harms.

### Depressive symptomatology

Recent efforts have focused on identifying factors related to onset and maintenance of smoking to better inform smoking interventions. Depressive symptoms represent an important area of study, given observed co-occurrence of smoking and depressive symptoms [4-6]. Research suggests a complex, bi-directional relation between smoking and depressive symptoms [7]. Depressive vulnerability is related to increased risk for college smoking [2,8] and is prospectively related to increased risk for teenage smoking [9], and smoking is related to depressive symptoms [10-13]. Non-depressed teen smokers are at a increased risk for developing depressive symptoms than non-smokers [14]. Based on documented associations between smoking and depressive symptomatology, researchers have begun to examine factors that may amplify risk for depressive symptoms among young adult smokers. Identification of these factors can be used to ascertain particularly vulnerable populations and address these factors in treatment. Several such factors relevant to better understanding the smoking-depressive symptom relationship include: smoking quit-attempt history, perceived health vulnerability, and readiness to change.

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## Readiness to change smoking and quit attempt history

The transtheoretical model [15] has been applied to examine tobacco use and associated depressive symptomatology [16], suggests that readiness to reduce smoking is an important predictor of changing smoking behavior [15], and posits that smokers may not always be ready to quit, even if they are currently in treatment [17]. Individuals that have no immediate intention to quit (i.e., precontemplation stage) or those intending to quit but have not yet made a change (i.e., contemplation stage) are at greatest risk for continued smoking. Greater readiness to changes associated with intention to quit (i.e., preparation stage) or having attempted to quit (i.e., action stage); that is, further progression along the behavior change continuum. Interventions have successfully produced increases in stage of change and readiness to change, and this in turn is associated with better cessation outcomes [18]. Few smokers in early stages of change are ready to quit [19,20], however, previous attempts to quit smoking are associated with increased readiness to change [21]. Generally, quit attempts during adolescence and early adulthood appear to be frequent yet unsuccessful [22], and high relapse rates may exacerbate depressive symptomatology. Furthermore, it is likely that frequent relapse (failed quit attempts), followed by increased levels of depressive symptoms, and might be evinced in an inverse relationship between readiness to change and depressive symptomatology.

## Perceived health

Another factor to consider in regard to depressive symptoms and smoking is perceived health, which stems from perceived likelihood of an undesired outcome occurring. Generally, smokers deny personal risk [23,24], and this may lead to less protective behaviors to eliminate threat of negative consequences. Extant literature examining perceptions of health vulnerability show that smokers often perceive their smoking-related risks as lower compared to peers [25-27]. Perceived health risk can serve as a deterrent to smoking, especially among those who believe it is difficult to quit and that negative health effects onset quickly [28]. Thus, smokers who hold the assumption that smoking is less habit-forming may be particularly likely to underestimate health effects of smoking. This phenomenon has been described as an “optimism bias” – that is, smokers are likely to inaccurately assess personal risk of smoking [29]. For example, more than half (53.0%) of college smokers rated their health as being better than the average smoker their same age, and about one-fifth (19.0%) estimated that their health was better than that of age-matched non-smokers [29]. Notably, smokers reporting lower readiness to change (e.g., pre-contemplation stage) rated the health risks of smoking to be lowest, whereas those reporting greater readiness to change (e.g., preparation stage) endorsed the greatest perceptions of health risk due to smoking. Similarly, attempts to quit are often motivated by health concerns [29]. Regarding the impact of health perceptions on depressive symptoms, holding the assumption of good health status may be protective from negative affectivity (i.e., denying risk), however this may be a risky assumption given the deleterious health effects of smoking. Perceived health is distinguished from other constructs and suggests unique relationships with affectivity and emotions over and above risk factors [30]. Research indicates perceived health is a unique factor and shares no variance with smoking rate [31]. Additionally, perceived health generally associates with affect-relevant constructs (i.e., depressive symptoms), which suggests that perceptions of poorer health are linked with greater emotional vulnerability relative to perceptions of good health [31].

## Current study

Overall, readiness to change, quit history and perceived health likely interact dynamically to confer risk for poor outcomes including smoking-related (e.g., cessation failure) and psychological outcomes (e.g., increased depressive symptoms, low self-efficacy for change). We examined main and interactive effects of readiness to change, quit attempt history, and perceived health status in terms of depressive symptoms. Our first hypothesis was that main effects would emerge

such that: low readiness to change (i.e., being in pre-contemplation versus contemplation stage) would be associated with increased depressive symptoms; quit attempt history (i.e., previous failures), in contrast to no previous history, would be associated with increased depressive symptoms; and perception of poor health in comparison to peers, versus good or comparable health, would be associated with greater depressive symptoms. Our second hypothesis was that quit attempt history and readiness to change would interact with respect to depressive symptoms such that the combination of low readiness to change and a quit attempt history would be associated with increased levels of depressive symptomatology. Our third hypothesis was that a three-way interaction would emerge such that the impact of low readiness to change and a quit attempt history on depressive symptoms would be strongest among those with a poor perception of their own health, whereas those with no previous quit history, high in readiness to change, and perceptions of good health would have the lowest level of depressive symptoms.

## Method

Data were from the baseline assessment from a larger four-year intervention called Students Using Computerized Coaching to Effectively Stop Smoking (SUCCESS), funded by the National Cancer Institute with the goal of developing and evaluating an online-based program for a cigarette smoking prevention and cessation among under graduates.

## Sampling

Undergraduates were recruited for participation at a large university in Texas. The university was not a tobacco-free campus and had over 32,000 undergraduate and graduate students at the time of recruitment. The demographics of the sample and student population map on to those of the national population. Participation was advertised through announcements and flyers on campus, newsletters, e-mail, and during in-class presentations. Participants were considered eligible if they: 1) reported smoking at least one cigarette per day for six months; 2) were between the ages of 18-35 years; 3) had no contraindication to use of nicotine patch; and 4) had no friends or household members participating in the study. Participants were provided \$10 gift cards in exchange for participation.

## Measures

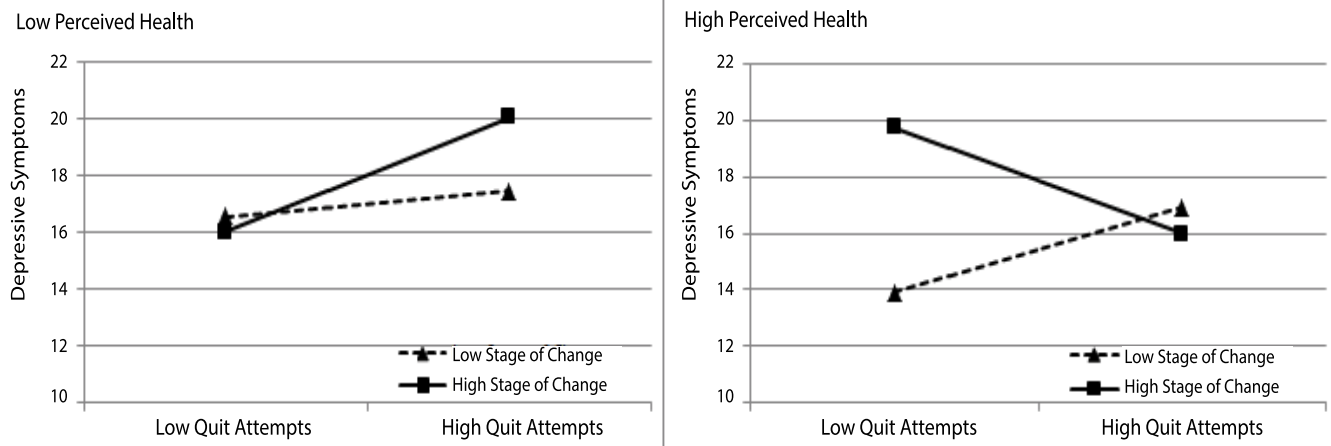
**Demographics:** Participants reported information including age, gender, education level, and ethnicity.

**Depressive Symptoms:** Depressive symptom level over the past week was assessed using the Center for Epidemiologic Studies Depression (CES-D) scale [32].

**Readiness to change:** Readiness to change was measured via items of motivation to quit [33] involving a continuous index wherein scores were computed from the product of two items: “In the last year, how many times have you intentionally quit smoking for at least 24 hours?” which ranged from 1=“None” to 5 = “Six or more times” and “Are you seriously thinking of quitting smoking?” where 1=“No”, 2=“Yes, within the next 6 months,” and 3=“Yes, within the next 30 days”. Participants in the precontemplations stage received a 0, those in contemplation stage received a 1, and those in preparation stage received a 2.

**Perceived health:** Perceived health was measured using a 5-point scale item [34]: “How would you compare your health to the average non-smoker your age?” Perceived health was dummy coded such that participants responding with either “about the same,” “somewhat better,” or “much better” received a 1, and participants responding with “somewhat worse” or “much worse” received a 0.

**Quit attempt history:** Participants were asked if they had ever attempted to quit smoking [35]. Quit attempts were dummy coded such that participants responding “yes” to having ever attempted to quit smoking received a 1 and participants responding “no” received a 0.



**Figure 1:** This figure shows a three-way interaction that emerged with depressive symptoms as outcome and quit attempts, readiness to change, and perceived health as independent variables. This demonstrates that quit attempt history is positively associated with greater depressive symptoms, especially for individuals high in readiness to change and low in perceived health. Conversely, quit attempt history was negatively associated with depressive symptoms among individuals high in readiness to change and high in perceived health.

**Table 1:** Participant demographic characteristics

Characteristic	n (%) or M(SD)	Depressive symptoms M(SD)	F	p-value
Age, M(SD)	24.19 (4.04)	-	-	-
Gender			0.42	0.51
Male	260 (52.53)	0.84 (0.54)		
Female	235 (47.47)	0.87 (0.55)		
Race/ethnicity			0.35	0.63
Non-Hispanic white	302 (61.13)	0.82 (0.55)		
Non-Hispanic black	29 (5.87)	0.93 (0.57)		
Asian	102 (20.65)	0.93 (0.57)		
AI, AN, PI*	7 (1.42)	1.00 (0.43)		
Hispanic	54 (10.93)	0.82 (0.48)		
Education			0.72	0.58
Freshman	60 (12.15)	0.91 (0.56)		
Sophomore	75 (15.18)	0.85 (0.55)		
Junior	161 (32.59)	0.82 (0.52)		
Senior	124 (25.10)	0.91 (0.58)		
Graduate	74 (14.98)	0.80 (0.54)		
Marital status			2.17	0.14
Married	53 (10.73)	0.75 (0.54)		
Not married	441 (89.27)	0.87 (0.55)		

AI: American Indian, AN: Alaska Native, PI: Pacific Islander

## Analysis plan

Analyses were conducted using SAS 9.2. Data cleaning and preliminary analyses were performed to assess whether the assumptions of parametric data were met. Multicollinearity was tested for the main effects model by running the variance inflation factor (VIF) and the tolerance levels for independent variables (IVs). VIF and tolerance were below 2.0 and greater than 0.1, respectively, thus, multicollinearity was not an issue [36].

Pearson correlations were conducted, followed by a series of hierarchical regressions with respect to depressive symptoms. First, with gender controlled, the main effects of readiness to change, quit attempts, and perceived health were examined as IVs. Next, two-way interactions among IVs were investigated with respect to depressive symptoms. Finally, three-way interactions were assessed among IVs with respect to depressive symptoms. Standardized beta coefficients for each model were calculated to determine the strength of effects on depressive symptoms.

## Results

### Participant Characteristics

Of the 509 eligible participants, 495 ( $M_{age}=23.84$ ,  $SD=4.92$ , 47.47% female) completed the baseline survey. Participants reported

the following races: 71.05% Caucasian, 6.28% Black/African American, 20.65% Asian/Pacific Islander, 5.59% Multi-Ethnic, 0.76% Native American/American Indian, and 13.90% Other. 10.93% of participants reported being Hispanic or Latino. With respect to educational levels, 12.15% were Freshmen, 15.18% Sophomore, 32.59% Junior, 25.10% Senior, and 14.98% Graduate.

### Preliminary Analyses

Table 1 presents demographic characteristics of the sample. Analysis of variance (ANOVA) showed that gender, ethnicity, education, and marital status were not related to depressive symptoms. Pearson's regression analyses (Table 2) showed that females were more likely to be ready to change their smoking ( $r=0.12^{**}$ ,  $p<0.01$ ) and marginally likely to attempt to quit ( $r=0.08$ ,  $p=0.07$ ). Younger participants were more likely to report depressive symptoms ( $r=-0.15$ ,  $<0.001$ ) relative to older participants. Alcohol use was significantly related to fewer quit attempts ( $r=-0.11$ ,  $<0.05$ ). Drug use was higher among females ( $r=0.11$ ,  $<0.05$ ) and was positively related to alcohol use ( $r=0.15$ ,  $<0.001$ ).

### Factors associated with Depressive Symptoms

To test our first hypothesis, we examined main effects using multiple regression models. Our first model included readiness to change as the IV and depressive symptoms as the outcome. Readiness to change was associated with decreases in depressive symptoms ( $\beta=-0.16$ ,  $p<0.01$ ). Our second regression model included quit attempts as the IV and depressive symptoms as the outcome. A marginally positive relationship emerged between quit attempt and depressive symptoms ( $\beta=0.08$ ,  $p<0.1$ ). Our third model included health perception as the IV and depressive symptoms as the outcome, and there were significant associations ( $\beta=-0.11$ ,  $p<0.05$ ).

To test our second hypothesis, we utilized a regression model wherein readiness to change and quit attempts were entered as IVs and depressive symptoms as the outcome. Main effects were evaluated at Step 1 and two-way product terms at Step 2 (Table 2). A negative relationship with marginal significance was found between depressive symptoms and the interaction of readiness to change and health perception ( $\beta=-0.32$ ,  $p<0.1$ ).

To test our third hypothesis we evaluated the same regression model from the second hypothesis with an additional IV; perceived health. Main effects were evaluated at Step 1, two-way products at Step 2, and three-way interactions at Step 3. Step 1 revealed a significant main effect of readiness to change on depressive symptoms when controlling for quit attempts and perceived health ( $\beta=-0.12$ ,  $p<0.01$ ). Step 3 revealed a significant three-way interaction between readiness to change, quit attempt, and perceived health with respect to



**Table 2:** Means, Standard Deviations, and Correlations among Variables

	1.	2.	3.	4.	5.	6.	7.	8.
1. Smoking Readiness to Change	--							
2. Quit Attempts	0.30***	--						
3. Perceived Health	0.02	0.06	--					
4. Depressive Symptoms	-0.13**	0.03	-0.11*	--				
5. Gender	0.12**	0.08†	0.07	0.03	--			
6. Age	0.08	-0.05	-0.08	-0.15***	-0.03	--		
7. Alcohol use	-0.06	-0.11*	-0.01	0.04	0.06	0.07	--	
8. Drug use	0.02	0.04	-0.03	-0.00	0.11*	0.07	0.15***	--
Mean	8.01	0.11	2.34	0.85	1.47	24.19	1.91	2.81
Standard Deviation	0.11	0.31	0.78	0.54	0.50	4.04	0.52	0.58

Note. N=495 \*\*\*  $p < .001$ . \*\*  $p < .01$ . \*  $p < .05$ . †  $p < .1$ .

**Table 3:** Hierarchical regression analysis with respect to depressive symptoms on the CES-D

	Independent Variables	B	SE B	$\beta$
Step 1	RTC	0.41	0.12	-0.16**
	QA	2.83	1.64	0.08†
Step 2	RTC	-0.71	0.14	-0.29
Step 1	RTC	0.41	0.12	-0.16**
	QA	3.08	1.64	0.09†
	PH	-1.60	0.62	-0.11*
Step 2	RTC x QA	-0.37	0.49	-0.15
	RTC x PH	-0.28	0.16	-0.32†
	QA x PH	-2.61	1.99	-0.30
Step 3	RTC x QA x PH	-1.20	0.63	-2.84*

Note. N=495; \*\*\*  $p < .001$ , \*\*  $p < .01$ , \*  $p < .05$ .  
 RTC: Smoking Readiness to Change  
 QA: Quit Attempts  
 PH: Perceived Health  
 x denotes interaction term.  
 All regression models control for gender.

depressive symptoms ( $\beta=0.63, p<0.05$ ). The interaction was graphed using parameter estimates from the regression equation where low and high values were specified as one standard deviation below and above their respective means [37] (Table 3) (Figure 1).

## Discussion

This study evaluated relationships between health perceptions, smoking quit attempt history, and readiness to change with regard to depressive symptoms. Findings revealed readiness to change was negatively associated with depressive symptoms, which supports research indicating that smokers in early stages of change tend to be less ready to change [19,20]. Interestingly, drug use and readiness to change were correlated with being female, suggesting that females used more drugs relative to males and were higher in readiness to change compared to males. Although this may seem surprising given that evidence has documented males as being at higher risk for drug use relative to females [8], these findings might indicate that females in this sample may have been more open and forthcoming regarding their substance use compared to male counterparts, and may also have been more motivated to change their behaviors. Additional work is needed to understand underlying mechanisms that may play potentially differential roles among drug-using females and males.

Further, findings indicated that readiness to change may amplify risk for depressive symptoms among young adult smokers. We also expected that a history of attempting to quit smoking would be associated with increased depressive symptoms, and found marginal support for this hypothesis. This should be cautiously interpreted as consistent with perspectives that numerous unsuccessful quit attempts might be linked with depressive symptoms. This marginally inverse relationship may be due to and affected by subsequent lower self-efficacy for change [2], and failing to successfully quit may make one feel discouraged about quitting and about one's ability to stay abstinent. Further, multiple relapses may exacerbate depressive symptomatology. We additionally expected that perception of one's own poor health in comparison to the health of peers would be

associated with greater depressive symptoms. Results supported this hypothesis in that perceptions of poor health (e.g., perceiving oneself as less healthy than one's peers) were associated with increased depressive symptoms. Taken together, these findings are consistent with research and furthermore indicate that beliefs about own health can adversely impact affect. Findings further revealed a marginally significant interaction between readiness to change and perceived health such that readiness to change marginally moderated the effect of perceived health on depressive symptoms. This may warrant additional research to determine whether readiness to change might be a clinically relevant point to intervene to protect against depressive symptoms and encourage motivation to reduce smoking.

Results revealed a significant three-way interaction such that on the one hand, quit attempts was positively associated with depressive symptoms, particularly among individuals high in readiness to change if they perceived their health as poorer relative to peers, whereas on the other hand, quit attempts was negatively associated with depressive symptoms, particularly among individuals high in readiness to change if they perceived their health as comparable or better than that of their peers. These findings support the assertion that readiness to change quit history and perceived health interact in a dynamic way to confer greater risk for poor outcomes.

It is possible that an individual's perceptions of his or her own health relative to the health of peers may not only affect the success of attempts to quit smoking but may also influence affect (e.g., depressive symptoms) and perceptions of own ability to abstain from tobacco. This supports the perspective that failing to quit smoking may make one feel discouraged about quitting, and multiple failures may exacerbate depressive symptomatology. This appears to be particularly true for individuals who view themselves as having poorer health compared to peers. Feelings of discouragement might increase urge to smoke, which in turn may interfere with motivation to abstain and might lead to even more negative effect. However, failing to successfully quit may not always lead to feeling depressed about failures. The protective factor appears to be related to the perceptions of health in that these individuals may be at less risk for negative affect interfering with motivation to abstain from smoking.

A potential implication for these findings is that individuals higher in depressive symptoms may be more likely to perceive their health as worse than their peers and fail when trying to quit smoking. This could be due to reductions in self-efficacy which might lead individuals to feel that they cannot resist smoking. An alternative and tentative explanation is that perceptions of one's own health might be a useful indicator of health status relative to others. It is possible that even taking into account optimism bias, individuals who perceive themselves as healthier than their peers might actually, on average, be healthier than their peers. In other words, it could be that individuals, who perceive their own health as good, are, on average, actually healthier than individuals who view their own health as poor. Additionally, previous literature suggests that there is a relationship between the degree to which an individual perceives they are at risk and their readiness to quit [38], and perceptions of risk can distinguish between intending or not intending to quit [39]. Therefore, it possible that people who view themselves as in good health and at high risk

for jeopardizing their health (e.g., via smoking) are likely to take action by attempting to quit. A second implication is that good health perceptions might provide some protective buffer against discouraging effects of quit failure. Thus, it appears that perceptions of own health might be an interesting and possibly important entry point on which to intervene. Helping individuals contextualize their health status might provide some needed motivation to quit smoking. Providing the undergraduate smokers with motivational counseling designed to identify tangible ways to improve the likelihood of successfully quitting might provide unique benefit. Armed with specific tools and strategies (e.g., distracting oneself from dwelling on urges to smoke via cognitive tasks), undergraduate smokers attempting to quit might experience favorable effects including improved perceptions of her health which may lead to continued motivation to quit and fewer depressive symptoms.

## Limitations

Findings should be interpreted in light of limitations. The sample consists of undergraduates, and thus, generalizability is limited. Further, data were cross-sectional, which limits causal inferences. This is a non-clinical and non-treatment seeking population and additional research is needed to understand whether findings are generalizable to a clinical population.

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### Contributors

Dr. Foster conducted literature searches, conducted statistical analyses, and wrote the discussion section. Dr. Barnighausen assisted with the discussion section and proved feedback to the overall paper. Mr. Khalil assisted with statistical analyses and with writing the method and results sections. Ms. Farris wrote the introductory section. Dr. Prokhorov designed the parent study, wrote the protocol, provided feedback, and supported the discussion section. All authors contributed to and have approved the final manuscript.

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