Original Investigation

Looming Vulnerability and Smoking Cessation Attempts

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Abstract

Introduction: The looming vulnerability model holds that people become anxious when they perceive threats as growing larger and accelerating toward them in space and time. Preliminary research suggested that a guided imagery induction designed to activate a sense that health consequences of smoking are a looming threat led more smokers to attempt to quit. This study tested the effect on quit attempts in a larger sample and examined age, sex, and sensation seeking as moderators.

Aims and Methods: Adult smokers (≥ 10 cigarettes/day) screened for risk of anxiety or mood disorders ($N = 278$, 52% male; 77% African American) were randomly assigned to receive (1) looming vulnerability or (2) neutral guided imagery exercises. At a 4-week follow-up, they reported quit attempts, smoking rate, self-efficacy, outcome expectancies, and contemplation status.

Results: Those in the looming condition (17%) were no more likely than those in the control condition (20%) to make a quit attempt. There were no significant group differences in expectancies, contemplation, or follow-up smoking rate, and no significant moderators.

Conclusions: The looming induction was the same one used in earlier work in which it had stronger effects. Those who respond to it with increased urgency about quitting smoking might be offset by others who are more reactant and deny the message. Inconsistencies across studies may reflect differences in inclusion criteria, such that the present sample was on average heavier smokers with longer smoking history and more severe nicotine dependence, yet higher self-efficacy.

Implications: An induction designed to activate a sense that the health consequences of smoking constitute a looming vulnerability failed to increase quit attempts or reduce smoking rate among adult daily smokers. Inconsistencies across studies might reflect varying sample characteristics resulting from changes in screening criteria.

Introduction

Despite widespread dissemination of information about the negative consequences of cigarette smoking, about one-seventh (14%) of adults in the United States are current smokers,¹ and smoking cessation remains a critical public health need. Smoking cessation campaigns succeed to the degree that a high proportion of smokers attempt to quit and that a high proportion of attempters succeed. The research reported in this article addresses the issue of getting many smokers to attempt to quit.

Strategies for motivating smokers to attempt to quit include (1) taking advantage of teachable moments (eg, postheart attack), (2)

psychoeducation, and (3) fear arousal via presentation of negative smoking consequences. Each of these approaches has generated successes; for example, quit rates are very high after a cancer diagnosis.² Standardized verbal and pictorial messages have been used to discourage smoking; time series data from Canada suggest that pictorial warnings helped increase quit attempts.³ Personalizing information about health risks might be especially useful, one approach being to give feedback based on individual risk assessments (eg, for lung cancer risk⁴ or genetic susceptibility to nicotine dependence⁵).

However, there is still room for improvement and innovation in promoting quit attempts. In 2015 only a little over one-half (55%)

of adult US smokers made a quit attempt of at least 24 h.⁶ Almost one-third (32%) of US adult smokers in 2015 did not even report wanting to quit completely.⁶ Our research tested a novel approach to motivating smokers to quit, based on Riskind's "looming vulnerability" model of anxiety.⁷ According to this model, anxiety is associated not only with perceiving a stimulus as threatening but specifically with perceiving the threat as getting larger or moving closer in space or time.

As the person imagines the process by which a threat is approaching, anxiety increases. For example, a static perception that the world economy is fragile might arouse some anxiety, but a vivid image of an accelerating threat (high rate of mortgage defaults—lower credit availability—lower business activity—recession—decreased consumer demand—declining revenues—layoffs—loss of my job—inability to pay rent—loss of home) would provoke high anxiety. Analogously, a static perception that smoking has negative long-term consequences might be disconcerting, but believing that major health problems are rapidly gaining in magnitude and approaching the smoker would be more anxiety-provoking and induce a greater sense of urgency about quitting. This emphasis on a dynamic appraisal of health-relevant threats as accelerating is what differentiates looming vulnerability from related concepts such as perceived vulnerability, the perception that one is susceptible to consequences of an action such as smoking, which plays a role in motivating behavior change in frameworks such as the theory of planned behavior⁸ and the Health Belief Model.⁹

Empirically, dynamic acceleration of threat coming toward the person predicts anxiety in nonclinical and clinical samples; perceptions of looming vulnerability have been correlated with spider phobia, social anxiety, and Obsessive Compulsive Disorder.¹⁰ Experimental manipulations using imagery to invoke the perception of accelerated threat have increased anxiety.¹⁰ An applied implication of the looming vulnerability model is that guided imagery interventions may be used to reduce anxiety. For example, instructions to imagine a threatening process as slowing down, "freezing," or receding from oneself have lowered anxiety.¹⁰ In one study, participants with probable Generalized Anxiety Disorder who were randomly assigned to listen to audio-guided imagery exercises in which their self-generated worry scenarios featured slowed-down progression of threats reported much greater reductions in state anxiety than did those in a control condition using similar imagery exercises directed at neutral content.¹¹

In contrast to these applications of the model to *reduce* maladaptive anxiety, our objective was to *increase* smokers' anxiety regarding an objectively dangerous situation, the health consequences of smoking, in the hope that this will motivate them to try to take protective action by attempting to quit. In a pilot study for this project, participants in the looming vulnerability condition showed significantly higher state anxiety after the induction and nonsignificantly higher contemplation of quitting, self-efficacy, and negative smoking outcome expectancies.¹² At 1-month *follow-up* those in the looming vulnerability condition reported having smoked significantly fewer cigarettes (29% fewer) over the past month. Most importantly, 33% of the looming participants, compared with 16% of control participants, reported having made a ≥ 24 -h quit attempt since the first session, though this effect was not statistically significant in a small sample.

That the looming vulnerability induction did not decrease self-efficacy, perhaps because the imagery scripts included the possibility of eliminating the threat by quitting smoking, is important because

those who think they cannot do anything about a threat are inclined to protect themselves emotionally by ignoring or denying it.¹³ As such, studies of other approaches to using fear appeals to motivate smokers to quit find that such messages have the greatest effect if combined with messages conveying that smokers can stop smoking and therefore avert the threat.¹⁴

Our pilot study, however, had several limitations.¹² The sample was small, limiting statistical power. Follow-up assessments were conducted via telephone, precluding the possibility of biochemical corroboration of self-reported abstinence. There was no explicit advice to quit, and participants were not directed to any resources they might use in trying to do so. Finally, there was no measurement of actual perceptions of the consequences of smoking as looming and therefore no way to determine whether the effect on quit attempts was mediated as hypothesized. Each of these limitations is addressed in the current study.

Our main hypothesis was that smokers receiving a looming vulnerability induction would be more likely to make a quit attempt in the following 4 weeks than would those in a control condition. We also examined effects of the induction on contemplation of quitting, self-efficacy, outcome expectancies, and smoking rate. We measured participants' actual perceptions of looming vulnerability to health consequences of smoking, to test whether the induction motivates quit attempts via the hypothesized mediating mechanism of looming perceptions.

We also tested three possible moderators of the effect of the looming manipulation on quit attempts. First, we examined *sensation seeking*,¹⁵ the tendency to pursue novel sensations, adventure, and excitement and to be willing to take risks to experience intense sensations and novelty. Studies of persuasion to engage in safer sexual practices¹⁶ and to avoid drug use¹⁷ have found fear appeals to be more effective for people low in sensation seeking. Second, we evaluated whether *sex* moderates response to the manipulation based on trends in the pilot study,¹² in which the odds ratio for quit attempts during the month after the experiment (looming vs. control) was 5.45 for women and 1.78 for men. Finally, we tested *age* as a possible moderator. Younger smokers might subscribe to an illusion of invulnerability and therefore be relatively unconcerned about long-term negative health consequences of smoking. Conversely, in research on pictorial health warnings on cigarette package labels, age was negatively correlated with perceived effectiveness, meaning that younger smokers considered these graphic images more effective deterrents to smoking.¹⁸

Method

Participants

Participants were 278 cigarette smokers (145 men, 133 women), recruited via newspaper and online ads as well as flyers distributed in the community. To minimize selection bias, recruitment materials did not allude to quit attempts as a dependent variable. A majority of the sample were African American (215) or Caucasian (47). Most (239) were non-Hispanic, while 10 participants were Hispanic, and 29 did not report ethnicity. The average age was 49.79 years (SD = 11.42).

Inclusion criteria were (1) adult (age 18 or older), (2) daily smoker (at least 10 cigarettes/day, confirmed by expired air CO ≥ 9 ppm¹⁹ at the first assessment), (3) total score ≤ 5 on the Modified Mini Screen²⁰ (MMS, a modification of the MINI²¹) including a score of 0 on the suicidality item, (4) fluent in English, and (5) planning to remain local long enough to complete the study.

The MMS screening was a safety precaution for our looming induction, which on average increased state anxiety in preliminary research. Those scoring 6 or higher on the MMS are considered at moderate to high risk of having anxiety, mood, or psychotic disorders. We used the lowest (most conservative) cutoff score recommended on the basis of research²⁰ validating the MMS against a full diagnostic interview.

More than 1200 people replied to our advertisements. The number who were not in the final sample for each reason were: (1) could not be contacted after leaving a message expressing interest (312), (2) not interested after hearing full study description (187), (3) eligible per phone screen but never showed up for first assessment (88), (4) unable to travel to our lab (21), (5) not fluent in English (4), and (6) scored ≥ 1 on MMS suicidality item (14), scored ≥ 6 on MMS (244), cigarettes per day < 10 (359), CO < 9 at first assessment (57).

Materials and Procedure

Participants found to be eligible via phone screen and interested in the study were scheduled for the initial appointment. At that session, after completing informed consent, they took the expired air CO test. If smoker status was confirmed, they went on to complete baseline measures in one of four random orders.

Baseline Measures

Visual Analogue Scale (VAS): State anxiety was measured with a VAS in which the participant makes a mark along a 100 mm horizontal line anchored by the phrase “Not at All” at the left (0) and “Extremely” at the right end (100), with the word “Anxious” printed above the line in the middle; the score is the number of millimeters from the left end to the mark. VAS measures have proven useful as indicators of state anxiety in smoking research.²²

Demographics, smoking history, quitting history, and current (past month) smoking rate were measured with brief, face-valid questionnaires.

Nicotine dependence was indexed by the Fagerström Test for Nicotine Dependence (FTND²³), a 6-item scale with moderate internal consistency²⁴ and predictive validity in relation to abstinence in studies of varenicline.²⁵

Sensation seeking was measured with the revised Sensation Seeking Scale-V.¹⁵ This forced-choice self-report measure shows high internal consistency and evidence of concurrent validity in relating to attitudinal and behavioral criteria.²⁶

Contemplation of quitting was measured in two ways. The Contemplation Ladder (CL²⁷) consists of a ladder with rungs labeled 1–10. The lowest score (0, below the bottom rung) represents “no thought of quitting,” whereas a 10 reflects “taking action to quit (eg, cutting down, enrolling in a program).” CL scores predicted making a quit attempt.²⁸ Also, self-reports were used to stage smokers according to an algorithm²⁹ (no intention to quit within next 6 months = *precontemplators*; intending to quit in next 6 months but not next 30 days = *contemplators*; intending to quit in next 30 days = *preparers*).

Self-efficacy was measured with the Smoking Self-Efficacy Questionnaire (SSEQ³⁰), a 17-item measure of confidence in one’s ability to resist temptation to smoke in various high-risk situations. SSEQ scores have been shown to predict time to first lapse after a smoking cessation attempt.³⁰

Outcome expectancies for smoking were measured with the Smoking Consequences Questionnaire-Adult (SCQ-A³¹), a well-validated 55-item measure of expected consequences of smoking.

From the SCQ-A we used two scores—item means for (1) positive expectancies for smoking outcomes and (2) negative expectancies.

Experimental Manipulation of Looming Vulnerability

After completing baseline measures and then a 90-s practice audiotape-guided imagery exercise, participants were randomly assigned to either the looming condition ($n = 146$) or the control condition ($n = 132$) using a preselected random order generated via www.randomizer.org, with the condition unknown to the experimenter until this point. Randomization was stratified by sex and by whether the participant had attempted to quit smoking previously.

The imagery scenarios were the ones used in our pilot study,¹² presented in one of four random orders. The scenarios for each condition were recorded in two separate versions (one with a male voice; one with a female voice), and which version the participant heard was determined randomly. In the looming vulnerability condition, participants engaged in four audiotape-guided imagery exercises, each lasting about 3 min. In each case, the scenario they imagine is one in which their smoking speeds up the occurrence of negative health consequences, which can be slowed by reducing smoking but can only be stopped by quitting smoking. One example (conveyor belt) placed the participants in a dimly lit factory, in which they are carried along faster and faster on a conveyor belt as they continue to smoke. This conveyor belt is described as ultimately leading to a diagnosis of lung cancer. The central ideas for these scenarios were suggested by Dr. John Riskind, author of the looming vulnerability model. McDonald et al.¹² elaborated these ideas by adding information on health consequences of smoking and ways in which stopping smoking would avert them, and by adding, in response to feedback from practice participants before the main pilot study began, sensory details to make the scenarios more vivid.

Participants in the control condition also engaged in four audiotape-guided imagery exercises. These scenarios incorporated elements of movement, whether in space or the progression of time, and they were matched for length to the looming vulnerability scenarios, but they contained no references to smoking or its consequences. As an example, the match for the “conveyor belt” looming scenario in the control condition (Escalator) takes place in an empty mall in the morning. The participants imagine they are slowly and steadily carried by the escalator until reaching the top.

Posttest Measures

After the imagery exercises, participants completed a second state anxiety VAS as a manipulation check as well as the Physical health subscale of the Cigarette Smoking Consequences Looming Scale (CSCLS-P)³² measure of perceptions of looming vulnerability to the consequences of smoking. The scenario-anchored format of the CSCLS-P is based on The Looming Maladaptive Style Questionnaire (LMSQ),³³ a dispositional measure of a tendency to perceive threats as looming.

In test development research with a sample of adult smokers, CSCLS scores correlated positively with the LMSQ, supporting convergent validity.³² Concurrent validity findings were favorable; the CSCLS correlated positively with contemplation of quitting, negative smoking outcome expectancies, motivation to quit, and past quit attempts.³² The CSCLS-P subscale includes 12 items based on four scenarios (three questions follow each scenario), each rated 1–5 (total scores = 12–60), with higher scores reflecting stronger perceptions that the health consequences of smoking are looming.

Table 1. Descriptive Statistics on Baseline Measures

	N	Mean	Std. deviation
Age of first cigarette	275	15.32	4.89
# years daily smoker	278	29.67	12.50
# past quit attempts (among those with any)	187	4.10	8.36
Baseline expired air CO	278	17.99	7.29
Avg # cigs/day (past month)	278	16.62	8.13
SSS-V	278	15.93	5.97
Contemplation Ladder	275	6.09	2.67
Smoking Self-Efficacy Qstr.	263	56.45	23.24
CSCLS-Physical (looming health consequences)	276	44.28	11.65
SCQ-A positive outcome expectancies for smoking	278	5.02	1.43
SCQ-A negative outcome expectancies for smoking	278	5.61	1.32
Nicotine dependence (FTND)	274	5.42	1.997

CSCLS = Cigarette Smoking Consequences Looming Scale; FTND = Fagerström Test for Nicotine Dependence; SCQ-A = Smoking Consequences Questionnaire-Adult; SSS-V = Sensation Seeking Scale-V.

Advice to Quit

At the completion of the assessments, the experimenter gave each participant (regardless of condition) a handout containing advice to quit smoking, along with written information about (1) quitnet.com as a free site they could use to obtain community support and extensive information concerning cessation methods, as well as (2) the telephone-based counseling provided for free via 1-800-QUIT-NOW.

Four-Week Follow-up Assessment

Four weeks later there was a second session, at which participants completed contemplation status, self-efficacy, outcome expectancy, and nicotine dependence measures [same measures described earlier]. They also reported on smoking rates and quit attempts (≥ 24 h) since the first session. Participants completed an expired air CO test, with self-reported current (≥ 7 -day point prevalence) abstinence considered corroborated by a reading of ≤ 6 ppm.³⁴ To minimize demand, the follow-up session was conducted by a research assistant masked to the participant's experimental condition.

Participants were compensated for their time: \$10 if they came to baseline session but turned out to be ineligible, \$30 for the initial assessment session for eligible participants who completed it, and another \$40 for completing the follow-up. The study was preregistered on ClinicalTrials.gov (NCT02522156).

Results

All inferential tests were two-sided, with $\alpha = .05$.

Sample Description

Table 1 shows descriptive data for the full sample. On average participants were moderately heavy smokers (mean of just under 17 cigarettes/day) with long smoking histories (mean of almost 30 years). The sample was of modest Socioeconomic status (SES). Only 18% had a bachelor's degree or higher, and more than three-quarters (79%) of participants reported annual household income below \$30 000.

A majority (60%) indicated that they had made at least a 24-h quit attempt. Of those with at least one quit attempt, the median number of attempts was 2. With respect to readiness to quit in the future, about one-third (32%) were preparers according to the stage

of change algorithm, whereas 29% were contemplators and 39% precontemplators.

Attrition

Of the 278 participants, 33 (12%) failed to complete the second assessment. Table 2 shows comparisons of completers with those who failed to complete follow-up. There were no significant differences between the two groups.

Impact of Looming Vulnerability Induction

The looming manipulation did not increase the probability of a quit attempt in the ensuing 4 weeks. Indeed, the probability of a quit attempt (17%) in the looming condition was nonsignificantly lower than in the neutral condition (20%). Likewise, CO-corroborated abstinence at follow-up (7-day point prevalence) was equivalent in the looming vulnerability condition (2%) and in the neutral condition (2%). Table 3 also shows that the looming vulnerability condition, compared with control, did not significantly alter follow-up self-efficacy, outcome expectancies, contemplation of quitting, or smoking rate.

Moderator Effects

Table 4 shows the summary results of moderated multiple regressions using Hayes' PROCESS macro in SPSS to test continuous [sensation seeking, age] moderators of the experimental condition effect on whether or not participants made a quit attempt in the ensuing 4 weeks. Neither of the moderators significantly interacted with imagery condition to predict quit attempts.

Participant sex also did not moderate the effect of the induction. Women were slightly more likely to make a quit attempt in the looming (19%) than in the neutral (16%) condition, whereas the reverse was true for men (16% in looming condition; 22% in neutral condition). However, this trend was not significant (Breslow-Day chi-square for the moderator effect with 1 *df* was 1.31, $p = .25$).

Effects of Experimental Manipulation on State Anxiety and Looming Perceptions

To evaluate the effect of the manipulation on state anxiety (VAS), we conducted a repeated measures analysis of variance (ANOVA). Participants in the looming condition did become more anxious from pre- ($M = 19.63$, $SD = 21.90$) to postmanipulation ($M = 32.69$, $SD = 28.47$), but no more so than those in the control condition ($M = 17.47$ and $SD = 21.04$ premanipulation and $M = 28.74$ and

Table 2. Attrition Analyses

	Completer (<i>n</i> = 245)		Attriter (<i>n</i> = 33)		<i>T</i> (<i>df</i>)	<i>p</i>
	Mean	SD	Mean	SD		
Baseline FTND	5.45	2.04	5.22	1.70	0.62 (274)	.54
State anxiety VAS (preintervention)	18.35	21.38	18.90	21.97	0.13 (246)	.90
State anxiety VAS (postintervention)	30.04	26.52	34.90	29.97	0.93 (260)	.35
Age of first cigarette	15.49	4.93	14.03	4.41	1.59 (273)	.11
# years daily smoker	29.93	12.54	27.70	12.19	0.96 (276)	.34
# past quit attempts (among those with any)	3.70	4.70	7.09	20.88	1.80 (185)	.07
CO reading	18.04	7.36	17.64	6.86	0.30 (276)	.77
Avg # cigs/day	16.85	8.51	14.88	4.11	1.31 (276)	.19
SSS-V (sensation seeking)	16.01	6.07	15.34	5.21	0.60 (276)	.55
CL (contemplation)	6.16	2.66	5.53	2.70	1.26 (273)	.21
SSEQ (self-efficacy)	57.13	22.26	51.38	29.53	1.30 (261)	.20
CSCLS-P [looming perceptions]	44.18	11.64	45.015	11.924	0.37 (274)	.71
SCQ-A Benefit Subscale (outcome expectancies)	5.01	1.44	5.08	1.38	0.26 (276)	.79
SCQ-A Risk Subscale	5.65	1.29	5.33	1.47	1.32 (276)	.19
Age	50.02	11.43	48.12	11.4	0.90 (276)	.37

CL = Contemplation Ladder; CSCLS = Cigarette Smoking Consequences Looming Scale; FTND = Fagerström Test for Nicotine Dependence; SCQ-A = Smoking Consequences Questionnaire-Adult; SSEQ = Smoking Self-Efficacy Questionnaire; VAS = Visual Analogue Scale.

Table 3. Impact of Looming Vulnerability Induction

		Time 1		Time 2		RM ANOVA time × condition <i>F</i> (<i>p</i>)
		Looming (<i>n</i> = 146)	Neutral (<i>n</i> = 132)	Looming (<i>n</i> = 128)	Neutral (<i>n</i> = 118)	
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Past month average daily smoking rate	—	15.88 (6.33)	17.42 (9.71)	13.52 (6.78)	14.84 (11.63)	0.02 (.88)
Contemplation Ladder	—	6.41 (2.67)	6.07 (2.67)	6.45 (2.80)	5.96 (2.64)	0.17 (.68)
Positive smoking outcome expectancies	—	5.16 (1.33)	4.87 (1.56)	5.05 (1.57)	4.86 (1.31)	0.54 (.46)
Negative smoking outcome expectancies	—	5.63 (1.25)	5.56 (1.34)	5.60 (1.40)	5.65 (1.33)	0.81 (.37)
Smoking self-efficacy	—	56.58 (23.74)	57.72 (20.66)	58.29 (27.88)	54.34 (26.70)	1.72 (.19)

ANOVA = analysis of variance; RM = Repeated Measures.

Standard Deviation [SD] = 25.16 postmanipulation). The time effect was significant, $F(1, 239) = 68.32, p < .001$, but the time × condition interaction was not, $F(1, 239) = 0.37, p = .54$.

We also tested the effect of experimental condition on the hypothesized mediator of an effect on quit attempts, perception of the health consequences of smoking as looming threats (CSCLS-P). Those in the looming condition ($M = 44.85$, $SD = 11.57$) did not differ significantly from those in the neutral condition ($M = 43.65$, $SD = 11.76$), $t(274) = 0.86, p = .39$. Even in the absence of a main effect, mediation analysis may still provide useful information.^{35,36} Thus, we used Hayes' PROCESS macro in SPSS to assess whether looming cognitions (measured CSCLS-P) mediated between the looming induction and quit attempts. This mediator effect was nonsignificant, in that the 95% confidence interval, based on 5000 bootstrap samples for the indirect effect of experimental condition on quit attempts via CSCLS-P included zero (−.053 to .109).

Discussion

The attempt to motivate smokers to make a cessation attempt by using imagery to induce a sense that the health consequences of smoking constitute a looming (gaining, accelerating, coming closer) threat was not effective. Relative to a neutral imagery condition, those exposed to the looming manipulation were not more likely to make a quit attempt in the subsequent 4 weeks. They also did not statistically differ in outcome expectancies for smoking, self-efficacy, contemplation of quitting, or smoking rate at follow-up.

Methodological limitations of the research need to be considered. First, advice to quit smoking was given only in writing, to standardize the advice and preclude the possibility of experimenter bias. A more personal interaction might have had external validity in resembling what might be provided by, for example, physicians in primary care. Second, our expired air CO minimum of 9 for inclusion in the study, which ruled out 57 prospective participants, may have been too high in light of current guidelines, which we did

Table 4. Interactions Between Study Condition and Prospective Moderators Predicting Between-Session Quit Attempts

Variable	B	SE B	β	p	95% CI [lower, upper]
Age	.00	.03	.01	.99	[-.06, .06]
Sensation seeking	.00	.05	-.08	.94	[-.11, .10]

CI = confidence interval; SE = Standard Error.

apply in analyzing CO-corroborated abstinence from the follow-up assessment.³⁴

In terms of substantive interpretation of the null results of this study, message framing research points to a possible limitation in principle of the looming vulnerability induction. From the standpoint of prospect theory,³⁷ the looming induction would likely be viewed as a “loss-framed” message, by virtue of its emphasis on the negative consequences that will ensue if one fails to quit smoking. A quantitative review of message framing in health communication research³⁸ showed a small *disadvantage* for loss-framed messages in promoting illness prevention behaviors including smoking cessation.

Second, the looming vulnerability conceptualization might be valuable in principle, but its manipulation via a single exposure to a total of about 12 min of guided imagery that is standardized rather than tailored to the individual participant might be insufficiently powerful to affect behavior. Consistent with this interpretation, the experimental conditions did not differ significantly in state anxiety or in perceiving health consequences of smoking as looming threats.

These first two explanations rest uneasily, though, beside the more promising results obtained in earlier research using the same imagery manipulation.¹² As such, we consider more likely a third possible explanation, that the manipulation might have opposite effects for different subsets of participants, with those whom it motivates to initiate, or at least consider, a quit attempt offset by those for whom it has contrasting effects. Research on using “outcome narratives” to promote colorectal cancer screening is relevant. These narratives, or stories about the outcomes that can occur if precautions are not taken, with more favorable consequences to be expected if one does engage in the recommended behavior (colorectal cancer screening, or in our case smoking cessation), seem akin to our guided imagery induction. A review found the effects of outcome narratives to be inconsistent across studies and in particular to have variable effects of either increasing or decreasing fear of colorectal cancer.³⁹ It may be, in other words, that some participants take the imagery induction to heart, consider its implications for their health, and formulate an intention to quit smoking, whereas others respond to information about the threat with defensive denial, actively rejecting the message. Such reactance would be analogous to the finding that adolescents at risk for smoking showed *greater* susceptibility after encountering graphic antismoking warning labels.⁴⁰

This last explanation raises the question of what differentiates those for whom the looming induction works from those for whom it is counterproductive, and whether there is any basis to think the group for whom it is effective was more heavily represented in the prior study.¹² None of the planned moderator analyses (age, sex, and sensation seeking) in the current study was significant, and in general the sample was similar to the sample from our pilot study¹² (majority African American, non-Hispanic, low Socioeconomic status, and middle-aged). There were a couple of possibly relevant differences, however. The sample for the current study smoked at a higher rate (roughly 17 vs. 13 cigarettes/day), scored one-half SD higher on positive outcome expectancies for smoking ($M = 5.02$ vs. 4.32), had a slightly longer smoking

history (about 30 vs. 27 years on average), and reported greater nicotine dependence (FTND mean of 5.42 vs. 4.64) but scored a full standard deviation higher on self-efficacy (SSEQ mean of 56 vs. 33).

We introduced for this project inclusion/exclusion criteria that may have been consequential in this sense. Whereas in the pilot study¹² participants had to be daily smokers but with no minimum rate and no mental health screening, in the current project there was a minimum rate of 10 cigarettes/day and exclusion of those reporting suicidality or a score indicative of moderate or high risk of anxiety, mood, or psychotic disorders. The risk screening excluded almost as many (244) participants as we enrolled, and the daily smoking rate minimum excluded more (359) than the number of enrolled participants. As a consequence, we enrolled heavier smokers with more severe nicotine dependence and favorable views of smoking, albeit a perhaps exaggerated confidence in their ability to quit smoking. We did not have a measure of anxiety sensitivity, the fear of anxiety-related sensations, in the study, but it seems plausible that screening out those at moderate or higher risk of anxiety disorders selected for low anxiety sensitivity as well. Given that anxiety sensitivity predicts elevated symptoms in response to anxiety or panic-relevant experimental manipulations⁴¹ and is associated with more favorable outcome expectancies for negative affect reduction from smoking,⁴² an especially low-anxiety sensitivity current sample could help explain the differing results from our pilot study.¹²

Future research would need to test this explanation directly, but we believe it is plausible that sampling differences account for the differences in our results relative to the pilot study.¹² It would be useful to test these sampling differences as possible moderators of the effects of looming vulnerability induction, or fear appeals more generally, on quit attempts. It would also be useful to test directly hypothesized mechanisms of such moderator effects, including defensive responses to threatening information. Think-aloud protocols^{43,44} might be well-suited to detecting such reactions.

Supplementary Material

A Contributorship Form detailing each author's specific involvement with this content, as well as any supplementary data, are available online at <https://academic.oup.com/ntr>.

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Declaration of Interests

None declared.

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