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Associations between the smoking-relatedness of a cancer type, cessation attitudes and beliefs, and future abstinence among recent quitters

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Abstract

Objective—Smoking after a diagnosis of cancer can negatively impact treatment outcomes and quality of life. It is important that patients quit smoking and remain abstinent regardless of cancer type. Some cancer types (eg, lung) have stronger links to smoking as a cause than do others (eg, colorectal). The aims of this study were to (1) assess associations between smoking-relatedness of the cancer type with beliefs and attitudes concerning smoking abstinence (eg, confidence, self-efficacy), and (2) assess these variables as predictors of future abstinence.

Methods—In this secondary analysis, cancer patients ($N = 357$) who quit smoking within the previous 90 days were assigned a code of 3, 2, or 1 according to the cancer type's level of smoking-relatedness: Very related ($n = 134$, thoracic and head and neck), Somewhat related ($n = 93$, acute myeloid leukemia, bladder, cervix, colorectal, esophageal, kidney, liver, pancreas, and stomach), and Unlikely related ($n = 137$, all other cancer types).

Results—Smoking-relatedness was positively associated with plan to stay smoke-free, maximum confidence in being smoke-free in 6 months, higher abstinence self-efficacy, and lower expected difficulty in staying smoke-free. Each of the 4 beliefs and attitude variables predicted abstinence 2 months later. Smoking-relatedness also predicted abstinence in a univariate model, but not in a multivariable model with the belief and attitude variables. Using backwards stepwise procedures, the final model included plan to stay smoke-free, confidence in being smoke-free, and abstinence self-efficacy.

Conclusion—These results are consistent with our conceptualization of cessation motivation differing by smoking-relatedness of the cancer type and predicting future abstinence.

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CONFLICT OF INTEREST

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Keywords

attitudes; beliefs; cancer; cessation motivation; oncology; smoking; smoking relapse

1 | BACKGROUND

It is estimated that cigarette smoking causes nearly 480 000 deaths annually in the US.¹ One of the major health consequences is cancer, with smoking estimated to contribute causally to 30% of all cancers deaths.² In the most recent Surgeon General's report, smoking was associated with 12 different types of cancer including lung, head and neck (HN), acute myeloid leukemia, bladder, cervix, colon, rectum, esophagus, kidneys, larynx, liver, pancreas, and stomach.¹ Although a high percentage of lung cancer patients attribute their cancer to smoking, people with cancers that are also smoking-related (eg, colorectal) are less likely to identify smoking as a primary cause of their cancer.³

Once an individual has been diagnosed with cancer, continued smoking contributes to several adverse health consequences, regardless of the type of cancer. For example, smoking has been associated with a reduction in cancer treatment efficacy, greater treatment complications, higher risk of developing second primary tumors, higher cancer recurrence rates, and increased risk of overall mortality.^{1,4}

Despite myriad potential negative consequences, over one-third of patients with cancer continue to smoke after diagnosis.⁵ Some of the barriers are a typically high nicotine dependence, significant stress, and lack of knowledge of the numerous benefits of smoking cessation.^{6,7} Even among patients who do initially quit smoking upon receiving a cancer diagnosis, smoking relapse rates are high (up to 60%).^{8,9} Thus, it is important to identify variables that predict tobacco abstinence in cancer patients, and that may suggest targets for intervention.

Studies have found higher smoking cessation rates among patients with cancers widely known to be smoking related compared with those with cancers for which the smoking-attributable risk is unclear or less widely known to the public. For example, one review found that smoking cessation rates varied from 46% to 96% in smokers with lung and HN cancers, compared with 4% among smokers with breast cancer.¹⁰ Other studies have found that lung cancer patients are more likely than other cancer patients to quit smoking within 5 to 6 months of diagnosis.^{11,12}

Higher quit rates among patients with cancers widely known to be smoking related have also been observed within the context of smoking cessation interventions.^{13,14} Authors have suggested that differences in cessation rates are a consequence of differential smoking cessation motivation across cancer types. That is, because the public health message that smoking causes lung cancer has been widely disseminated, lung cancer patients as well as the general public associate their cancer with smoking.¹⁵ This greater awareness may contribute to the greater motivation to quit smoking and maintain smoking abstinence that is evident among lung cancer patients. Patients diagnosed with other cancers may be less likely to change their smoking behavior due to the lack of association with their cancer diagnosis.⁶

However, the association between cancer smoking-relatedness and smoking cessation motivation has not been tested.

Prior studies have identified a link between cognitive motivational variables and smoking behavior among patients with cancer types widely known to be smoking related. For example, a series of studies identified cessation self-efficacy, pros and cons of quitting, risk perception, and emotional distress as associated with smoking abstinence in patients recently diagnosed with lung or HN cancer.^{16–18} Additionally, high levels of public self-consciousness about smoking predicted smoking abstinence in 40 HN patients,¹⁹ and the interaction between behavioral self-blame and perceived control over their cancer were significant predictors of smoking behavior in another sample of 55 HN patients.²⁰ Overall, these studies suggest that there is an association between cessation-related attitudes and beliefs and smoking behavior among cancer patients. However, these studies were primarily focused on patients with lung or HN cancers and are limited by their small sample sizes.

To identify possible, and potentially distinct, intervention targets to improve smoking cessation outcomes among cancer patients with a variety of cancer types, in the current study, we analyzed data from a randomized controlled trial assessing a smoking relapse-prevention intervention.²¹ The primary aim of the present study was to examine the associations between the smoking-relatedness of a cancer type and cessation-related beliefs and attitudes among a diverse sample of cancer patients who had recently quit smoking. Cancer types were classified into 3 groups based on public's knowledge³ and cancer's empirical link with smoking^{1,22}: very related, somewhat related, and unlikely related. We examined cessation-related attitudes and beliefs based on previous research demonstrating a relationship with future smoking status: plan to stay smoke-free,²³ confidence in not smoking,⁹ commitment to abstinence,⁸ abstinence self-efficacy,^{16,24} and perceived risk associated with smoking after cancer diagnosis.^{8,16,25} We hypothesized that higher levels of smoking-relatedness would be associated with stronger cessation-related beliefs and attitudes (eg, greater self-efficacy, plans to stay abstinent, perceived risk).

A second aim was to assess smoking-relatedness and the cessation-related beliefs and attitudes variables as predictors of smoking status 2 months later. We hypothesized that the degree of smoking-relatedness of the cancer type and the cessation-related attitudes and beliefs would predict smoking status at 2 months. Finally, we used multivariable analyses to assess the relative contribution of individually significant predictors.

2 | METHODS

The present study is a secondary analysis using data collected for a randomized controlled trial testing the efficacy of a targeted, multimodal, empirically-based smoking relapse prevention intervention for cancer patients (412 enrolled). Participants in the control group received standard of care, and those in the intervention group standard of care +8 relapse-prevention booklets and an educational DVD.²¹ The relapse-prevention booklets were mailed over the course of 3 months and included information relevant for the general population of smokers (eg, coping with urges). The DVD included smoking relapse prevention information targeted for cancer patients (eg, cancer-related benefits of quitting

smoking). The DVD was viewed by participants at enrollment, and they were provided a copy. Follow-up assessments occurred 2, 6, and 12 months after baseline.

This study assessed self-report measures acquired at baseline for the subset of participants who completed the 2-month follow-up ($n = 357$) from which 7-day point prevalence abstinence was derived.

2.1 | Study participants

Participants were recently diagnosed cancer patients who reported quitting smoking within the previous 90 days. All participants were receiving the first round of cancer treatment at a large NCI-designated Comprehensive Cancer Center. Inclusion criteria were as follows: age 18 years, smoked 10 cigarettes per day for 1 year prior to diagnosis, able to read/write English, able to give informed consent, quit smoking after diagnosis, and abstinent 24 hours, but 3 months.

Based on the public's knowledge³ and cancer's empirical link with smoking,^{1,22} participants' cancer types were classified as follows: very related (Very, $n = 133$; thoracic [$n = 65$] and HN [$n = 67$]), somewhat related (Somewhat, $n = 93$; acute myeloid leukemia [$n = 14$], bladder [$n = 16$], cervical [$n = 5$], colorectal [$n = 13$], esophageal [$n = 13$], kidney [$n = 15$], liver [$n = 4$], pancreatic [$n = 11$], and gastric [$n = 2$]), and unlikely related (Unlikely, $n = 131$; all other cancer types, eg, breast [$n = 46$], endometrial [$n = 12$], melanoma [$n = 10$]). Groups were, respectively, coded 3, 2, and 1 to reflect the level of smoking-relatedness.

2.2 | Procedure

Study procedures have been described in detail elsewhere.²¹ An electronic capture and trigger system was used to identify potential participants using the electronic medical record. Patients meeting inclusion criteria and wishing to participate completed informed consent and the baseline assessment. Participants were compensated \$25 at baseline and \$25 for each follow-up. The protocol was approved by the Chesapeake Institutional Review Board.

2.3 | Measures

2.3.1 | Demographic, smoking history, and clinical variables—Standard survey items assessed demographic information and smoking history. Cancer stage, treatment, and comorbidity data were extracted from medical records. Participants also completed the Fagerström Test for Nicotine Dependence,²⁶ a standard measure of nicotine dependence, reworded to reflect their pre-quitting level of nicotine dependence.²⁷

2.3.2 | Plan to stay smoke-free—Participants were asked about their plans to stay abstinent following their cancer treatment: “plan to stay smoke-free,” “planning to quit for good, but may slip,” “plan to resume smoking less than before,” and “plan to resume smoking as much as before.” Based on the distribution, the 4 responses options were dichotomized into “plan to stay smoke-free” versus other.

2.3.3 | Confidence in not smoking—Participants were asked “How confident are you that you will not smoke in the next 6 months?” Based on response distribution, the 7-point

Likert scale was dichotomized into “extremely confident” versus all other lower levels of confidence.

2.3.4 | Commitment to abstinence—The items “I have a desire to quit smoking,” “I will successfully quit smoking,” and “Staying smoke-free will be difficult” were used to assess commitment to abstinence.²⁸ Responses ranged from 1 (strongly disagree) to 9 (strongly agree). Based on the pattern of responding, desire to quit and expected success in quitting were dichotomized into “maximum desire to quit” and “maximum expected success in quitting” (score of 9) versus all other lower levels.

2.3.5 | Abstinence self-efficacy—Total score on the situation-specific abstinence self-efficacy scale²⁹ was used to assess confidence in not smoking. It is composed of 20 items ranging from 0 (not at all confident) to 5 (extremely confident). Cronbach’s alpha was .93.

2.3.6 | Perceived risks associated with smoking after cancer diagnosis—A modified version of a 5-item risk perception tool was used to assess the perceived risks of resuming smoking after a cancer diagnosis.¹⁶ Two items were added to include beliefs about how resuming smoking would influence cancer outcomes.³⁰ Response options ranged from 1 (strongly disagree) to 4 (strongly agree), and total scores were used for the analyses. Cronbach’s alpha was .90.

2.3.7 | Smoking status—Seven-day point-prevalence abstinence was assessed at baseline and the 2-month follow-up using self-report.

2.4 | Statistical analyses

Descriptive statistics summarized demographic, smoking history, and clinical characteristics. Differences by smoking-relatedness were analyzed using chi-square and analysis of variance. Demographic and smoking history variables that differed by smoking-related cancer group were included as covariates in primary analyses with a belief or attitude as the outcome variable.

The relationship between smoking-relatedness and each attitude and belief variable was examined using linear or logistic regression. The linear effect of smoking-relatedness was evaluated in a model controlling for demographic and/or smoking-related variables that differed by level of smoking-relatedness.

Prospective predictors of smoking status at the 2-month assessment were first evaluated individually using logistic regression. Candidates were level of smoking-relatedness and each attitude or belief variable that was significantly associated with level of smoking-relatedness. Study intervention condition was included in these models. Significant univariate predictors were then entered into a multivariable model, and backward stepwise procedures were used to identify the variables making a unique contribution.

3 | RESULTS

3.1 | Sample characteristics

Of the 596 participants assessed for eligibility, 431 met inclusion criteria and 414 completed the baseline assessment and were included in the parent study. Data were obtained from 357 (86%) participants at the 2-month assessment and, therefore, used in the current analysis. Participant characteristics are reported in Table 1. The Very and Somewhat groups had a higher proportion of men and were, on average, older as compared with the Unlikely group. Participants within the Unlikely smoking-related group were more likely to be employed and to self-report a difficult or very difficult financial situation.

For smoking variables, the Very and Somewhat groups had smoked longer than those in the Unlikely group. In addition, the Very group had a higher smoking rate (cigarettes per day) and nicotine dependence (Fagerström Test for Nicotine Dependence) than the Unlikely group.

For clinical variables, participants in the Somewhat and Unlikely groups were more likely to have a cancer in the early stage and to have received chemotherapy. Participants in the Very group had significantly more comorbidities.

3.2 | Beliefs and attitudes variables

Descriptive statistics of cessation belief and attitude variables are presented in Table 2, as well as results of logistic and linear regression analyses, controlling for the demographic and smoking history variables that differed across levels of smoking-relatedness (see Table 1). Analyses revealed that smoking-relatedness was positively associated with (1) current plan to stay smoke-free, (2) maximum confidence in being smoke-free in 6 months, and (3) cessation self-efficacy; and negatively associated with anticipated difficulty in staying smoke-free. No significant associations were found for desire to quit smoking, expected success in quitting, and perceived risks associated with smoking after cancer.

3.3 | Prediction of smoking status at 2 months

At the 2-month follow-up, 266 (74.5%) patients reported 7-day point-prevalence abstinence, with no significant differences between groups. Table 3 summarizes level of smoking-relatedness and the four attitude/belief variables as predictors of abstinence at the 2-month assessment using logistic regression. Individual analyses showed that significant predictors of abstinence were smoking-relatedness, current plan to stay smoke-free, maximum confidence in not smoking in 6 months, higher abstinence self-efficacy, and lower expected difficulty in staying smoke-free. A multivariable model showed that current plan to stay smoke-free remained a significant predictor and higher abstinence self-efficacy was a marginally significant predictor. Backward stepwise procedures resulted in a final model with current plan to stay smoke-free, maximum confidence in not smoking in 6 months, and abstinence self-efficacy as significant predictors of smoking abstinence. Thus, with these belief and attitude variables in the model, level of smoking-relatedness was not a significant predictor of abstinence at 2 months.

4 | DISCUSSION

Although immediate smoking cessation is warranted, many cancer patients continue to smoke and those who do quit often relapse.^{8,9} Previous studies have found higher cessation rates in patients with a smoking-related cancer, suggesting that there may be a difference in cessation motivation across cancer types.^{13,14} In this study, we advanced prior research by examining whether the smoking-relatedness of a patient's cancer type was associated with cessation-related beliefs and attitudes. Our results supported the hypothesized association between the degree of cancer smoking-relatedness and these motivational variables. Specifically, level of smoking-relatedness of the cancer type was positively associated with plans to stay smoke-free, maximum confidence in not smoking in 6 months, and abstinence self-efficacy; and it was inversely associated with anticipated difficulty staying smoke-free. These variables, with the exception of the last, were significant predictors of smoking status at the 2 months follow-up.

Smoking-relatedness was positively associated with smoking abstinence at 2 months. That is, the stronger the association between an individual's cancer type and smoking, the more likely they were to be smoke-free. However, this variable was not a significant predictor when entered in the multivariable model along with beliefs and attitudes variables. These findings highlight the importance of cessation motivation variables in smoking cessation treatments with the oncologic patient population. Patients with a cancer widely known to be smoking-related may make a connection between their cancer and smoking and, as a result, increase their intentions and confidence to be smoke-free. This is supported by prior research that demonstrates that although a high percentage of lung cancer patients attribute their cancer to smoking, people with other cancers that are also smoking-related (eg, colorectal) are less likely to identify smoking as a primary cause of their cancer.³ Consequently, they appear less likely to quit smoking¹³ or seek smoking cessation treatments.³¹ However, the relationship between smoking-relatedness and abstinence is complex and could be influenced by other factors. For example, patients with lung cancer experience stigma and blame^{32,33} that can increase their stress levels leading to continued smoking.⁶ Thus, future studies should explore the role of variables such as perceived stigma, blame, or shame as potential predictors of smoking status in cancer patients.

Overall, findings of the present study suggest that patients with cancers not widely known to be smoking related may need greater education regarding the relationship of their cancer to smoking, as well as the cancer treatment and prognosis implications of continue smoking.

4.1 | Study limitations

First, participants had quit smoking and were enrolled in a smoking relapse prevention intervention trial. They likely have specific characteristics that limit generalizability to the population of smokers with cancer. Furthermore, they likely had higher smoking cessation motivation than cancer patients who continued to smoke. Thus, even stronger associations with smoking-relatedness and smoking cessation might have been found with a less restricted sample of cancer patients who smoke. Second, participants were grouped based on cancers' empirical links with smoking as well as the public's knowledge of the links. To date, smoking has been associated with 12 different types of cancer. However, this list may

increase in the future because there are cancer types for which the evidence is building yet is not sufficient to infer a causal relationship (eg, breast cancer). In addition, the literature on the public knowledge or beliefs regarding the link between smoking and cancer is limited; thus, these categorizations are likely fluid and pose a challenge for how to best categorize the smoking-relatedness of cancer types. Third, those variables that were not unimodal and symmetric (eg, confidence in not smoking) were dichotomized to minimize the effect of the lack of normality. Fourth, the majority of study participants were Caucasian, which limits generalizability of the results. However, previous studies have not found significant differences in smoking status among cancer patients with different races/ethnicities.^{9,34} Finally, to reduce burden to this vulnerable population, smoking abstinence was self-reported, and no biochemical validation was conducted at the 2-month follow-up. Prior studies have had mixed findings regarding concordance between self-report and biochemically verified abstinence among cancer patients. Some studies found high concordance of 85% to 91% between self-reported tobacco abstinence and biochemical validation in cancer patients,^{35–37} whereas others have indicated self-report to be unreliable.^{38,39} It is thus possible that some participants in our sample were misclassified, and future studies should include biochemical verification of self-reported smoking abstinence.

Our study has several strengths. Although prior studies have found that patients with highly smoking-related cancers tend to be the most likely to quit, our inclusion of patients with multiple cancer types along with categorization of cancer type by level of smoking-relatedness extends prior findings. There has been a call for research on differences among patients with diverse cancer types to further understand the observed differences in smoking rates.^{13,14} The observed associations between cancer type and cessation attitudes and beliefs, as well as the relationship between these beliefs and future abstinence, fill a gap in the literature and suggest important targets for intervention.

4.2 | Clinical implications

The results of the present study indicate that beliefs and attitudes concerning smoking abstinence differ across types of cancer. Because continued smoking after a diagnosis of cancer has adverse effects regardless of cancer type,^{1,4,40} there is a need to enhance cessation motivation and to educate patients about the risks associated with continued smoking. This is particularly so for patients diagnosed with a cancer type not usually perceived as smoking-related. These findings point to the particular need to develop and test interventions to motivate smoking cessation among patients with a cancer type not strongly associated with smoking.

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TABLE 1

Demographic, smoking, and clinical characteristics by level of smoking-relatedness

Demographic Variables	All (N = 357)	Very (n = 133)	Somewhat (n = 93)	Unlikely (n = 131)	χ^2/F
Sex: Male	49.0%	57.9%	62.4%	30.5%	28.73 *** <i>a,c</i>
Age: M (SD)	54.9 (10.7)	58.5 (9.3)	56.4 (10.0)	50.3 (10.9)	22.80 *** <i>a,c</i>
Race: Non-Hispanic white	86.6%	91.0%	84.9%	83.2%	3.70
Marital status: Married or has a life partner	54.9%	56.4%	57.0%	51.9%	0.76
Education: Beyond high school diploma	54.0%	48.5%	55.1%	59.1%	2.96
Employed: Yes	58.4%	50.8%	55.6%	68.0%	8.18 * <i>a</i>
Self-rated financial situation: Difficult or very difficult	28.0%	20.6%	33.0%	32.0%	5.690 *** <i>a,b</i>
Self-reported annual income: \$30 K	42.7%	42.1%	38.4%	46.3%	1.34
Smoking variables					
Years smoking—M (SD)	34.7 (12.0)	39.3 (10.6)	36.0 (11.5)	29.0 (11.4)	28.84 *** <i>a,c</i>
CPD average—M (SD)	20.8 (9.7)	23.4 (11.0)	20.5 (8.6)	18.4 (8.6)	8.74 *** <i>a</i>
Fagerström dependence—M (SD)	5.2 (2.2)	5.7 (2.2)	5.1 (2.0)	4.7 (2.1)	7.89 *** <i>a</i>
7-day point prevalence abstinence at baseline	70.9%	70.4%	64.1%	76.1%	3.79
Clinical variables					
Early stage cancer	58.7%	50.0%	62.8%	66.7%	7.28 * <i>a</i>
One or more comorbidities	36.4%	51.1%	35.5%	21.1%	24.00 *** <i>a,b,c</i>
Chemotherapy	21.0%	10.5%	28.0%	26.7%	14.08 *** <i>a,b</i>
Radiation therapy	10.6%	13.5%	14.0%	5.3%	6.12 * <i>a,c</i>
Surgery	65.8%	72.2%	62.4%	61.8%	3.81

Notes: M = mean; SD = standard deviation; CPD = cigarettes per day.

^o $P < .10$,* $P < .05$,** $P < .01$,*** $P < .001$ for omnibus comparison.

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Significant difference with $P < .05$ between Very and Unlikely.
 η^2 Significant difference with $P < .05$ between Very and Somewhat.
 ζ^2 Significant difference with $P < .05$ between Somewhat and Unlikely.

TABLE 2

Association of attitude and belief variables with smoking-relatedness

Variable	%	AOR [95% CI]	χ^2	<i>P</i>
Plan to stay smoke-free for good	67.1	1.38 [1.01, 1.89]	4.11	.043
Maximum confidence will not be smoking in 6 months	55.4	1.67 [1.23, 2.27]	11.00	<.001
Maximum desire to quit smoking	78.0	1.17 [0.84, 1.71]	0.99	.320
Maximum expected success in quitting	72.3	1.16 [0.84, 1.62]	0.81	.370
	<i>M</i> (SD)	<i>b</i> (SE)	<i>t</i>	<i>P</i>
Expected difficulty in staying smoke-free (range 1-9)	6.1 (3.1)	−0.62 (0.22)	−2.83	.005
Abstinence self-efficacy (range 9-45)	38.5 (7.4)	1.23 (0.53)	2.30	.022
Perceived risks associated with smoking (range 7-28)	22.7 (4.3)	0.06 (0.31)	0.18	.854

Abbreviations: AOR, adjusted odd ratio; CI, confidence interval; M, mean; SD, standard deviation; SE, standard error.

Prediction of attitude/belief variable by smoking-relatedness 1–3, or was assessed using logistic or linear regression controlling for 4 demographic and 3 smoking variables that were associated with level of smoking-relatedness (see Table 1).

N's range from 353 to 357 due to missing observations for 4 predictors.

TABLE 3

Prediction of 7-day point prevalence abstinence at 2 months

Predictor	Univariate Models			Multivariable Model			Final Model		
	AOR (95% CI)	P		AOR (95% CI)	P		AOR (95% CI)	P	
Level of smoking-relatedness	1.34 (1.01-1.77)	.041		1.20 (0.87-1.64)	.274		–	–	
Plan to stay smoke-free for good	5.08 (3.05-8.47)	<.001		2.28 (1.23-4.23)	.009		2.42 (1.30-4.49)	.005	
Maximum confidence will not be smoking in 6 months	4.92 (2.88-8.39)	<.001		1.81 (0.88-3.72)	.106		2.10 (1.04-4.27)	.039	
Expected difficulty in staying smoke-free	0.85 (0.78-0.93)	<.001		0.92 (0.84-1.02)	.118		–	–	
Abstinence self-efficacy	1.09 (1.06-1.13)	<.001		1.04 (1.00-1.09)	.051		1.04 (1.00-1.09)	.042	

Abbreviations: AOR, adjusted odd ratio; CI, confidence interval.

All analyses included intervention condition as a covariate (all p 's > .13).