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ORIGINAL ARTICLE

Why Don't Cancer Survivors Quit Smoking? An Evaluation of Readiness for Smoking Cessation in Cancer Survivors

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Background: Cancer survivors have a high rate of participation in cigarette-smoking cessation programs but their smoking-abstinence rates remain low. In the current study, we evaluated the readiness to quit smoking in a cancer-survivor population.
Methods: Cross-sectional data survey conducted among 112 adult cancer survivors who smoked cigarettes in Tennessee. Analyses were conducted using a two-sample *t*-test, χ^2 test, Fishers Exact test, and multivariable logistic regression with smoker's readiness to quit as the dependent variable. We operationally defined a smoker not ready to quit as anyone interested in quitting smoking beyond the next 6 months or longer (or not at all), as compared to those that are ready to quit within the next 6 months.
Results: Thirty-three percent of participants displayed a readiness to quit smoking in the next 30 days. Smokers ready to quit were more likely to display high confidence in their ability to quit (OR = 4.6; 95% CI, 2.1-9.7; $P < 0.0001$) than those not ready to quit. Those ready to quit were nearly five times more likely to believe smoking contributed to their cancer diagnosis (OR = 4.9; 95% CI, 1.1-22.6; $P = 0.0432$). Those ready to quit were also much more likely to attempt smoking cessation when diagnosed with cancer (OR = 8.9; 95% CI, 1.8-44.3; $P = 0.0076$) than smokers not ready to quit. Finally, those ready to quit were more likely to endorse smoking more in the morning than other times of the day, compared to those not ready to quit (OR = 7.9; 95% CI, 1.5-42,3; $P = 0.0148$), which increased odds of readiness to quit within the next 6 months.
Conclusions: Despite high participation in smoking-cessation programs for cancer survivors, only one-third of participants were ready to quit. Future research is needed to develop programs targeting effective strategies promoting smoking cessation among cancer survivors who are both ready and not ready to quit smoking.
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Key Words: Smoking, Smoking cessation, Cancer survivors, Health behavior

INTRODUCTION

Cigarette smoking is the single most important preventable cause of morbidity, mortality, and excess health care costs in the United States, causing approximately 480,000 premature deaths and accounting for 30% of all cancer deaths annually.[1] Smoking increases the risk of 19 types of cancer,[2] and is attributable to over 90% of lung cancer mortality.[3] And yet, while approximately one-half of cancer survivors quit smoking at or around the time of their cancer diagnosis,[4] many of these survivors relapse following treatment. Smoking cessation among cancer survivors is an escalating concern as their numbers in the US continue to grow.[5]

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In 2016, there were an estimated 15.5 million cancer survivors; 98% of these individuals had a cancer diagnosis as an adult.[6,7] The National Coalition for Cancer Survivorship and the National Cancer Institute defines an adult cancer survivor as any individual diagnosed with cancer (from initial diagnosis until death).[8] While smoking cessation after a cancer diagnosis is associated with greater response to cancer treatment[1,9,10] and reduced mortality risk,[1,3,9] as well as a reduction in risk of non-cancer related health conditions, such as heart disease, stroke, and chronic obstructive lung disease,[1] there is still a lack of effective smoking cessation treatments for cancer survivors.

Despite a growing body of literature examining the effectiveness of smoking cessation interventions tailored for both adult cancer survivors and survivors of childhood cancer, these interventions have proven ineffective.[11] In a systematic review and meta-analysis in oncology populations, Nayan et al.[11] concluded that "tobacco cessation interventions in the oncology populations, in both the short-term and long-term follow-up groups, do not significantly affect cessation rates." However, it is unclear why behavioral and pharmacologic interventions for smoking cessation have not been shown to be efficacious in this population.[12]

Interestingly, despite the low rates of cessation in cancer survivors, the extant literature suggests that cancer survivors join smoking cessation programs in high numbers. In a study of adult smokers who were survivors of child hood cancer, 67% of eligible participants contacted through a telephone based recruitment strategy agreed to participate.[13] In a another study of cancer survivors with adult onset, a staggering 99.5% of survivors approached through a face-to-face recruitment strategy agreed to participate.[13] However, consistent with the rest of the extant literature, in both of these studies cotinine verified cessation rates were low ($< 4\%$). Unfortunately, there is a lack of research regarding the 'disconnect' between the high participation rates of cancer survivors in smoking cessation programs and the extremely low rates of cessation.

One possible explanation may be that while cancer survivors recognize the need to quit smoking and may even feel compelled or obligated to participate in smoking cessation programs, similar to the general population of adult smokers they demonstrate variable readiness to quit smoking. While 69% of smokers in the general population want to quit in the next year,[14] fewer than 10% of smokers are ready to make a serious smoking cessation attempt in the next 30 days.[15] Little is known about the readiness to quit smoking among cancer survivors.[16-18]

The purpose of the current investigation is to evaluate the level of readiness to quit smoking in a sample of cancer survivors who smoke as well as determine predictors of those ready to quit.

MATERIALS AND METHODS

1. Design and setting

This study was a cross-sectional assessment of readiness to quit smoking among cancer survivors. We recruited and surveyed participants at the four West Cancer Center locations around the Memphis, Tennessee area.

2. Participants and eligibility

Subjects were eligible to participate if they were: 1) $\geq$ 18 years of age; 2) currently receiving treatment at one of the West Cancer Centers; and 3) have received, understood, and signed the informed consent. Patients interested in participating were referred to a University of Tennessee Health Science Center (UTHSC) staff member to assess eligibility and describe their participation in the study. Once consent was obtained, the participant had the option to complete the survey individually or have the UTHSC staff member read the survey to them. The survey was anonymous, and was approved by the UTHSC Intuitional Review Board.

3. Measures

The survey assessed (1) demographics, (2) smoking history, (3) readiness to quit smoking (including stages of change), (4) self-efficacy to quit (measured on a five-point scale with 5 being extremely confident), (5) reasons for smoking (measured on a five-point scale with 5 being extremely true), (6) perceived benefit of quitting smoking (measured on a five point scales with 5 being strongly agree) and (7) cancer diagnosis and status. We had participants complete the Fagerström Test for Nicotine Dependence.[19] Based on the Transtheoretical Model of the Stages of Change,[20] we operationally defined a smoker not ready to quit as anyone interested in quitting smoking beyond the next 6 months or longer (or not at all), as compared to those that are ready to quit within the next 6 months.

4. Statistical data analysis

Statistical analyses were conducted using SAS/STAT v.14.1 (SAS Institute Inc., Cary, NC, USA). Descriptive statistics including means and their standard deviations, or frequencies and proportions of key demographic and tobacco variables were computed for the overall study population, and by readiness to quit among current smokers ($N = 110$): ready to quit within the next 6 months ($n = 72$) and not ready to quit within 6 months ($n =$

38). Differences in means between the respective groups of current smokers were tested using two-sample *t*-test while differences in proportions were compared using a χ^2 test or Fishers Exact test, respectively. We applied a multivariable logistic regression model to determine the relative odds with which demographic variables and intrapersonal factors were associated with smoker's readiness to quit. The initial regression model was based on the univariate findings. Covariates significant at $P < 0.5$ were entered into a multivariate model. The final multivariate model was reduced using a manual backwards selection approach to retain only significant variables and important confounders. All associations were considered significant at the alpha level of 0.05 while confounders were retained at 0.1 alpha level.

RESULTS

We surveyed a total of 631 cancer survivors (Table 1). Participants were predominantly female (63.8%), white (59.8%), non-Hispanic (99.5%), and with an average age of 60.7 years (SD = 14.2). Over one-half were married (54.1%), had greater than a high school education (57.4%) and were currently being treated for cancer (51.3%).

Nearly one-half of the sample reported smoking at least 100 cigarettes in their lifetime, with 17.8% self-identifying as current daily smokers and 32.0% as former smokers. Current smokers (N = 112) reported smoking an average of 34.3 years (SD = 13.5) with an average of 13.3 (SD = 10.3) cigarettes per day for the past seven days and were retained for further analyses.

Table 1. Sample characteristics of all cancer survivors surveyed (N = 631)

Demographic	Value
Age (yr)	60.7 ± 14.2
Gender (female)	63.8
Race	
White	59.8
African American	38.3
Other	1.9
Non-Hispanic	99.5
Married	54.1
Education	
<High school	10.4
High school/general education development	32.2
>High school	57.4
Smoking status	
Never	50.2
Former	32.0
Current	17.8

Values are presented as mean ± SD or percent only.

Only 32.7% of current smokers reported a readiness to quit in the next 30 days, which is a common criteria for inclusion into many smoking cessation studies.[12] Another one-third (32.7%) indicated they were ready to quit smoking within the next 1 to 6 months and nearly 35% (34.6%) of smokers were not ready to quit smoking within the next six months.

Analyses indicate that the 65.4% who were either ready to quit in the next 30 days or 6 months were quite similar whereas contrasts were observed between these two groups and the 34.6% of the sample who were not ready to quit in the next six months. As such, multivariate analyses were conducted between (a) those ready to quit in the next 30 days or next six months ('ready to quit'; n = 72) with (b) those not ready to quit within the next six months ('not ready to quit'; n = 38).

Univariate comparisons among current smokers presented in Table 2 indicated that those ready to quit were more likely to be younger (56.8 years vs. 62.2 years; $P = 0.0263$), have smoked less years on the average (32.1 cigarettes vs. 38.2 cigarettes; $P = 0.0240$), use e-cigarettes at a higher rate (20.8% vs. 5.3%; $P = 0.0317$), are trying to quit now (84.5% vs. 28.9%; $P < 0.0001$), have tried quitting in their lifetime (84.7% vs. 56.8%; $P = 0.0014$), are more confident in their ability to quit ($P < 0.0001$), believe smoking contributed to their cancer (48.4% vs. 16.1%; $P = 0.0023$), have tried quitting when they were diagnosed (61.8% vs. 17.7%; $P < 0.0001$), believe quitting would result in health benefits ($P < 0.0001$), believe quitting would increase chances of cancer survival ($P = 0.0008$), think that quitting would decrease the chances of recurrence ($P < 0.0001$), and continued to smoke because they were also consuming alcohol ($P = 0.0229$), or out of weight gain concern ($P = 0.0377$). They were also less likely to use roll your own tobacco (5.6% vs. 21.1%; $P = 0.0132$) or smoke cigarillos (1.4% vs. 10.5%; $P = 0.0287$), and try quitting cold turkey (58.3% vs. 84.6%; $P = 0.0211$).

When univariate comparisons were adjusted for other variables in the model, four significant associations remained with one confounding factor. First, those that used roll your own tobacco had over a 90% lower odds of readiness to quit in the next six months (OR = 0.04; 95% CI, 0.01-0.67; $P = 0.0244$). Second, smokers ready to quit were more likely to display a higher confidence in their ability to quit smoking (OR = 3.49; 95% CI, 1.72-7.09; $P = 0.0005$) than those not read to quit. Third, cancer survivors ready to quit were over ten times more likely to believe that smoking contributed to their cancer diagnosis (OR = 10.37;

Table 2. Univariate comparisons between survivor smokers who were ready to quit and not ready to quit within 6 months (N = 110)

Variable	Ready to quit within 6 months (n = 72)	Not ready to quit within 6 months (n = 38)	*P*-value[b]
Age (yr)	56.8 ± 12.5	62.2 ± 10.6	0.0263*
Gender (male)	45.1	54.1	0.3752
Race			0.5729
White	57.8	57.9	
Non-white	39.4	42.1	
Multiracial	2.8	0.0	
Marital status (married)	46.5	42.1	0.6618
Education			0.3211
Less than high school	16.9	21.1	
Diploma or general education development	36.6	47.4	
Some college	46.5	31.6	
Cancer status			0.3327
Evaluation	12.9	10.5	
Diagnoses	12.9	2.6	
Treatment	61.4	73.7	
Remission	12.9	13.2	
Lung and/or bronchus cancer	34.7	18.4	0.0735
Other tobacco product use			
Smokeless tobacco	9.7	7.9	0.7512
Snus	5.6	2.6	0.4839
Hookah	4.2	2.6	0.6826
Roll your own tobacco	5.6	21.1	0.0132*
Cigarillo	1.4	10.5	0.0287*
Electronic cigarettes	20.8	5.3	0.0317*
Years smoked currently	32.1 ± 13.7	38.2 ± 12.4	0.0240*
Daily use	88.4	94.7	0.2816
Average cigarettes per day	12.9 ± 10.6	14.4 ± 9.5	0.4918
Trying to quit now	84.5	28.9	<0.0001*
Tried to quit in the past	84.7	56.8	0.0014*
Times tried to quit	5.3 ± 5.8	4.0 ± 2.7	0.1669
Self-efficacy to quit[a]	4.0 ± 1.1	2.5 ± 1.0	<0.0001*
Believe smoking contributed to cancer	48.4	16.1	0.0023*
Tried to quit when diagnosed with cancer	61.8	17.7	<0.0001*
Doctor advised to quit	75.0	72.2	0.7585
Doctor provided smoking cessation resources	38.2	51.4	0.1945
Methods tried			
Nicotine replacement therapy	78.6	88.9	0.2698
Medication prescription	80.0	82.4	0.7838
Cold turkey	58.3	84.6	0.0211*
Group program	96.9	100.0	0.5345
Counseling	96.9	100.0	0.5366
Telephone quit line	93.9	97.2	0.4538
Electronic cigarettes	90.4	91.7	0.8370
Perceived benefit of quitting[a]	4.2 ± 1.0	2.8 ± 1.6	<0.0001*
Quitting would increase chances of cancer survival[a]	3.4 ± 1.3	2.5 ± 1.3	0.0008*
Quitting would decrease cancer recurrence[a]	3.5 ± 1.1	2.2 ± 1.2	<0.0001*
I continued to smoke because…[a]			
I never intended to stay tobacco free	1.4 ± 1.0	2.6 ± 1.7	0.0008*
I was too stressed and anxious about my cancer	3.0 ± 1.7	3.4 ± 1.7	0.2982
To alleviate boredom	2.1 ± 1.3	1.8 ± 1.4	0.2679
Other smokers around me continued to smoke	2.6 ± 1.6	2.7 ± 1.7	0.8020
I was feeling depressed	2.5 ± 1.6	2.2 ± 1.7	0.3742
I was drinking alcohol	2.2 ± 1.5	1.5 ± 1.2	0.0229*
I was concerned about gaining weight	2.0 ± 1.5	1.4 ± 1.1	0.0377*
FND Score Categories	3.7 ± 1.9	3.9 ± 2.1	0.4663

Values are presented as mean ± SD or percent only. [a]Measured on a five-point Likert scale with 5 being a higher endorsement for the item. [b]Chi-square or exact *P*-value for %; or *t*-test for means. *$P < 0.05$.

Table 3. Results from the final multivariate model[a]

Variable	Crude OR	Crude 95% CI	Crude *P*-value	Adjusted OR	Adjusted 95% CI	Adjusted *P*-value
Roll your own cigarettes	0.22	0.06-0.80	0.0214	0.04	0.01-0.67	0.0244
Trying to quit now	13.20	5.08-34.09	<0.0001	3.89	0.85-17.81	0.0794
Self-efficacy to quit	3.46	2.14-5.59	<0.0001	3.49	1.72-7.09	0.0005
Contributed to cancer	4.73	1.61-13.88	0.0047	10.37	1.96-54.89	0.0059
Tried quitting when diagnosed	7.39	2.67-20.47	0.0001	6.39	1.12-36.43	0.0366

[a]Predictors entered into the final multivariate model that were not retained included age, other tobacco use, years smoked, tried to quit in the past, believed smoking contributed to their cancer, tried to quit cold turkey, perceived benefits of quitting, continued to smoke because they never intended to stay quit, continued to smoke because they were drinking alcohol, and continued to smoke because they were concerned about gaining weight.

95% CI, 1.96-54.89; $P = 0.0059$). Finally, those ready to quit were more likely to attempt smoking cessation when they were diagnosed with cancer (OR = 6.39; 95% CI, 1.12-36.43; $P = 0.0366$) than those smokers who were not ready to quit. Even though trying to quit now was associated with almost 4 times increased odds of readiness to quit within 6 months, it didn't reach traditional significance at the 0.05 level. However, we retained it in the model as a confounder for adjustment purposes. The final model had high predictive power with area under the receiver operating characteristic curve of 0.94 (Table 3).

DISCUSSION

We observed that only about one third of cancer survivors who smoke are ready to make a cessation attempt in the next 30 days and one third of smoking cancer survivors indicate an unwillingness to engage in a smoking cessation attempt within the next six months. Those ready to engage in a cessation attempt within the next six months, relative to those not ready, were more likely to report a higher confidence in their ability to quit smoking, more likely to acknowledge that smoking contributed to their cancer diagnosis, and were more likely to attempt cessation when they were diagnosed with cancer.

The finding that the majority of cancer survivors that smoke are not ready to quit in the next 30 days may help explain why participation in stop smoking programs is very high in cancer survivors yet cessation rates are low.[13,21] Traditional smoking cessation programs often include having the smoker set a quit date within 6 months, and most often it is within 30 days of entering the program.[12] Our research indicates that two-thirds of cancer survivors are not ready to quit in such a short time frame. A possible explanation for this observation is that cancer survivors are joining stop-smoking cessation programs because they feel obligation or pressured by health care providers, not because they feel ready to quit.

Given the apparent disconnect between cancer survivor participation in smoking cessation programs and their readiness to quit smoking, interventions need to account for differing levels of readiness. A growing literature exists utilizing combined behavioral and pharmacologic rate reduction with the outcome of cessation at follow-up among smokers not ready to quit.[22-24] The rationale is that self-efficacy may be enhanced through a gradual reduction in smoking over time. In a systematic review of rate reduction studies among smokers not ready to quit, Asfar et al. concluded that combined behavioral and pharmacologic (typically nicotine replacement therapy in the form of the patch or gum) rate reduction more than doubled the odds of total cessation at follow-up in smokers not ready to quit relative to control or comparison groups.[22]

To our knowledge, no study has compared, in any population, the efficacy of a smoking cessation program that tailors the intervention goals to the readiness level of participants. While the readiness rate of smoking among cancer survivors is slightly higher (33%) than that of the general smoking population (20%-30%),[25,26] the majority of cancer survivors are not ready to make a cessation attempt in the next 30 days. Future research is needed to compare the effectiveness of traditional smoking cessation programs with rate reduction programs among cancer survivors.

Our study has several strengths. To our knowledge few studies have evaluated readiness to quit smoking in cancer survivors.[16-18] Our study participants represented a diverse sample of cancer survivors. However, our study has several limitations. First, we relied on self-reports of smoking status, and there is some indication that cancer survivors are more likely to underreport their tobacco status than the general population of smokers.[13,21] As such, our estimates to tobacco use in our sample may be underestimates. While we conducted surveys anonymously in

the hope that this would increase honest reporting of tobacco status, future studies should consider using biochemical verification. Additionally, we recruited survivors from a single cancer center. However, because we recruited from four locations representing a diverse range of socio-economic status, racial, and ethnic characteristics, we do not feel that this biased our results. Finally, our assessment was cross-sectional which prevented us from examining changes in readiness to quit over time.

In summary, only about one third of smoking cancer survivors are ready to quit smoking at any given point in time. These results have implications for treating survivors in the future, as interventions are needed to address both cancer survivors ready to quit as well as those not ready to quit.

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CONFLICTS OF INTEREST

No potential conflicts of interest were disclosed.

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