

# Interest in Cessation Treatment Among People Who Smoke in a Community-Based Multidisciplinary Thoracic Oncology Program



Meghan Meadows-Taylor, PhD,<sup>a</sup> Kenneth D. Ward, PhD,<sup>b</sup> Weiyu Chen, MPH,<sup>b</sup> Nicholas R. Faris, M.Div,<sup>a</sup> Carrie Fehnel, BBA,<sup>a</sup> Meredith A. Ray, PhD,<sup>c</sup> Folabi Ariganjoye, M.B.B.S.,<sup>a</sup> Courtney Berryman, AA,<sup>a</sup> Cheryl Houston-Harris, BS,<sup>a</sup> Laura M. McHugh, RN,<sup>a</sup> Alicia Pacheco, MHA,<sup>a</sup> Raymond U. Osarogiagbon, M.B.B.S.<sup>a,\*</sup>

<sup>a</sup>Multidisciplinary Thoracic Oncology Program, Baptist Cancer Center, Memphis, Tennessee

<sup>b</sup>Division of Social & Behavioral Sciences, School of Public Health, The University of Memphis, Memphis, Tennessee

<sup>c</sup>Division of Epidemiology, Biostatistics, and Environmental Health, School of Public Health, The University of Memphis, Memphis, Tennessee

Received 10 February 2021; revised 13 April 2021; accepted 23 April 2021  
Available online - 7 May 2021

## ABSTRACT

**Introduction:** To evaluate the need for tobacco cessation services within a multidisciplinary clinic (MDC), we surveyed patients on their smoking status, interest in quitting, and willingness to participate in a clinic-based cessation program. We further evaluated the association between interest in cessation or willingness to participate in a cessation program and overall survival (OS).

**Methods:** From 2014 to 2019, all new patients with lung cancer in the MDC at Baptist Cancer Center (Memphis, TN) were administered a social history questionnaire to evaluate their demographic characteristics, smoking status, tobacco dependence, interest in quitting, and willingness to participate in a cessation program. We used chi-square tests and logistic regression to compare characteristics of those who would participate to those who would not or were unsure and Kaplan-Meier curves and Cox regression to evaluate the association between cessation interest or willingness to quit and OS.

**Results:** Of 641 total respondents, the average age was 69 years (range: 32–95), 47% were men, 64% white, 34% black, and 17% college graduates. A total of 90% had ever smoked: 34% currently and 25% quit within the past year. Among the current smokers, 60% were very interested in quitting and 37% would participate in a cessation program. Willingness to participate in a cessation program was associated with greater interest in quitting ( $p < 0.0001$ ), better OS ( $p = 0.02$ ), and reduced hazard of death (hazard

ratio = 0.52, 95% confidence interval: 0.30–0.88), but no other characteristics.

**Conclusions:** Patients with lung cancer in an MDC expressed considerable interest in tobacco cessation services; patients willing to participate in a clinic-based cessation program had improved survival.

© 2021 The Authors. Published by Elsevier Inc. on behalf of the International Association for the Study of Lung Cancer. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

\*Corresponding author.

Disclosure: Dr. Osarogiagbon reports stock ownership from Eli Lilly, Gilead Sciences, and Pfizer; serving as paid consultant from the Association of Community Cancer Centers, the American Cancer Society, AstraZeneca, and Tryptych Healthcare Partners; being a founder of Oncobox Device Inc.; and having patents for a surgical lymph node specimen collection kit in the United States and People's Republic of China. The remaining authors declare no conflict of interest.

Address for correspondence: Raymond U. Osarogiagbon, M.B.B.S., Multidisciplinary Thoracic Oncology Program, Baptist Cancer Center, 80 Humphreys Center Drive, Suite 330, Memphis, TN 38120. E-mail: [rosarogi@bmhcc.org](mailto:rosarogi@bmhcc.org)

Cite this article as: Meadows-Taylor M, et al. Interest in Cessation Treatment Among People Who Smoke in a Community-Based Multidisciplinary Thoracic Oncology Program. *JTO Clin Res Rep* 2021;2:100182

© 2021 The Authors. Published by Elsevier Inc. on behalf of the International Association for the Study of Lung Cancer. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

ISSN: 2666-3643

<https://doi.org/10.1016/j.jtocrr.2021.100182>

**Keywords:** Smoking cessation; Multidisciplinary care; Lung cancer; Tobacco cessation services

---

## Introduction

Cigarette smoking is the predominant risk factor for lung cancer, estimated to be responsible for 80% to 90% of lung cancer deaths in the United States.<sup>1,2</sup> In addition to increasing lung cancer risk and mortality, smoking increases the risk of disease recurrence, adversely affects treatment response, negatively affects quality of life, and is linked to the onset of other chronic health conditions, including cardiovascular disease and respiratory illness.<sup>3-6</sup> People with lung cancer who do not smoke have improved prognosis and achieve a better response to treatment compared with those who smoke.<sup>2,7,8</sup> Smoking alters drug metabolism, potentially increasing treatment toxicity and decreasing therapeutic efficacy.<sup>4,5,7,9-12</sup> Smoking cessation is associated with a lower risk of second primary cancers, better health-related quality of life, and reduced pain severity for patients diagnosed with lung cancer.<sup>7,13-15</sup> Smoking cessation after a diagnosis of lung cancer is associated with improvements in overall survival (OS).<sup>4,16,17</sup> Notwithstanding the adverse effects of smoking and the benefits of cessation, an estimated 40% to 50% of people who smoke continue to do so even after a lung cancer diagnosis.<sup>8,11,18</sup> Thus, cessation treatment is essential for high quality oncology care and may improve clinical outcomes.

Despite its known benefits, tobacco cessation treatment is inconsistently delivered in oncology practice. Although the American Society of Clinical Oncology (ASCO), the American Association for Cancer Research, the Joint Commission for the Accreditation of Hospitals, and the Oncology Nursing Society all recommend addressing tobacco use within the context of lung cancer care, few patients ever receive effective cessation treatment.<sup>4,7,19-21</sup> In a survey of more than 1500 medical oncologists by the International Association for the Study of Lung Cancer, 97% of respondents reported regularly asking patients about their tobacco use, 85% reported asking patients who smoke if they would quit smoking, and 87% advised them to stop smoking. Nevertheless, only 44% reported discussing medication options and 42% reported actively treating or referring patients for cessation support.<sup>22</sup> Similar estimates of 30% to 40% assistance with quitting were reported in a survey of nearly 1200 ASCO members.<sup>23</sup> Approximately 85% to 90% of respondents in both the International Association for the Study of Lung Cancer and ASCO surveys believed that tobacco adversely affects cancer outcomes and that cessation should be incorporated as a standard part of cancer care, suggesting even motivated

oncologists do not necessarily provide cessation support to their patients with cancer.<sup>22,23</sup>

Although oncologists perceive that patients may be resistant to cessation treatment, evidence suggests that patients are highly motivated to quit, especially those who have tobacco-related cancers.<sup>24-26</sup> The Mayo Clinic's Nicotine Dependence Center compared patients with lung cancer to nonlung cancer controls and revealed that among patients who received smoking cessation treatment, those with lung cancer reported a higher motivation to stop smoking and more advanced readiness to change smoking behavior than those without lung cancer.<sup>24</sup> Strong quit motivation is correlated with high quitting self-efficacy and greater likelihood of making a quit attempt, leading to improvements in prognosis and disease outcomes.<sup>27,28</sup> Nevertheless, even patients with lung cancer who make a quit attempt often relapse without assistance. The multidisciplinary care model, with multiple services and follow-up under one roof, formalized coordination of care through the use of a navigator, and enhanced communication between providers, may be uniquely suited for delivering high-quality and effective smoking cessation treatment.<sup>7,29-31</sup> However, research is limited on the levels of interest and acceptability of smoking cessation in this setting.

We analyzed factors associated with patients' interest in quitting and willingness to participate in a community health care system's multidisciplinary thoracic oncology clinic-based smoking cessation program and evaluated patient outcomes in relation to their expressed interest in quitting smoking. In addition, we evaluated the association between interest or willingness to participate in a cessation program and OS. We hypothesize that individuals who express a strong desire to quit smoking are most likely to succeed in their quit attempts, leading to potential improvement in survival.

## Materials and Methods

### Patients

The project was approved by the Institutional Review Board of the Baptist Memorial Healthcare Corporation with a waiver of the informed consent requirement for this low-risk intervention. We prospectively collected patient responses to an intake questionnaire administered at initial evaluation in the Multidisciplinary Thoracic Oncology Clinic at Baptist Cancer Center (Memphis, TN). This is a community-based health care system with a catchment area extending to counties in Kentucky, Mississippi, Arkansas, and Tennessee, U.S. states with the four highest per capita lung cancer incidence and mortality rates.<sup>32,33</sup> During their first clinic appointment, patients completed a social history questionnaire developed for clinical use, from which data for

this study were extracted. The social history questionnaire included information on sociodemographic characteristics (age, sex, race, marital status, education level, and employment status), smoking status and history, and health behaviors.

### Measures

Smoking status at the time of the survey was evaluated by self-report using the following question from the social history questionnaire: "Have you ever smoked?" Those who responded "yes, currently" were classified as current smokers, those who responded "yes, but only in the past" were classified as former smokers, and those who responded "no, never" were classified as never smokers. Those who responded "yes, currently" or "yes, but only in the past" were secondarily classified as "ever" smokers. Because some patients with lung cancer may quit smoking in response to symptoms of lung cancer and are at high risk of relapse, we further categorized former smoking status (those who responded "yes, but only in the past") into those who quit within the past 12 months of the date of the survey and those who quit more than 12 months from the date the survey was taken. Other health behaviors evaluated using the social history questionnaire included whether the patient drinks alcohol, exercises regularly, ever used illicit drugs, or ever used other tobacco products (e.g., cigars, pipes, chew, or snuff).

Other tobacco-related measures in our study used standard epidemiologic instruments. Ever smokers reported the number of packs per day they smoked and their age at smoking initiation. Number of cigarettes smoked per day was estimated as the number of packs smoked per day multiplied by 20. Pack years was calculated by multiplying the number of packs of cigarettes smoked per day by the number of years the patient has smoked. Nicotine dependence was measured with the two-item Heaviness of Smoking Index, a widely used measure of nicotine dependence that predicts success at quitting smoking.<sup>34,35</sup> The Heaviness of Smoking Index uses a six-point scale calculated from the number of cigarettes smoked per day (1–10, 11–20, 21–30, 31+) and the time to first cigarette after waking ( $\leq 5$ , 6–30, 31–60, and 61+ min). We calculated the Heaviness of Smoking Index only for the current smokers.

Current smokers reported their level of interest in quitting ("How interested are you in quitting smoking in the next month") as "not at all," "a little," or "a lot." For analyses, those who responded that they were either "a little" or "a lot" interested were considered to be interested in quitting. Current smokers also reported their willingness to participate in a cessation program in the clinic ("If a stop smoking program was offered by our clinic that gave you advice during your office visit about

how to quit, and a few brief phone calls to check on your progress, how likely are you to participate?"; responses were "I would not participate"; "I might participate but am not sure"; "I would participate"). For analyses, those who responded that they "would not" participate or "might but am unsure" were classified as not willing to participate and compared with those who responded that they would participate. Responses classified as "not reported" were excluded from analyses for both outcome measures.

Each respondent's social history questionnaire was matched to their electronic health record. Aggregate clinical cancer stage, comorbidities, histologic diagnosis, and treatment were collected. Comorbidities were aggregated based on the Charlson comorbidity index.<sup>36</sup> The Charlson comorbidity index was further categorized into three groups on the basis of whether the patient had 0, 1 to 2, or greater than or equal to 3 comorbidities. Performance status was derived from the Eastern Cooperative Oncology Group scale and categorized as 0 to 1 or greater than or equal to 2.<sup>37</sup> Survival information, including vital status and date of death, was derived from the following sources: state vital statistics databases, clinical record reviews, and direct patient or caregiver contact. We calculated OS times from each patient's date of histologic diagnosis until death or date of contact of their last follow-up.

### Statistical Analysis

We compared the characteristics of patients diagnosed with lung cancer who (1) were interested in quitting versus not interested in quitting smoking or (2) would participate in a cessation program versus would not or were unsure whether they would participate. We report continuous variables using median (interquartile range) and compared groups with the two-sample *t* test or Wilcoxon-Mann-Whitney test. Categorical variables are presented as frequency (%) and compared using the chi-square test or Fisher's exact for small cell counts.

Logistic regression was used to evaluate individual characteristics associated with interest in quitting or willingness to participate in smoking cessation treatment, respectively. OS was estimated using the Kaplan-Meier method, and groups were compared using the log rank test. We fit univariate and multivariable Cox proportional hazard models to determine if interest in quitting or willingness to participate in smoking cessation treatment was associated with overall lung cancer survival. We evaluated the proportional hazards assumption for these models graphically using log(–log) plots.

We performed model building for both the logistic and Cox proportional hazard models. Independent variables considered for the models included demographics (age, sex, race, marital status, education

level), tobacco use (pack years, Heaviness of Smoking Index), health behaviors (currently drinks alcohol, currently exercises, has ever used illicit drugs), and clinical characteristics (performance status, Charlson comorbidity index, clinical stage, histologic diagnosis). In addition, for the models evaluating associations for willingness to participate in a cessation program, we included interest in quitting smoking as an independent variable. We included the sociodemographic, smoking-related factors, and clinical characteristic variables in each model if they were significantly ( $p < 0.10$ ) associated with outcomes (interest in quitting, willingness to participate in cessation program, OS) or if they were deemed to be clinically important on the basis of previous knowledge or literature. For the Cox proportional hazard models, if the variable met the criteria for a potential confounder, we checked whether including the variable in the models changed parameter estimates of associations between either interest in quitting or willingness to participate with OS by at least 10%.<sup>38</sup> If so, they were retained as a confounder in the model. Missing data for predictor variables was addressed by including item nonresponse as either an additional category (i.e., not reported) for categorical variables or using a dummy variable to indicate missingness for continuous variables.

$p$  values and model-based odds ratios or hazard ratios with 95% confidence intervals for these models are reported where appropriate. The type I error rate was controlled at the 0.05 level. No adjustments were made for multiple comparisons.<sup>39,40</sup> All analyses were performed in Statistical Analysis System version 9.4 (SAS Institute Inc, Cary, NC).

## Results

A total of 841 new patients were referred for evaluation or treatment of lung cancer in the multidisciplinary clinic between October 9, 2014, and May 4, 2019. Of these, 641 (74%) had a confirmed diagnosis of lung cancer. The average age of the analyzed patients with lung cancer was 69 years (range: 32–95). A total of 64% of patients were white, and 34% were black. Most respondents were of female sex (53%) and married (52%). For this cohort, most did not get regular exercise (65%) and only 17% graduated college. Most had adenocarcinoma (46%); the cohort was 44% early stage (I or II), 49% late stage (III or IV), and 6% stage unknown. Demographics for the overall cohort are presented in [Table 1](#).

### Smoking Status

A total of 90% of respondents ( $n = 575$ ) had ever smoked, including 34% who currently smoked ( $n = 218$ )

and 25% ( $n = 85$ ) who quit smoking within the past year. Current smokers were more likely to be black (42% versus 31% white), single, divorced, or widowed (56%), attend high school or less (74%), have non-adenocarcinoma (61%), and less likely to exercise regularly (16%), compared with both former and never smokers. Former smokers were more likely to be older (median age of 71), consume alcohol (72%), and have a higher Charlson comorbidity index (28% with index  $\geq 3$ ) than current or never smokers. Respondents who never smoked were more likely to be of female sex (75%), married (64%), and have graduated college (29%). Other characteristics by smoking status are presented in [Supplementary Table 1](#).

### Interest in Quitting Smoking

Among the current smokers, 60% ( $n = 130$ ) were “very” interested in making a quit attempt in the next month, 18% ( $n = 39$ ) were “somewhat” interested, and 10% ( $n = 21$ ) were not interested; the rest were unreported ( $n = 28$ ). Those who were interested (very and somewhat) in quitting were younger ( $p = 0.007$ ), had lower median pack years of smoking (47 versus 60,  $p = 0.01$ ), and were less likely to have adenocarcinoma ( $p = 0.004$ ) than those who had no interest in quitting smoking in the next month ([Supplementary Table 2](#)). The adjusted logistic regression model included age, histologic diagnosis, pack years of smoking, and alcohol consumption. After adjusting for other factors, only histologic diagnosis ( $p = 0.0008$ ) was significantly associated with interest in cessation. The groups did not differ significantly on any other sociodemographic, tobacco use, health behavior, or health status characteristics ([Table 2](#)). Although not statistically significant, those interested in quitting had higher OS than those not interested in quitting (1-y survival 64% versus 56%; [Fig. 1](#) and [Supplementary Table 3](#)).

### Willingness to Participate in a Clinic-Based Cessation Program

Of the 218 current smokers, 37% ( $n = 80$ ) reported that they would be willing to participate in a smoking cessation program. Black respondents were as likely as white respondents to be interested in participating (51% versus 49%, respectively; [Supplementary Table 4](#)). Willingness to participate in a cessation program was associated with greater interest in quitting ( $p < 0.0001$ ; [Table 3](#)), but no other sociodemographic, clinical, or smoking-related characteristics (amount smoked, age at smoking initiation, or dependence). Interestingly, willingness to participate in a smoking cessation program was also associated with greater OS (log rank  $p = 0.02$ ; [Fig. 2](#)) and reduced hazard of death (hazard ratio: 0.52,

**Table 1. Demographics, Smoking History, and Clinical Characteristics of Patients Diagnosed With Lung Cancer Evaluated in a Multidisciplinary Clinic**

Demographic & Clinical Characteristics	Total, n (%) N = 641
Age, median (interquartile range) (range)	69 (63-75) (32-95)
Sex	
Male	304 (47)
Female	337 (53)
Race	
White	409 (64)
Black	221 (34)
Others	6 (1)
Unknown or not reported	5 (1)
Marital status	
Single, divorced, or widowed	296 (46)
Married or partnered	332 (52)
Not reported	13 (2)
Insurance	
Medicaid	282 (44)
Medicare	110 (17)
Commercial	229 (36)
Self-insured or none	20 (3)
Education	
High school or less	418 (65)
Some college	41 (6)
College graduate or higher	106 (17)
Other or not reported	76 (12)
Alcohol consumption	
Yes	420 (66)
No	197 (31)
Not reported	24 (4)
Regular exercise	
Yes	146 (23)
No	416 (65)
Not reported	79 (12)
Use of illicit drugs	
Yes	24 (4)
No	530 (83)
Not reported	87 (14)
Charlson comorbidity index	
0	152 (24)
1-2	322 (50)
≥3	167 (26)
Performance status ECOG score	
0-1	500 (78)
≥2	141 (22)
Aggregate clinical stage	
I-II (early)	285 (44)
III-IV (late)	316 (49)
Unknown	40 (6)
Histologic diagnosis	
Adenocarcinoma	293 (46)
Nonadenocarcinoma, others, or unknown	348 (54)
Smoking status	
Current	218 (34)
Former	357 (56)

(continued)

**Table 1. Continued**

Demographic & Clinical Characteristics	Total, n (%) N = 641
Quit within the past 12 mo	85 (24)
Quit more than 12 mo	256 (72)
Quit status unknown	16 (4)
Never	59 (9)
Not reported	7 (1)
Ever smokers (current + former):	
Packs per day, median (interquartile range) (range)	1 (1-1.5) (0-5)
Pack years, median (interquartile range) (range)	47 (27-65.25) (0-292)
Age at smoking initiation, median (interquartile range) (range)	17 (15-20) (7-65)
Current smokers only	
How soon after you wake up do you have your first cigarette?	
Within 5 min	53 (24)
Within 6-30 min	74 (34)
Within 31-60 min	37 (17)
After 60 min	32 (15)
Not reported	22 (10)
Heaviness of smoking index	
Low addiction	78 (36)
Moderate addiction	83 (38)
High addiction	27 (12)
Unknown	30 (14)
How interested are you in quitting smoking in the next month?	
Very interested	130 (60)
A little interested	39 (18)
Not at all or not reported	49 (22)
Willingness to participate in a clinic cessation program	
I would participate	80 (37)
I might participate but am unsure	64 (29)
I would not participate or not reported	74 (34)

Abbreviation: ECOG, Eastern Cooperative Oncology Group.

95% confidence interval: 0.30–0.88; [Table 4](#)). The 1- and 3-year survival estimates by willingness to participate are provided in [Supplementary Table 5](#).

**Table 2. Factors Associated With Current Smokers' Levels of Interest in Quitting Smoking**

Characteristics	Odds Ratio (95% Confidence Interval)	p Value
Age	0.97 (0.92-1.01)	0.16
Pack years of smoking	0.99 (0.98-1.00)	0.13
Alcohol consumption		0.97
No	1 (ref)	
Yes	1.09 (0.49-2.43)	
Histologic diagnosis		0.0008
Adenocarcinoma	1 (ref)	
Nonadenocarcinoma, others, or unknown	3.62 (1.17-7.69)	

Abbreviation: ref, reference.

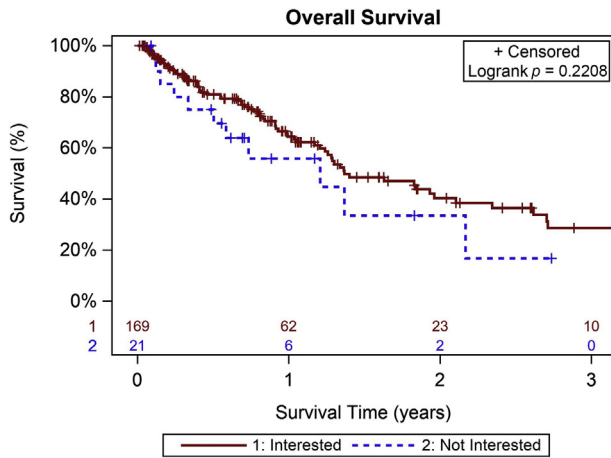


Figure 1. Overall survival by current smokers' interest in quitting.

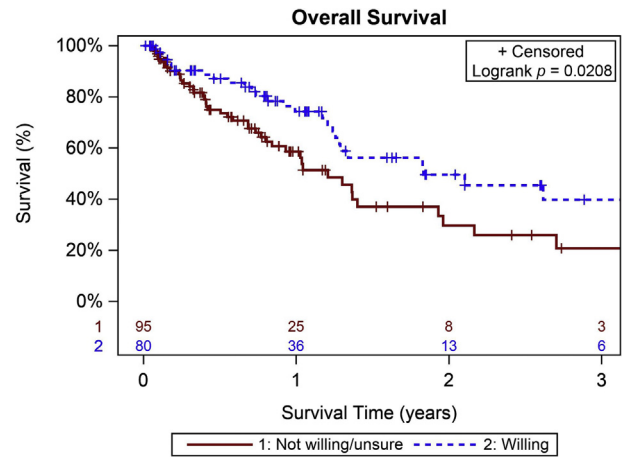


Figure 2. Overall survival by current smokers' willingness to participate in a clinic-based cessation program.

### Discussion

Our results indicate that more than half of the people surveyed in a community-based multidisciplinary lung cancer program currently smoke or recently quit, indicating a considerable need for cessation support within the context of multidisciplinary thoracic oncology care. Most people who currently smoke in our cohort reported interest in quitting and more than one-third were willing to participate in a clinic-based cessation program, suggesting the opportunity to leverage this care-delivery platform to fulfill an unmet patient care need. Willingness to participate was similar across a broad range of sociodemographic factors, tumor characteristics, and nicotine dependence levels and was associated with improved OS.

We found that 60% of patients surveyed were “very” interested in making a quit attempt, whereas only 10%

were not interested at all. Our findings support current evidence that patients with cancer are as willing to quit smoking as people without tobacco-related cancer. In a study of patients treated in the Mayo Clinic Nicotine Dependence Center, patients with lung cancer seeking cessation treatment were significantly more likely to be “highly motivated” to quit than nonlung cancer controls.<sup>24</sup> Among patients with lung or head and neck

Table 3. Factors Associated With Current Smokers' Willingness to Participate in a Clinic-Based Cessation Program

Characteristics	Odds Ratio (95% Confidence Interval)	p Value
Age	0.97 (0.93-1.02)	0.22
Race		0.06
White	1 (ref)	
Black	1.95 (0.98-3.88)	
Education		0.91
High school or less	1.06 (0.41-2.76)	
College or higher	1 (ref)	
Pack years of smoking	1.00 (0.99-1.01)	0.93
Interest in quitting		0.004
Not interested	1 (ref)	
Interested	20.03 (2.57-156.31)	

Abbreviation: ref, reference.

Table 4. Results From the Cox Proportional Hazard Models to Evaluate the Association Between Interest in Cessation or Willingness to Participate in a Cessation Program and Overall Survival

Variables	Hazard Ratio (95% Confidence Interval)	p Value
<b>Unadjusted</b>		
Interest in cessation		0.22
No	1 (ref)	
Yes	0.67 (0.36-1.27)	
Willingness to participate in cessation program		0.02
No	1 (ref)	
Yes	0.57 (0.35-0.92)	
<b>Adjusted</b>		
Interest in cessation <sup>a</sup>		0.19
No	1 (ref)	
Yes	0.60 (0.28-1.30)	
Willingness to participate in cessation program <sup>b</sup>		0.02
No	1 (ref)	
Yes	0.52 (0.30-0.88)	

<sup>a</sup>Adjusted for age, education level, pack years, histologic diagnosis, Charlson comorbidity index, and performance status.

<sup>b</sup>Adjusted for age, sex, race, pack years, histologic diagnosis, Charlson comorbidity index, and performance status.

Abbreviation: ref, reference.

cancer, 51% of people who smoke and 20% of those who recently quit expressed interest in an individualized smoking cessation program.<sup>25</sup> In addition, in a study of patients with cancer referred to a phone-based cessation counseling program, of 1126 patients contacted by the cessation program, only 30 (3%) declined to participate.<sup>26</sup> Other studies have revealed positive results of cessation treatment among patients with lung cancer.<sup>41</sup> These findings counter the sense of fatalism sometimes expressed by providers that patients with lung cancer do not want to quit.<sup>42</sup> We report a high level of motivation to quit smoking among patients with lung cancer within a multidisciplinary care environment and reveal that more than one-third of patients would be willing to participate in a clinic-based cessation program if it were offered. Our study provides additional evidence that supports the value of quitting smoking within a multidisciplinary environment even after a diagnosis of lung cancer.

Patients can still benefit from cessation services even if they do not have any initial desire to quit. Cessation treatment is moving toward an “opt-out” approach, in which all patients are referred to cessation services regardless of quit readiness.<sup>43-45</sup> Among 2765 patients with cancer who smoked and received oncology services at the Roswell Park Cancer Institute, half received a mail invitation to contact a cessation service whereas the other half received the mailing plus telephone cessation support initiated by the Roswell Park Cancer Institute. Whereas only 1.2% of patients who received the mailing only contacted the cessation service, among patients who received the mailing plus telephone support, 4.5% reported at follow-up no tobacco use for the past 30 days and only 2.7% declined to participate.<sup>26</sup> Among a consortium of Michigan oncology practices that enrolled 4347 patients with cancer who smoked in proactive telephone counseling from the state Quitline from 2012 to 2017, increases in referrals, receipt of cessation services, completion of treatment, and quit rates were observed.<sup>43</sup> Although not from randomized trials, these clinical data suggest considerable feasibility and efficacy of “opt-out” programs to improve cessation among patients with cancer.

In contrast, current guidelines recommend that patients be referred to cessation treatment on the basis of physician determination of their readiness to quit, but oncologists do not consistently assess readiness.<sup>22,23</sup> An “opt-out” approach can improve the reach of tobacco cessation services because patients who are motivated but may not express readiness during their visit owing to lack of confidence will still be referred to cessation treatment.<sup>7,44,45</sup>

Because some patients may not be sufficiently motivated to participate in cessation services at the start of cancer treatment, it is imperative to offer cessation programs at multiple points along the cancer care continuum from prediagnostic testing, to treatment, and throughout follow-up care.<sup>7,24</sup> Patients treated in a multidisciplinary clinic meet with providers at every step of the continuum, allowing providers to promote cessation throughout the entirety of care.<sup>7,31</sup> The high level of interest in quitting smoking in our cohort implies that few patients would choose to opt-out, providing a basis for recommending cessation services in this context.

Our finding of a significant association between willingness to quit smoking and improved survival ( $p = 0.02$ ) strengthens the need for increased efforts to motivate and assist patients to quit throughout their care. This remarkable finding warrants further evaluation. One mechanism of action in which willingness to quit can potentially influence survival is through successful quit attempts. Studies reveal that quit motivation is associated with higher quitting self-efficacy and a higher probability of making a quit attempt.<sup>27,46</sup> Furthermore, quitting smoking after a cancer diagnosis is associated with better lung cancer survival.<sup>16,17,47,48</sup> A study of 543 patients with early stage NSCLC found that smoking cessation was associated with improved overall and recurrence-free survival.<sup>48</sup> We hypothesize that those with stronger motivation (as indicated by willingness to participate in a cessation program) were ultimately more successful in quitting after cancer diagnosis, leading to a survival improvement. These patients may have decided to seek treatment elsewhere or even quit on their own; however, motivational factors alone are associated with reduced cessation maintenance and increased relapse, especially among patients with cancer. This further emphasizes the need for cessation services, especially during the “teachable moment” at the time of initial evaluation within a lung cancer clinic.<sup>49</sup>

It is also possible that those with more favorable prognoses were especially interested in cessation support. Interestingly, we found that patients with non-adenocarcinoma were more likely to express interest in quitting. Others have suggested that patients with less severe disease are more likely to continue to smoke after diagnosis.<sup>50</sup> Because they are often asymptomatic, these patients may downplay the severity of their condition and thus may be less likely to quit smoking.<sup>24,50</sup> In addition, despite a racial difference in smoking status, black respondents were as likely as white respondents to be interested in participating in a cessation program,

further emphasizing the need for physician-led assistance in cessation treatment especially within a racially diverse area. Cessation treatment within a multidisciplinary care setting may be well suited to target patients who may need more assistance with quit motivation.

Our main limitation is that we did not measure actual quit behavior or true quit rates and, therefore, cannot draw causal inference from our results, which may be driven by patient self-selection; however, we accounted for performance status, Charlson comorbidity index, and histologic diagnosis as indicators of prognosis in our modeling, which did not influence our conclusions. We also evaluated smoking by self-report using clinical rather than standard epidemiologic definitions of smoking status, opening up the possibility of recall and misclassification bias, and we did not biochemically verify smoking status. We plan to validate our hypothesis with prospective data collection on verified quit attempts and biochemically corroborated quit status in the future. Our survey was conducted in one health care system, potentially limiting generalizability to other health care settings; however, patients in our community-based health care system were racially diverse and demographically similar to the general U.S. lung cancer population.

Strengths of our study include prospective data collection and evaluation of a relatively large sample of patients from a high-risk population in a large community health care system in the U.S. lung cancer mortality belt. Future studies should seek to understand the drivers of outcome differences between people with differing levels of motivation to quit and evaluate the impact of a systematic intervention for smoking cessation within the multidisciplinary care-delivery environment.

Given the health benefits of quitting smoking, including decreased postoperative complications, increased efficacy of lung cancer treatment, improved prognosis, and better quality of life, smoking cessation treatment is warranted. Unfortunately, most patients do not receive effective cessation treatment despite emphasis from clinical practice guidelines on the importance of smoking interventions in oncology practice. Contributing to this impasse is that delivery of lung cancer services in the United States tends to be highly fragmented. A multidisciplinary model of care is a potential solution that can reduce this fragmentation while also improving care quality and enhancing patient satisfaction. There is considerable need for, and interest in, smoking cessation services in a multidisciplinary thoracic oncology care setting. Integrating tobacco cessation programs within multidisciplinary thoracic oncology programs potentially enhances the value of such programs and their impact on patient outcomes.

## Acknowledgments

This work was supported by the Patient-Centered Outcomes Research Institute Award (IH-1304-6147, R.U. Osarogiagbon, PI) and the NCI Community Oncology Research Program (5UG1CA189873-07). The authors acknowledge the patients and their caregivers who participated in this study, those who conducted the survey evaluation, and the senior leadership of the Baptist Cancer Center for their support in establishing the multidisciplinary program that facilitated the conduct of this project. All statements in this presentation, including its findings and conclusions, are solely those of the authors and do not necessarily represent the views of the Patient-Centered Outcomes Research Institute, its Board of Governors, or Methodology Committee.

## Supplementary Data

Note: To access the supplementary material accompanying this article, visit the online version of the *JTO Clinical and Research Reports* at [www.jtocrr.org](http://www.jtocrr.org) and at <https://doi.org/10.1016/j.jtocrr.2021.100182>.

## References

1. American Lung Association. Lung cancer fact sheet. <https://www.lung.org/lung-health-diseases/lung-disease-lookup/lung-cancer/resource-library/lung-cancer-fact-sheet>. Accessed November 23, 2020.
2. US Department of Health and Human Services. *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2014.
3. Jassem J. Tobacco smoking after diagnosis of cancer: clinical aspects. *Transl Lung Cancer Res*. 2019;8 (Suppl 1):S50-S58.
4. Warren GW, Cummings KM. Tobacco and lung cancer: risks, trends, and outcomes in patients with cancer. *Am Soc Clin Oncol Educ Book*. 2013;33:359-364.
5. Warren GW, Sobus S, Gritz ER. The biological and clinical effects of smoking by patients with cancer and strategies to implement evidence-based tobacco cessation support. *Lancet Oncol*. 2014;15:e568-e580.
6. Office of the Surgeon General (US); Office on Smoking and Health (US). *The Health Consequences of Smoking: A Report of the Surgeon General*. Atlanta, GA: Centers for Disease Control and Prevention (US); 2004.
7. Warren GW, Ward KD. Integration of tobacco cessation services into multidisciplinary lung cancer care: rationale, state of the art, and future directions. *Transl Lung Cancer Res*. 2015;4:339-352.
8. Baser S, Shannon VR, Eapen GA, et al. Smoking cessation after diagnosis of lung cancer is associated with a beneficial effect on performance status. *Chest*. 2006;130:1784-1790.



9. Alsadius D, Hedelin M, Johansson KA, et al. Tobacco smoking and long-lasting symptoms from the bowel and the anal-sphincter region after radiotherapy for prostate cancer. *Radiother Oncol*. 2011;101:495-501.
10. Sobus SL, Warren GW. The biologic effects of cigarette smoke on cancer cells. *Cancer*. 2014;120:3617-3626.
11. Eifel PJ, Jhingran A, Bodurka DC, Levenback C, Thames H. Correlation of smoking history and other patient characteristics with major complications of pelvic radiation therapy for cervical cancer. *J Clin Oncol*. 2002;20:3651-3657.
12. Petros WP, Younis IR, Ford JN, Weed SA. Effects of tobacco smoking & nicotine on cancer treatment. *Pharmacotherapy*. 2012;32:920-931.
13. Richardson GE, Tucker MA, Venzon DJ, et al. Smoking cessation after successful treatment of small-cell lung cancer is associated with fewer smoking-related second primary cancers. *Ann Intern Med*. 1993;119:383-390.
14. Rowland C, Eiser R, Rowe R, Danson S. The effect of smoking on health-related quality of life in lung cancer patients: a systematic review. *BMJ Support Palliat Care*. 2012;2:312-318.
15. Daniel M, Keefe FJ, Lyna P, et al. Persistent smoking after a diagnosis of lung cancer is associated with higher reported pain levels. *J Pain*. 2009;10:323-328.
16. Parsons A, Daley A, Begh R, Aveyard P. Influence of smoking cessation after diagnosis of early stage lung cancer on prognosis: systematic review of observational studies with meta-analysis. *BMJ*. 2010;340:b5569.
17. Koshiaris C, Aveyard P, Oke J, et al. Smoking cessation and survival in lung, upper aero-digestive tract and bladder cancer: cohort study. *Br J Cancer*. 2017;117:1224-1232.
18. Cox LS, Africano NL, Tercyak KP, Taylor KL. Nicotine dependence treatment for patients with cancer: review and recommendations. *Cancer Interdiscip Int J Am Cancer Society*. 2003;98:632-644.
19. Hanna N, Mulshine J, Wollins DS, Tyne C, Dresler C. Tobacco cessation and control a decade later: American Society of Clinical Oncology policy statement update. *J Clin Oncol*. 2013;31:3147-3157.
20. Toll BA, Brandon TH, Gritz ER, Warren GW, Herbst RS, AACR Subcommittee on Tobacco and Cancer. Assessing tobacco use by cancer patients and facilitating cessation: an American Association for Cancer Research policy statement. *Clin Cancer Res*. 2013;19:1941-1948.
21. Oncology Nursing Society. ONS: Nursing leadership in global and domestic tobacco control. *Oncol Nurs Forum*. 2008;35:745-747.
22. Warren GW, Dibaj S, Hutson A, Cummings KM, Dresler C, Marshall JR. Identifying targeted strategies to improve smoking cessation support for cancer patients [published correction appears in *J Thorac Oncol*. 2015;10:1702]. *J Thorac Oncol*. 2015;10:1532-1537.
23. Warren GW, Marshall JR, Cummings KM, et al. Addressing tobacco use in patients with cancer: a survey of American Society of Clinical Oncology members. *J Oncol Pract*. 2013;9:258-262.
24. Sanderson Cox L, Patten CA, Ebbert JO, et al. Tobacco use outcomes among patients with lung cancer treated for nicotine dependence. *J Clin Oncol*. 2002;20:3461-3469.
25. Cooley ME, Emmons KM, Haddad R, et al. Patient-reported receipt of and interest in smoking-cessation interventions after a diagnosis of cancer. *Cancer*. 2011;117:2961-2969.
26. Warren GW, Marshall JR, Cummings KM, et al. Automated tobacco assessment and cessation support for cancer patients. *Cancer*. 2014;120:562-569.
27. Schnoll RA, Rothman RL, Newman H, et al. Characteristics of cancer patients entering a smoking cessation program and correlates of quit motivation: implications for the development of tobacco control programs for cancer patients. *Psychooncology*. 2004;13:346-358.
28. Curry SJ, Grothaus L, McBride C. Reasons for quitting: intrinsic and extrinsic motivation for smoking cessation in a population-based sample of smokers. *Addict Behav*. 1997;22:727-739.
29. Kedia SK, Ward KD, Digney SA, et al. 'One-stop shop': lung cancer patients' and caregivers' perceptions of multidisciplinary care in a community healthcare setting. *Transl Lung Cancer Res*. 2015;4:456-464.
30. Smeltzer MP, Rugless FE, Jackson BM, et al. Pragmatic trial of a multidisciplinary lung cancer care model in a community healthcare setting: study design, implementation evaluation, and baseline clinical results. *Transl Lung Cancer Res*. 2018;7:88-102.
31. Osarogiagbon RU, Rodriguez HP, Hicks D, et al. Deploying team science principles to optimize interdisciplinary lung cancer care delivery: avoiding the long and winding road to optimal care. *J Oncol Pract*. 2016;12:983-991.
32. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. *CA Cancer J Clin*. 2020;70:7-30.
33. Islami F, Bandi P, Sahar L, Ma J, Drope J, Jemal A. Cancer deaths attributable to cigarette smoking in 152 U.S. metropolitan or micropolitan statistical areas, 2013-2017. *Cancer Causes Control*. 2021;32:311-316.
34. Heatherton TF, Kozlowski LT, Frecker RC, Rickert W, Robinson J. Measuring the heaviness of smoking: using self-reported time to the first cigarette of the day and number of cigarettes smoked per day. *Br J Addict*. 1989;84:791-799.
35. Chaiton MO, Cohen JE, McDonald PW, Bondy SJ. The Heaviness of Smoking Index as a predictor of smoking cessation in Canada. *Addict Behav*. 2007;32:1031-1042.
36. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis*. 1987;40:373-383.
37. Oken MM, Creech RH, Tormey DC, et al. Toxicity and response criteria of the Eastern Cooperative Oncology Group. *Am J Clin Oncol*. 1982;5:649-655.
38. Maldonado G, Greenland S. Simulation study of confounder-selection strategies. *Am J Epidemiol*. 1993;138:923-936.
39. Rothman KJ. No adjustments are needed for multiple comparisons. *Epidemiology*. 1990;1:43-46.
40. Althouse AD. Adjust for multiple comparisons? It's not that simple. *Ann Thorac Surg*. 2016;101:1644-1645.

41. Wewers ME, Jenkins L, Mignery T. A nurse-managed smoking cessation intervention during diagnostic testing for lung cancer. *Oncol Nurs Forum*. 1997;24:1419-1422.
42. Cataldo JK, Dubey S, Prochaska JJ. Smoking cessation: an integral part of lung cancer treatment. *Oncology*. 2010;78:289-301.
43. Notier AE, Hager P, Brown KS, Petersen L, Bedard L, Warren GW. Using a quitline to deliver opt-out smoking cessation for cancer patients. *JCO Oncol Pract*. 2020;16:e549-e556.
44. Richter KP, Ellerbeck EF. It's time to change the default for tobacco treatment. *Addiction*. 2015;110:381-386.
45. Ohde JW, Master Z, Tilburt JC, Warner DO. Presumed consent with opt-out: an ethical consent approach to automatically refer patients with cancer to tobacco treatment services. *J Clin Oncol*. 2021;39:876-880.
46. Borland R, Yong HH, Balmford J, et al. Motivational factors predict quit attempts but not maintenance of smoking cessation: findings from the International Tobacco Control Four country project. *Nicotine Tob Res*. 2010;12(suppl 1):S4-S11.
47. Dobson Amato KA, Hyland A, Reed R, et al. Tobacco cessation may improve lung cancer patient survival. *J Thorac Oncol*. 2015;10:1014-1019.
48. Zhou W, Heist RS, Liu G, et al. Smoking cessation before diagnosis and survival in early stage non-small cell lung cancer patients. *Lung Cancer*. 2006;53:375-380.
49. Dresler C, Warren GW, Arenberg D, et al. "Teachable Moment" interventions in lung cancer: why action matters. *J Thorac Oncol*. 2018;13:603-605.
50. Ostroff JS, Jacobsen PB, Moadel AB, et al. Prevalence and predictors of continued tobacco use after treatment of patients with head and neck cancer. *Cancer*. 1995;75:569-576.