




RESEARCH ARTICLE

Associations between cancer diagnosis and patients' responses to an inpatient tobacco treatment intervention

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Abstract

Background: Diagnosis of a chronic illness, such as cancer may influence health behavior changes, such as smoking cessation. The present analyses examine associations between a cancer diagnosis (i.e., yes or no) and response to an opt-out smoking cessation bedside intervention provided to hospitalized patients. It was hypothesized that patients with a past or present cancer diagnosis would report higher motivation and engagement with quitting smoking, and higher rates of smoking abstinence after hospital discharge, compared to those without a cancer diagnosis.

Methods: Chart review was conducted on 5287 inpatients who accepted bedside treatment from a counselor and opted-in to automated follow-up calls from July 2014 to December 2019.

Results: At the time of inpatient assessment, those with a past or present cancer diagnosis ($n = 419$, 7.9%) endorsed significantly higher levels of importance of quitting than those without a cancer diagnosis (3.92/5 vs. 3.77/5), and were more likely to receive smoking cessation medication upon discharge (17.9% vs. 13.3%). Follow-up data from 30-days post-discharge showed those with a cancer diagnosis endorsed higher rates of self-reported abstinence (20.5%) than those without a cancer diagnosis (10.3%; $p < 0.001$).

Conclusion: Being hospitalized for any reason provides an opportunity for smokers to consider quitting. Having a previous diagnosis of cancer appears to increase intention to quit and lead to higher rates of smoking cessation in patients who are hospitalized compared to patients without cancer. Future research needs to work toward optimizing motivation for smoking cessation while admitted to a hospital and on improving quit rates for all admitted patients, regardless of diagnosis.

KEY WORDS

cancer, cessation, hospitalization, inpatient, prevention, smoking, tobacco

1 | INTRODUCTION

Smoking by cancer patients and cancer survivors is causally linked to several adverse health outcomes.¹ Fortunately, quitting smoking even after a cancer diagnosis improves health and survival.^{2,3} Smoking cessation benefits cancer patients by improving cancer-related outcomes (e.g., reduces the risk of secondary tumors) as well as decreasing the likelihood of other smoking-related health issues (such as heart disease, stroke, and pulmonary disease).⁴ For this reason, clinical practice guidelines from multiple oncology organizations emphasize the importance of providing smoking cessation treatments to all patients with cancer.^{3,5}

Given the health benefits of quitting smoking, hospitals and medical systems are encouraged to implement tobacco treatment programs into their care system.^{6,7} It is recommended that tobacco treatment programs include specialized tobacco treatment clinicians that provide cessation counseling, resources, medications, or referral to external resources such as state quitlines.⁸⁻¹⁰ Despite systemic barriers to implementation, many established tobacco treatment programs have succeeded in efficiently integrating evidence-based treatments into clinical settings.^{10,11} Both providers and patients benefit from these services, as they reduce smoking-related burdens on health, improve treatment efficacy, and reduce costs for the hospital.¹²⁻¹⁵

Research¹⁶ suggests that some medical diagnoses (e.g., cancer) may serve as the foundation for increased motivation for health behavior change, such as smoking cessation. However, patients face barriers to quitting, including stigmatization associated with smoking, lack of cessation assistance, lack of institutional resources, lack of training, lack of time, and lack of prioritization of smoking cessation in the context of cancer care.^{3,17-19}

To overcome barriers related to access to evidence-based care, opt-out approaches have been utilized. In an opt-out program, patients are identified through structured tobacco use screening and are automatically referred for smoking cessation support.¹³ After referral, the patient chooses their level of involvement in treatment. Not only are these interventions efficacious, but they have been proven to reduce readmission rates and costs.^{20,21} In the outpatient setting, opt-out approaches have been well-received by cancer patients.²² However, little is known about the degree of effectiveness of these interventions among cancer patients, relative to those without such a diagnosis. The purpose of the present study is to examine outcomes from an opt-out smoking cessation bedside consult intervention and the effect of a cancer diagnosis on outcomes and other therapeutic factors (e.g., importance of quitting).

2 | METHODS

2.1 | Setting and participants

The Tobacco Treatment Program (TTP) at the Medical University of South Carolina (MUSC) serves three inpatient hospitals within the MUSC system. Overall, the TTP is an integrated, comprehensive, opt-out tobacco treatment program with both inpatient and outpatient services. The program is staffed by psychologists, pharmacists, and certified tobacco treatment specialists. The TTP receives daily notifications of all hospital inpatients, who report any current tobacco use at the time of admission.²¹ These patients are then visited by a clinician who conducts a brief interview and documents the encounter in the electronic health record at the bedside using an iPad. Patients who receive the bedside consult are also enrolled to receive automated, interactive voice recognition (IVR) calls 3-, 14-, and 30-days post-discharge to assess their smoking status and refer them to the South Carolina Quitline or outpatient counseling if desired. Patients may decline the bedside consult and/or the telephone follow-up calls. Details of the patient tracking and follow-up system used at MUSC can be found elsewhere.^{20,21}

The present analysis consists of data from participants who self-reported tobacco use upon admission and completed an inpatient counseling session during their hospitalization between July 2014 and December 2019. Medical record numbers were used to link patients to the National Cancer Registry Database, and patients were coded as having a past or current cancer diagnosis if their date of cancer diagnosis occurred prior to or on the day of the inpatient admission. Follow-up data were collected through the chart review of patients' responses to the IVR telephone system 30-days following discharge. This study was exempt from participant consent and approved by the MUSC Institutional Review Board.

2.2 | Measures

2.2.1 | Demographics and smoking characteristics

Patients' race and biological sex were collected from medical records. TTP clinicians asked patients which tobacco products they used over the past month (cigarettes, cigars, hookah, bidis, oral tobacco, or e-cigarettes), how often they used the product(s) over the past month (daily or non-daily), how many units were used per day (e.g., cigarettes smoked per day), and how soon after waking they used their first product (a proxy for dependence²³).

2.2.2 | Importance to quit

The importance to quit was measured by asking “How important is quitting smoking to you on a scale of 1–5, with 5 being the most important?”

2.2.3 | Confidence in quitting

The importance to quit was measured by asking “How confident are you that you will be able to remain smoke free on a scale of 1–5, with 5 being the most confident?”

2.2.4 | Quit attempts in the past year

Patients were asked how many times, if any, they tried to quit smoking during the past year.

2.2.5 | Medication during hospitalization

Patients were asked if they had received a quit smoking medication (such as nicotine replacement therapy [NRT]) during hospitalization.

2.2.6 | Medication recommendation for discharge

Counselors discussed discharge medication options with patients, which included NRT, bupropion (Zyban), or varenicline (Chantix). A shared decision was made between the patient and counselor to recommend medications for discharge.

2.2.7 | Discharge medication

Counselors pended recommendations for medications to the attending physician in the medical record system. Chart review was used to determine if medication was approved and provided by the physician upon discharge.

2.2.8 | Seven-day point prevalence abstinence

This was collected during the 30-day IVR phone follow-up, if completed. Patients were coded “quit” if they endorsed not smoking for the 7 days prior to the phone call. If not quit, participants were asked about the level of interest in quitting in the near future by endorsing “ready” or “not ready” to quit.

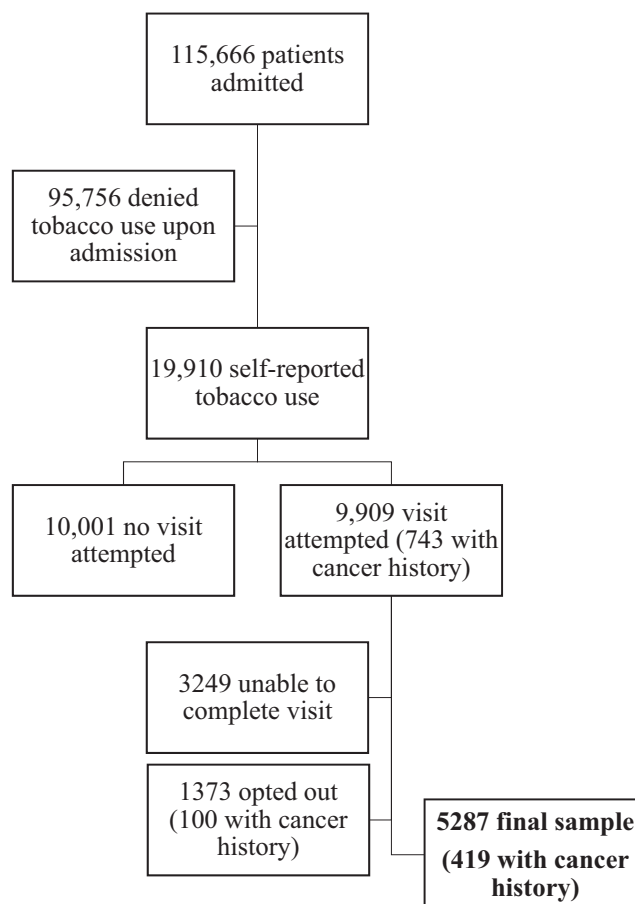


FIGURE 1 Flow chart of patient records reviewed. Visits were not attempted due to limitations of staff availability and/or patients discharged prior to visit attempt. Visits were unable to be completed due to patients being unavailable during the visit attempt.

2.3 | Analyses

Descriptive statistics were used to describe sample characteristics, including patient demographic information. Chi-squared analyses and *t*-tests were used to compare interview and follow-up responses between cancer and non-cancer groups. Follow-up analyses were completed with both the sample of completed follow-up responders as well as the full sample using an intent-to-treat (ITT) approach,²⁴ coding non-responders as smoking, as a sensitivity analysis. Research data originated from electronic health records and are not shared due to privacy restrictions.

3 | RESULTS

3.1 | Sample characteristics

A flow chart of patient records reviewed is shown in Figure 1. Of the 115,666 admitted patient medical records reviewed, 19,910 (17.2%) were self-reported tobacco use upon

admission. Of those, 9909 (49.8%) identified smokers were attempted to be visited by the TTP counselor, with 743 matched to a cancer diagnosis prior to admission using the National Cancer Center Registry database. Of all patients visited by the TTP, 100 (13.4%) patients with cancer diagnoses prior to admission and 1273 (13.9%) of patients without cancer opted out of the service. The remaining patients were unable to be counseled for a variety of reasons (e.g., not in the room, unresponsive).

Participant demographics and smoking information from the final sample ($N = 5287$) that completed the bedside interview and counseling are shown in Table 1. Of those, 419

(7.9%) were identified as having a cancer diagnosis prior to or during admission (leaving 4868 [92.1%] without). The most common cancer sites among patients identified included lung ($n = 90$), head/neck ($n = 56$), blood/bone ($n = 44$), brain ($n = 32$), and colorectal ($n = 27$). Generally, patients were middle-aged and represented the racial and ethnic demographics of South Carolina. A large majority (91.8%) were cigarette smokers, with nearly 75% of patients endorsing daily smoking/other product use, 43.2% endorsing high dependence, and reporting smoking between half to one pack of cigarettes per day, on average. Patients with a history of cancer were slightly older, but there were no significant

TABLE 1 Participant characteristics

Variable (<i>M</i> or <i>N</i> , <i>SD</i> or %)	Total sample (<i>N</i> = 5287)	Patients with cancer diagnosis (<i>N</i> = 419)	Patients without cancer diagnosis (<i>n</i> = 4868)	<i>p</i>
Age	45.32 (25.09)	48.95 (26.09)	45 (24.97)	0.002
Race/Ethnicity				
White	2819 (53.3%)	225 (53.7%)	2594 (53.3%)	0.525
Black/African American	1635 (30.9%)	117 (28.9%)	1518 (31.2%)	
Hispanic	67 (1.3%)	4 (<1%)	63 (1.3%)	
Asian	16 (<1%)	1 (<1%)	15 (<1%)	
Native American/Alaskan Native	22 (<1%)	4 (<1%)	18 (<1%)	
Other/Mixed	18 (<1%)	1 (<1%)	17 (<1%)	
Biological sex				
Male	2950 (55.8%)	247 (58.9%)	2703 (55.5%)	0.177
Female	2336 (44.2%)	172 (41.1%)	2164 (44.4%)	
Tobacco product use in past 30 days				
Cigarettes	4854 (91.8%)	390 (93.1%)	4464 (91.7%)	0.699
Cigars	299 (5.7%)	17 (4.1%)	282 (5.8%)	0.615
Pipe	3 (<1%)	0	3 (<1%)	n/a
Oral	113 (2.1%)	3 (<1%)	110 (2.3%)	0.083
E-cigarette	158 (3.0%)	15 (3.6%)	143 (2.9%)	0.595
Hookah	4 (<1%)	0	4 (<1%)	n/a
Bidis	0	0	0	n/a
Daily smoking	3950 (74.7%)	302 (72.1%)	3648 (75.0%)	0.212
Cigarettes per day	15.88 (11.29)	16.18 (11.85)	15.85 (11.24)	0.617
Time to smoke (dependence), min				
<5	2285 (43.2%)	183 (43.7%)	2102 (43.2%)	0.307
6–30	534 (10.1%)	43 (10.3%)	491 (10.1%)	
31–60	249 (4.7%)	18 (4.2%)	231 (4.7%)	
>60	440 (8.3%)	24 (5.7%)	416 (8.6%)	

Note: *N*s and percentages may not add up to 100 due to missing data. For the use of tobacco products, patients could endorse more than one response. *p*-values indicate results from chi-square tests or *t*-tests of each variable.

Abbreviation: SD, standard deviation.

differences between patients with and without cancer diagnoses on all other demographic or tobacco use variables. Results of age-adjusted analyses can be seen in the Table S1.

3.2 | Inpatient interview outcomes

Results are shown in Table 2. Patients with and without cancer diagnoses were compared on importance in quitting and confidence in quitting. Patients with cancer diagnoses reported higher importance of quitting smoking ($M = 3.92$ [standard deviation, $SD = 1.32$]) than those without a cancer diagnosis ($M = 3.77$, $SD = 1.36$; $t = 2.16$, $p = 0.031$). However, patients with and without cancer diagnoses did not differ in confidence in quitting smoking ($t = -0.31$, $p = 0.76$). In unadjusted analyses, patients without cancer made significantly more quit attempts in the past year ($M = 1.47$, $SD = 3.41$) than those with a cancer diagnosis ($M = 1.14$, $SD = 2.62$; $t = -2.36$, $p = 0.019$). However, when controlling for age, this effect was no longer significant.

When asked, 246/419 (58.7%) of patients with cancer diagnosis and 2992/4868 (61.5%) of patients without cancer diagnosis reported receiving medication in the hospital (mostly NRT); there was no significant difference between these groups ($\chi^2 = 1.23$, $p = 0.267$). The TTP clinician recommended discharge medication for more patients without a previous cancer diagnosis (2573/4868, 52.9%) than cancer patients (183/419, 43.7%; $\chi^2 = 13.03$, $p < 0.001$). However, a higher proportion of patients with cancer (75/419, 17.9%) were discharged with a completed medication order (signed off by the attending physician) compared to patients without cancer (649/4868, 13.3%; $\chi^2 = 6.81$, $p < 0.01$).

3.3 | Follow-up outcomes

Follow-up analyses are shown in Table 2, including adjusted sample sizes, ITT, and respondent-only results. Analyzing within an ITT framework coded all patients who did not complete the 30-day follow-up phone call. Cancer patients self-reported higher rates of abstinence (86/419, 20.5%) than those without a cancer diagnosis (502/4868, 10.3%; $\chi^2 = 45.75$, $p < 0.001$). Patients without a cancer diagnosis showed a higher proportion disinterested in quitting (4017/4868 82.5%) than those with a previous cancer diagnosis (292/419, 69.7%). When examining respondents only, a higher percent of patients with cancer diagnoses completed the follow-up survey than non-cancer patients ($\chi^2 = 33.29$, $p < 0.001$). Per self-report one month following discharge, patients with cancer diagnoses differed from those without cancer in smoking status ($\chi^2 = 17.84$, $p < 0.001$); a higher proportion of cancer patients (120/200, 60%) reported quitting than those without cancer (774/1773, 43%), and those

without cancer reported a higher proportion of disinterest in quitting (443/1773 [25%] vs. 32/200 [16%]).

4 | DISCUSSION

Results support the hypothesis that hospitalized patients with a cancer diagnosis reported higher rates of quitting smoking at follow-up than patients without a cancer diagnosis. However, there were no significant differences in confidence in quitting following discharge. Interestingly, patients with a cancer diagnosis reported fewer past-year quit attempts, although this effect was no longer significant when controlling for age. There were no significant differences between patients with and without cancer diagnoses on receiving smoking cessation medication in the hospital; however, patients with cancer were more likely to have pending medication suggestions completed by their physicians at discharge.

4.1 | Cancer and smoking cessation

In general, documentation of tobacco use and cessation within the cancer patient population has yielded inconsistent results. A review from 2003 estimated that 46%–75% of patients were smoking at the time of diagnosis, with 14%–58% continuing to smoke after treatment.²⁵ A more recently published study of intensive cessation support for patients demonstrated a 45% quit rate at 3 months.²⁶ However, in another study of an opt-out program where 730 cancer patients were automatically referred for phone-based smoking cessation support, patients reported a 20% quitting rate.²⁷ In the present study, patients with cancer history were more likely to have quit following the intervention; however, at the time of treatment, these patients declined services at the same rate as those without cancer history and also reported significantly fewer quit attempts in the past year. This suggests that, in general, patients with cancer may face similar challenges as those without cancer in deciding to quit smoking on their own. However, the effects of an intervention are somewhat stronger for those with a cancer history.

There are several possibilities with regard to why the study findings showed differences between patients with and without cancer diagnoses. First, a diagnosis of cancer may increase motivation for smoking cessation.²⁸ Indeed, the initial diagnosis of cancer may lead to spontaneous, unassisted quit attempts for cancer patients,²⁹ although this was not observed in the present sample based on the number of past-year quit attempts. Though diagnosis of cancer might increase motivation to quit smoking, patient factors such as perceived severity of the disease, perceived benefits of engaging in health behavior change, perceived barriers, and low self-efficacy for change can hinder smoking

TABLE 2 Results of interview and follow-up analyses

Variable (M, SD or n, %)	Patients with cancer diagnosis (N = 419)	Patients without cancer diagnosis (n = 4868)	t or χ^2 , p value
Interview during admission			
Importance to quit (1–5)	3.92 (1.32)	3.77 (1.36)	2.16, 0.031*
Confidence to maintain quit (1–5)	3.50 (1.35)	3.52 (1.32)	−0.31, 0.76
Number of past year quit attempts	1.14 (2.62)	1.47 (3.41)	−2.36, 0.019*
Received medication while inpatient	246 (58.7%)	2992 (61.4%)	1.23, 0.267
Recommended discharge medication	183 (43.7%)	2573 (52.9%)	13.03, <0.001**
Discharge medication order complete	75 (17.9%)	649 (13.3%)	6.81, <0.01*
30-Day follow-up			
Smoking status (ITT)			
Quit	86 (20.5%)	502 (10.3%)	47.55, <0.001**
Ready to quit	41 (9.8%)	349 (7.2%)	
Not ready to quit	292 (69.7%)	4017 (82.5%)	
Completed call	200 (47.7%)	1773 (35.7%)	33.29, <0.001**
Smoking status (responders)			
Quit	120 (60%)	774 (43%)	17.84, <0.001**
Ready to quit	48 (24%)	516 (29.1%)	
Not ready to quit	32 (16%)	443 (25%)	

Note: Smoking status (responders) shows outcomes as a result of the ratio of patients that completed the telephone call. Smoking status (ITT) shows outcomes with an ITT approach, wherein non-responders were coded as smoking and not ready to quit. Age-adjusted analyses can be seen in the Table S1.

Abbreviations: ITT, intent-to-treat; SD, standard deviation.

*Indicates significance at $p < 0.05$.; **Indicates significance at $p < 0.001$.

cessation efforts.³⁰ Collectively, these factors may contribute to different success rates for quitting among patients within a spectrum of diagnoses and prognoses.^{31–34} In the present study, recency of cancer diagnosis, treatment, or relatedness to hospital admission was not assessed. This allowed for a generalizable evaluation of cancer patients broadly. Future research could assess effects related to specifics of diagnosis, treatment, and temporal proximity on responses to interventions.

Second, hospitalized patients with a cancer history may have also been more receptive to and engaged in the intervention, and the results showing higher rates of follow-up completion support this. Interestingly, these patients were also more likely to have their discharge medications completed by their physician, which suggests higher provider engagement in tobacco treatment. Patients who were hospitalized without a cancer diagnosis may have found it more challenging to cultivate personal significance within the intervention, and

similarly, providers may not have prioritized tobacco treatment upon discharge.

The 60% self-reported quit rate observed from the current study is higher than expected, particularly given the relatively low-intensity support provided for cessation. Whereas these quit rates are encouraging, this could be in part be biased due to an expected 30% misreporting rate for tobacco use in cancer patients.³⁵⁻³⁸ There is also a possibility that patients who quit smoking were more likely to answer follow-up phone calls, and this is supported by the parallel high rate of quitting in patients without cancer (43%). Our ITT analysis (i.e., 20.5% vs. 10.3% abstinence) may be more accurate, while continuing to support the differences in cancer and non-cancer patient responses to treatment.

4.2 | Clinical implications

Although patients with cancer are motivated to quit smoking, they also experience unique barriers to quitting. The intervention discussed was more effective for patients with a cancer diagnosis than those without, which suggests that cancer patients may benefit from being approached multiple times about quitting smoking. That is, smoking cessation interventions should not be limited to encouraging quitting at the time of diagnosis or during the multitude of oncology appointments.³⁹ Our study suggests that hospitalizations that occur after the diagnosis, whether related to or unrelated to cancer itself, represent an important opportunity for intervention that likely capitalize on previous motivations.

For those who continued smoking after a cancer diagnosis, receiving intervention from a TTP clinician at a separate, likely unrelated, appointment (hospital admission) could have also provided extra support needed to engage with the patients about a meaningful plan to change their smoking behavior. Indeed, there may have been variations in counseling content between patients in the present study based on health history disclosure and connection to smoking cessation motivation. Providers need not be discouraged regarding the aforementioned data showing concerning rates of smoking following diagnosis; rather, providers should be encouraged to continue “planting the seed” at each opportunity for tobacco treatment interventions, as they likely build upon one another.

In the present sample, cancer patients were more likely to be given medication upon discharge, which also could have contributed to higher success rates. In general, providers may face several barriers to completing discharge medication requests for smoking cessation, such as the lack of time or misconceptions about the medications requested. It appears that a history of cancer diagnosis may be associated

with increased willingness and ability to complete these medication requests. This is, indeed, an area warranting further research and investigation, given the overall low rates of medication dispensing at discharge.

4.3 | Limitations

Several limitations must be considered within the present analysis. The present sample may not represent the full population of hospitalized smokers due to the lack of ability to visit every patient, time constraints, and other challenges upon admission, such as hesitancy to disclose tobacco use to medical staff. Likewise, overall follow-up rates were low and the reasons for these missing responses are unclear; thus, there are limitations to the ITT analyses used.⁴⁰ Additionally, biochemical verification was not used to confirm abstinence at follow-up.

Data collected during the TTP interviews are self-report and were subjected to time constraints placed on clinicians, who were mindful of other providers needing time with patients. This led to some participants with only partial interview data. Although patients with cancer reported statistically higher ratings of importance to quit, the means of ratings between groups were similar. Thus, the effect size should be interpreted with caution. Further, follow-up response rates were low. This is typical of such an intervention, and tobacco treatment programs are constantly considering ways to improve these systems. Nevertheless, the interpretation of the present analyses should be considered with missing data in mind. Finally, interview data should be interpreted with caution as the items used have not been psychometrically validated.

A low proportion of patients were identified as having a cancer diagnosis. Indeed, most cancer patients receive treatment outpatient and often do not require hospitalization, which limits the generalization of our results among all patients being treated for cancer. Similarly, other comorbid medical conditions not captured in the present study may have differed between groups. Future research could use more advanced propensity matching analyses to evaluate the extent of the effect of cancer diagnosis in the context of comprehensive medical histories. Further, the present sample of patients with cancer diagnoses may have, prior to hospitalization, been exposed to smoking cessation telephone counseling through the cancer hospital when being treated as an outpatient. However, these data are not available through patients' hospitalization records; therefore, we are unable to determine to what extent our cancer diagnosis sample received prior treatment. There was no overlap in treatments at the time of inpatient hospitalization. Along similar lines, past exposure to other smoking cessation counseling and treatment was not captured.

5 | CONCLUSION

The results of the present study suggest that patients with cancer diagnoses benefit from an intervention delivered during an inpatient hospitalization. Future interventions should capitalize upon this effect to tailor brief interventions for cancer patients, as well as to increase the salience of such interventions for the non-cancer populations. In addition, future research needs to work toward optimizing motivation for smoking cessation while admitted to a hospital and on improving quit rates for all admitted patients, regardless of diagnosis.

ETHICS STATEMENT

This study was exempt from participant consent and approved by the Medical University of South Carolina (MUSC) Institutional Review Board (IRB), which adheres to the U.S. Federal Policy for the Protection of Human Subjects.

DATA AVAILABILITY STATEMENT

Research data are originated from electronic health records and are not shared due to privacy restrictions.

CONFLICTS OF INTEREST

B.A.T. and K.M.C. are consultants to Pfizer on an Advisory Board on e-cigarettes and ways to improve smoking cessation delivery in health care settings. B.A.T. and K.M.C. testify on behalf of plaintiffs who have filed litigation against the tobacco industry.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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