

Research Report

Patterns of Smoking Cessation Strategies and Perception of E-cigarette Harm Among Bladder Cancer Survivors¹

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Received 5 November 2023

Accepted 14 January 2024

Pre-press 19 February 2024

Published 12 March 2024

Abstract.

BACKGROUND: Cigarette smoking is the leading preventable cause of bladder cancer (BC). Some proponents of e-cigarettes describe their use as a risk mitigation strategy despite potential carcinogen exposure and uncertain long-term risks.

OBJECTIVE: We assessed smoking cessation strategies, including e-cigarette use, and harm perception among patients with BC.

METHODS: We performed a cross-sectional study on a convenience sample of patients with BC at a single institution from August 2021 – October 2022. The survey instrument was sourced from the Cancer Patient Tobacco Use Questionnaire (C-TUQ) from the American Association for Cancer Research with standardized questions on tobacco use, cessation questions, and e-cigarette harm perceptions.

¹This study was presented at the International Bladder Cancer Network Meeting, September 28–30, 2023, Montreal, Canada.

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RESULTS: Of the 104 surveyed BC patients (mean age: 72 years; 27% female; 55% with muscle-invasive disease), 20% were current smokers (median pack years: 40) and 51% were former smokers (median pack years: 20). A minority (9%) had quit smoking at the time of diagnosis. Pharmacotherapy for smoking cessation included nicotine patches (25%), gum (21%), lozenges (8%), e-cigarettes (8%), and Varenicline/Bupropion (4%). Notably, 43% of patients who continued to smoke expressed willingness to switch to e-cigarettes as a cessation aid. E-cigarette users (11%) more commonly perceived e-cigarettes as non-harmful compared to former (4%) and non-smokers (4%) ($P = .048$), though all groups regarded e-cigarettes as equally addictive as traditional cigarettes.

CONCLUSIONS: Despite the prevalence of BC survivors who continue to smoke, a significant proportion perceive e-cigarettes as a viable and less harmful cessation aid. The infrequent use of FDA-approved pharmacotherapies underscores potential implementation gaps. These findings highlight the need for further research and targeted interventions in addressing smoking cessation among BC survivors.

Keywords: Bladder cancer, smoking, tobacco, e-cigarettes, harm

INTRODUCTION

Cigarette smoking is the leading modifiable risk factor for bladder cancer (BC), as the strong carcinogenic effect of tobacco smoking on the bladder urothelium increases the risk of BC three times relative to never smoking [1]. Continued smoking after the diagnosis of bladder cancer has oncologic and health-related quality-of-life implications for patients at all stages of treatment and survivorship. Patients who can quit smoking after diagnosis have a lower risk of bladder cancer recurrence, improved perioperative surgical outcomes, and better quality of life [2–4]. Current smokers are three times more likely to die of bladder cancer than former smokers and quitting can be considered one of the most effective available means of improving bladder cancer outcomes [4]. Despite this well-established risk factor, 76% of BC patients who are active smokers at the time of bladder cancer diagnosis report smoking sometime after diagnosis, with more than half continuing to smoke regularly after diagnosis, highlighting the need for a better understanding of cessation strategies [5].

Evidenced-based smoking cessation strategies in national guidelines include intensive behavioral interventions and FDA-approved pharmacotherapies such as nicotine replacement therapy (NRT), bupropion, and varenicline [6]. However, abrupt cessation of smoking without psycho- or pharmacotherapy (quitting “cold turkey”) is the most commonly reported method to quit smoking among BC survivors, (up to 66%), followed by NRT and self-help material, which appears discordant with cessation guidelines [7–9]. More than three-quarters of active smokers report attempting to quit smoking, but only 56% of patients are successful [10]. The high prevalence

of unsuccessful smoking cessation following cancer diagnosis highlights the importance of effective smoking cessation strategies in BC patients.

Electronic cigarettes (e-cigarettes) have recently grown in popularity as a potential tool for smoking cessation; however, e-cigarette use as a risk reduction strategy to promote cessation in BC patients is also controversial due to vaping-related urinary carcinogens and uncertain long-term health risks [11, 12]. Harm perception plays a direct role in influencing a patient’s behavior on using e-cigarettes, where those individuals who perceive e-cigarettes as less harmful may lead to experimentation, continuation, and regular use, along with the use as a cessation aid [13, 14]. However, a paucity of data exists on understanding BC survivor’s perception of e-cigarette harm.

The primary purpose of this cross-sectional study was to assess smoking cessation strategies among BC survivors who smoke. As a secondary aim, we assessed perceptions of harm related to e-cigarette use.

METHODS

Patient identification and data collection

A cross-sectional study was performed using a survey that was administered to a convenience sample of patients treated for BC. Subjects were English-speaking adults older than 18 years of age seen by a multidisciplinary team of medical, radiation, and urologic oncologists at a tertiary care academic center between August 2021 and October 2022. The study focused on gathering self-reported data through a survey administered via an iPad, and the information was subsequently recorded in the Research Electronic Data Capture (REDCap) system.

Participants were provided with iPads loaded with the electronic survey application. The self-administered survey was completed by the participants at their convenience, ensuring privacy and comfort. Research staff were available to assist participants with any technical difficulties or clarification needs. This study was approved by our institutional IRB (#21-1747). Informed consent was obtained.

Survey instrument

The survey instrument was sourced from questions included in the American Association for Cancer Research Cancer Patient Tobacco Use Assessment Task Force – Cancer Patient Tobacco Use Questionnaire (C-TUQ). This questionnaire included a comprehensive set of standardized questions assessing tobacco use and cessation [15]. The survey asks cancer survivors about their tobacco use through a self-administered questionnaire. Questionnaire domains include cigarette and other tobacco use status, intensity, and past use; use relative to cancer diagnosis and treatment; cessation approaches and history.

Questions related to perceptions of harm related to e-cigarette use were sourced from the Health Information National Trends Survey (HINTS) which has been used to report population-weighted harm perception of e-cigarettes compared to combustible cigarettes [16]. The HINTS collects nationally representative data routinely about the American public’s use of cancer-related information. The survey asked “How *harmful* are E-cigarettes compared to traditional cigarettes? ... A) More harmful, B), Just as harmful, C), Less harmful. How *addictive* are E-cigarettes compared to traditional cigarettes? ... A) More addictive, B), Just as addictive, C), Less addictive.”

Willingness to consider e-cigarette use as a smoking cessation aid was captured by the questions: “Are E-cigarettes a good alternative to smoking traditional cigarettes? Would you be willing to switch to E-Cigarettes to attempt to quit or mitigate the use of traditional cigarettes?”.

Statistical analysis

Patient demographic characteristics, diagnostic and treatment modalities, and smoking history were summarized using descriptive statistics. Perceptions of harm from e-cigarette use were stratified by smoking status and compared using Fischer’s exact test.

An alpha of 0.05 was used to define statistical significance.

RESULTS

A total of 104 survey respondents completed the survey and were included in the analysis. The majority of subjects were male (73.1%), identified as white (86.5%), and were insured by Medicare (59.6%). Additional demographic characteristics are shown in Table 1. The majority of patients had muscle invasive disease (55%), followed by non-muscle invasive disease (31%). Respondents were given the option to report all prior treatment modalities received. Of these, the most common treatments were transurethral resection of bladder tumor (TURBT, 66%), intravesical Bacillus Calmette–Guérin (BCG) therapy (31%), and systemic chemotherapy (26%).

Twenty-six percent ($n=27$) of respondents reported no prior or current history of smoking, 51% ($n=53$) were former smokers with a median smoking duration of 20 years, and 20% ($n=21$) were

Table 1
Patient demographics and characteristics ($n=104$)

Age	Value	
Median (range)	72 (49–90)	
Interquartile range	13	
Sex	N	Percent
Male	76	73
Female	28	27
Race		
White	90	87
Black or African American	10	10
Hispanic	2	2
American Indian or Alaska Native	2	2
Insurance Status		
Private	28	27
Medicare	62	60
Medicaid	6	6
Veterans Affairs	2	2
Uninsured	2	2
Other	4	4
Bladder Cancer Diagnosis		
Muscle Invasive	58	55
Non-Muscle Invasive	33	31
Metastatic	4	4
Unsure	8	8
Other	2	2
Bladder Cancer Treatment		
TURBT	69	66
BCG	35	31
Chemotherapy	27	26
Radiation	7	7
Immunotherapy	8	7
Radical Cystectomy	9	9
Other	13	13

Table 2
Use of smoking cessation aids (n = 21 current smokers)

Smoking Cessation Aid	N	%
Nicotine patch	6	25
Nicotine gum	5	21
Nicotine lozenge	2	8
Nicotine inhaler	0	0
Nicotine nasal spray	0	0
Bupropion (Zyban)	1	4
Varenicline (Chantix)	0	0
E-cigarettes or other electronic nicotine delivery systems	2	8

current smokers with a median smoking duration of 40 years. 9% of respondents who smoked at the time of their BC diagnosis reported subsequent smoking cessation.

Smoking cessation strategies employed by current BC survivors who smoke are shown in Table 2. Nicotine patches and gum were the most frequently used smoking cessation aids (25% and 21% respectively), while e-cigarettes and similar electronic devices were used by 8%. Pharmacotherapy, either Bupropion or Varenicline, was infrequently used (4% and 0%, respectively).

Perceptions of the harmfulness and addictiveness of electronic cigarettes are summarized in Table 3. Current smokers (81%) were significantly less likely to perceive e-cigarettes as harmful to health compared to former smokers (96%) or never smokers (96%, $p=0.048$). The majority of never smokers (59%) and former smokers (60%) perceived e-cigarettes as just as harmful as traditional cigarettes, compared to

roughly equal proportions of current smokers who considered e-cigarettes as just as harmful (43%) or less harmful (38%) than traditional cigarettes ($p=0.36$). The majority of respondents in all three groups perceived e-cigarettes as addictive (100%, 96%, 91%, respectively, $p=0.5$). The majority of never smokers (78%), former smokers (68%), and current smokers (62%) also viewed e-cigarettes as just as addictive as traditional cigarettes ($p=0.34$).

Perceptions of e-cigarettes as an alternative to smoking traditional cigarettes are summarized in Table 4. Despite the majority of never smokers (52%) and former smokers (55%) perceiving e-cigarettes as “definitely not” a good alternative to traditional cigarettes, there was no statistically significant difference compared to 24% of current smokers ($p=0.32$). However, the magnitude of this difference is substantial and the insignificant statistical test may be explained, in part, by the small numbers in these subgroups. Among current smokers, 43% expressed a definitive or possible willingness to switch to e-cigarettes as a smoking cessation aid. The median age of those willing to switch to e-cigarettes was 64 years, slightly younger than the median age of the study cohort (72 years).

DISCUSSION

Our primary study aim was to assess smoking cessation strategies among BC survivors. Among the current smokers surveyed, respondents infrequently reported the use of FDA-approved cessation aids,

Table 3
E-cigarette harms, perceptions, and addiction by smoking status (n = 101)

	Never Smoker (n = 27)	Former Smoker (n = 53)	Current Smoker (n = 21)	P-value
Are E-cigarettes harmful to health?				
Yes	26	51	17	0.048
No	1	2	4	
Are E-cigarettes addictive?				
Yes	27	51	19	0.5
No	0	2	2	
How harmful are E-cigarettes compared to traditional cigarettes?				
Less harmful	4	12	8	0.36
Just as harmful	16	32	9	
More harmful	7	9	4	
How addictive are E-cigarettes compared to traditional cigarettes?				
Less addictive	0	7	5	0.34
Just as addictive	21	36	13	
More addictive	6	10	3	

Table 4
Willingness to use E-cigarettes as a smoking cessation aid (n = 101)

Are E-cigarettes a good alternative to smoking traditional cigarettes?	Never Smoker (n = 27)	Former Smoker (n = 53)	Current Smoker (n = 21)	P-value
Definitely not	14	29	5	0.32
Probably not	8	13	9	
Might or might not	2	7	4	
Probably yes	3	3	1	
Definitely yes	0	1	2	
Would you be willing to switch to E-Cigarettes in order to attempt to quit or mitigate the use of traditional cigarettes?	Never Smoker (n = 27)	Former Smoker (n = 53)	Current Smoker (n = 21)	P-value
Yes	N/A	1	6	N/A
Maybe	N/A	1	3	
No	N/A	2	12	
I do not use either product	27	47	N/A	

with nicotine patches being the most commonly reported at 25%, 8% reported e-cigarette use, and none had used Varenicline. Only 9% of BC patients who smoked in our study reported that they quit at the time of receiving their bladder cancer diagnosis. Surprisingly, we found that the use of pharmacotherapy, specifically varenicline (0%) and bupropion (4%), was very low. National guidelines regarding smoking cessation for cancer patients recommend a combination of NRT in the form of a nicotine patch with a short-acting NRT such as lozenge, gum, or inhaler, plus varenicline as first line treatment [17]. As a second line, the guidelines endorse either varenicline or bupropion with a single NRT. The low use of varenicline or bupropion in our study highlights an opportunity for improvement in bladder cancer care. Prior studies have shown urologists are infrequently comfortable with prescribing NRT and seldom offer smoking cessation counseling [18, 19]. Several approaches for urologist engagement have been proposed including addressing established barriers to smoking cessation counseling with multilevel implementation strategies to promote tobacco treatment [19, 20].

The smoking cessation rate among our BC patients at the time of diagnosis is lower than the quit rates reported in other studies, which range from 8% to 48% [5, 21–26]. While the lower quit rate in our study may be a result of sample size or participant recall bias, it is also worth noting that several of the other studies included follow-up periods ranging from one to four years post-diagnosis to monitor disease progression and abstinence from smoking [23–26]. Since our study was cross-sectional rather than longitudinal, it is possible that some respondents with a recent diagnosis had not yet had an opportunity to engage in smoking cessation interventions at the time of

completing the survey. The time surrounding the initial diagnosis represents a valuable opportunity for the urologist to connect patients with smoking cessation resources, especially given the many known health risks of continued tobacco use, including the development of additional primary malignancies.

In two large studies examining e-cigarette use among BC patients, overall e-cigarette use was similarly low (4.4–9%); however, when stratifying by smoking status, the proportion of current smokers who had used e-cigarettes was notably greater than in our study (19.8–42%) [27, 28]. These results may reflect differential awareness of and access to e-cigarettes based on demographic, socioeconomic, or geographic factors. For instance, a prior study found that subjects younger than 65 years of age were three times as likely to use e-cigarettes as those in the 75–84 year age group, and those living in the least affluent areas were more than twice as likely compared to those living in the most affluent areas [27].

As a secondary study aim, we sought to examine perceptions of harm related to e-cigarette use among BC survivors as previous research has demonstrated that perception of risk plays a critical role in decisions to use tobacco. We found that BC patients who currently smoke commonly perceived e-cigarettes to be harmful to health, comparable to BC patients who formerly smoked and never smoked (81%, 96%, and 96%, respectively). The rates for all three groups, however, are still greater than those of similar cross-sectional surveys (35.6–40.1%) [14, 29]. Additionally, the majority of never smokers (59%) and former smokers (60%) in our study perceived e-cigarettes as just as harmful as traditional cigarettes, similar to current smokers (43%). While a 2015 study did not find a significant difference in this belief based on smoking status [29], a more recent survey

from 2021 revealed that a majority of respondents (70%) viewed e-cigarettes as harmful as traditional cigarettes, with non-smokers sharing this stance more often than smokers (72.4% vs. 61.7%, $P=0.01$) [30].

E-cigarette harm perception can significantly influence the behavior and decision-making processes of bladder cancer patients. These patients may be more inclined to adopt e-cigarettes as smoking cessation aids, assuming they pose a lower risk. However, this perception could lead to continued nicotine addiction or even prolonged exposure to harmful substances present in e-cigarette aerosols. Additionally, misinformation about the reduced harm of e-cigarettes might deter bladder cancer patients from seeking traditional smoking cessation treatments, potentially hindering their overall health outcomes. Taken together, these findings may reflect a growing awareness of the potential dangers of e-cigarette use, as suggested by one report demonstrating that an increasing fraction of US adults perceive e-cigarettes as more harmful than traditional cigarettes (6.8% in 2018, 12.8% in 2019, and 28.3% in 2020) [14]. As the popularity of e-cigarettes continues to grow, it is imperative to investigate the impact of harm perception on bladder cancer patients, ensuring they receive accurate information to make informed decisions about their health and well-being.

Of the subjects in our study who were current smokers, almost half (43%) reported that they would consider switching to e-cigarettes as a smoking cessation aid. Official guidance, however, remains mixed. In 2019, the American Cancer Society released a position statement against the use of e-cigarettes for smoking cessation, citing the lack of an FDA-approved product that has shown to be safe and effective for this use, in addition to warning of the health risks of e-cigarette use itself, such as nicotine addiction [31]. In the United Kingdom, however, experts have taken a harm reduction approach, acknowledging that while the long-term effects of e-cigarette use are unknown, the absence of tobacco makes them a safer alternative to traditional cigarettes, whose adverse effects are well-documented. Additionally, Cancer Research UK cautions against the use of e-cigarettes by youth and non-smokers, while also calling for further regulations to limit the use of these products to those quitting tobacco [32]. Several studies have shown that the majority of patients who adopt e-cigarette use to quit smoking continue to smoke some combustible cigarettes leading to dual use, rather than e-cigarette-only use [33]. Despite these differing views, all

the aforementioned societies advocate for ongoing research of e-cigarettes as a smoking cessation intervention [31, 32, 34].

Existing randomized controlled trials, systematic reviews, and meta-analyses have yielded conflicting results on the utility of e-cigarettes for smoking cessation [35–38]. Two randomized controlled trials comparing nicotine and non-nicotine e-cigarettes found similar rates of abstinence from tobacco use (ranging from 4.1% to 10.7% at various time points) with few adverse effects [39, 40]. Another study comparing second-generation nicotine-containing e-cigarettes to nicotine replacement therapy found a much higher one-year tobacco abstinence rate in the e-cigarette group (18.0% vs. 9.9%). However, the authors acknowledge that the lack of participant blinding may have influenced the perceived benefit [41]. A recent Cochrane review suggested e-cigarettes only work as a cessation aid in the setting of a randomized controlled trial as most become dual users in the real world setting [36]. Additionally, a recent meta-analysis has advocated that e-cigarettes should not be approved as consumer products but may warrant consideration as a prescription therapy (similar to prescription-only nicotine inhalers) [38]. Given a lack of universal agreement on the role of e-cigarette use in smoking cessation, both BC patients and providers should be aware that the long-term health consequences of e-cigarette use remain unknown.

Our study findings should be interpreted in the context of several limitations. As responses were self-reported, there is a potential risk of participant recall bias. Additionally, medical records were not accessed for this study, so respondents' medical histories including cancer pathology and treatment could not be verified. Our study sample size is relatively small, which might limit the generalizability of the findings. A larger, more diverse sample could provide a more comprehensive understanding of smoking cessation strategies and e-cigarette perceptions among bladder cancer survivors. Finally, the cross-sectional nature of our study inherently limited the collection of follow-up data, longitudinal data could offer insights into changes in smoking patterns and perceptions over time, providing a more nuanced understanding.

Our study also has several strengths. As one of only a few studies using patient-reported data on smoking behaviors and perceptions of e-cigarette use in individuals with bladder cancer, this study adds to the body of knowledge when caring for this population. Specifically, the large proportion of respondents

who viewed e-cigarettes as harmful compared to prior studies suggests a growing concern over the health risks of these products. Additionally, the use of e-cigarettes and FDA-approved smoking cessation therapies, as well as the low rate of quitting upon diagnosis, represent an area for ongoing improvement. Furthermore, given the unclear role of e-cigarettes for smoking cessation from prior studies, future investigations should explore the risks and benefits of such products for this purpose.

Several future potential areas of research arise from our work including conducting longitudinal studies to explore the relationship between e-cigarette use and specific outcomes in bladder cancer patients, including disease progression, recurrence rates, and overall survival. This can provide a more nuanced understanding of the potential harms associated with e-cigarette use in this population. Additionally, future studies may benefit from further investigation into the role of e-cigarettes as potential smoking cessation aids for bladder cancer survivors with a focus on examining the effectiveness, safety, and long-term outcomes associated with e-cigarette use in the context of quitting smoking among individuals with a history of bladder cancer.

CONCLUSIONS

Our study provides evidence of a possible growing concern over the harms of e-cigarette use among patients with bladder cancer. Additionally, FDA-approved pharmacotherapies are infrequently used as a smoking cessation aid, with only 9% of respondents who smoked quitting at the time of bladder cancer diagnosis. These findings underscore the need for more intensive smoking cessation treatment as a component of BC care. Additional research should explore the role of e-cigarettes in smoking cessation for BC survivors.

ACKNOWLEDGMENTS

The authors have no acknowledgments.

FUNDING

RSM is supported by NCI # K08 CA259452 and MSK Core Grant # P30 CA008748.

AUTHOR CONTRIBUTIONS

Conception; JC, WB, WB, RSM, MAB.

Performance of work; or interpretation of data; JC, SS, WB, WB, KW, RSM, AOG, KAM, MAB, HK.

Writing the article; JC, SS, RSM, AOG, KAM, MAB, HK.

All authors had access to the data.

CONFLICT OF INTEREST

JC, SS, WB, WB, KW, RSM, HK, AOG, KAM and MAB have no conflict of interest to report.

DATA AVAILABILITY

The data are not publicly available due to privacy or ethical restrictions.

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