Original Article

Electronic Cigarette Use Among Patients With Cancer

Characteristics of Electronic Cigarette Users and Their Smoking Cessation Outcomes

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BACKGROUND: Given that continued smoking after a cancer diagnosis increases the risk of adverse health outcomes, patients with cancer are strongly advised to quit. Despite a current lack of evidence regarding their safety and effectiveness as a cessation tool, electronic cigarettes (E-cigarettes) are becoming increasingly popular. To guide oncologists' communication with their patients about E-cigarette use, this article provides what to the authors' knowledge is the first published clinical data regarding E-cigarette use and cessation outcomes among patients with cancer. **METHODS:** A total of 1074 participants included smokers (patients with cancer) who recently enrolled in a tobacco treatment program at a comprehensive cancer center. Standard demographic, tobacco use history, and follow-up cessation outcomes were assessed. **RESULTS:** A 3-fold increase in E-cigarette use was observed from 2012 to 2013 (10.6% vs 38.5%). E-cigarette users were more nicotine dependent than nonusers, had more prior quit attempts, and were more likely to be diagnosed with thoracic and head or neck cancers. Using a complete case analysis, E-cigarette users were as likely to be smoking at the time of follow-up as nonusers (odds ratio, 1.0; 95% confidence interval, 0.5-1.7). Using an intention-to-treat analysis, E-cigarette users were twice as likely to be smoking at the time of follow-up as nonusers (odds ratio, 2.0; 95% confidence interval, 1.2-3.3). **CONCLUSIONS:** The high rate of E-cigarette use observed is consistent with recent articles highlighting increased E-cigarette use in the general population. The current longitudinal findings raise doubts concerning the usefulness of E-cigarettes for facilitating smoking cessation among patients with cancer. Further research is needed to evaluate the safety and efficacy of E-cigarettes as a cessation treatment for patients with cancer. ***Cancer* 2014;000:000-000.** © *2014 American Cancer Society.*

KEYWORDS: smoking cessation, tobacco, cancer, electronic cigarettes (E-cigarettes).

INTRODUCTION

Continued smoking after a cancer diagnosis increases the risk of adverse health outcomes, including treatment-related complications, disease recurrence, poor quality of life, second primary cancers, and mortality.[1-4] As a result of these known risks, leading oncology professional organizations have recommended that all patients with cancer should be asked about their smoking status, advised to quit, and assisted with smoking cessation.[5-8] Nonetheless, approximately two-thirds of adult cancer survivors who were smoking at the time of their cancer diagnosis continue to smoke after diagnosis.[9] The prevalence of continued smoking and the growing awareness of the importance of integrating smoking cessation into routine cancer care have prompted the American Society of Clinical Oncology to launch a campaign for oncologists to deliver evidence-based tobacco treatment consistent with the 2008 US Department of Health and Human Services clinical practice guideline for the treatment of tobacco use and dependence.[8,10] Several patient-level, provider-level, and systems-level barriers must be addressed to ensure that best practices for treating tobacco dependence are implemented in routine cancer care.[11-13]

Identified as a "disruptive technology" in the tobacco control field,[14] there is much current debate on whether electronic cigarettes (E-cigarettes) will facilitate or impede smoking cessation and the reduction of known hazards of traditional cigarettes and other combustible tobacco products.[15,16] Clinical anecdotes suggest that the increased popularity of E-cigarettes has prompted uncertainty within oncology and other medical specialties regarding how to best advise patients about the safety and efficacy of E-cigarettes as a cessation tool. E-cigarettes are battery-powered devices that mimic the

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We thank Maureen O'Brien, CNS, CTTS, Will Wikle, NP, CTTS, and Suhana de Leon-Sanchez, NP, CTTS, the Tobacco Treatment Specialists, and Dionne Birkbeck, Clinic Coordinator of the Memorial Sloan-Kettering Tobacco Cessation Program and Lou-Anne David for her assistance with article preparation.

See editorial on pages 000-000, this issue.

DOI: 10.1002/cncr.28811, **Received:** February 27, 2014; **Revised:** April 1, 2014; **Accepted:** April 2, 2014, **Published online** September 22, 2014 in Wiley Online Library (wileyonlinelibrary.com)

hand-to-mouth sensory experience of smoking and typically deliver nicotine to the user. E-cigarettes have gained rapid popularity since 2007 when they were first introduced into the US marketplace.[17] Although the US Food and Drug Administration (FDA) does not currently have the authority to regulate e-cigarettes, they have stated in the Federal Register their intent to extend their authority to include e-cigarettes as well as all other tobacco products. With limited data to guide E-cigarette regulation, establishing public health policy has been vexing for tobacco control. Despite limited available data regarding E-cigarette safety,[15] adult ever-use nearly quadrupled from 2010 to 2012, with 10.6% of all adults in the United States and 44.6% of current smokers reporting having ever used E-cigarettes.[18]

Cigarette smokers report using E-cigarettes to manage nicotine cravings and withdrawal symptoms, to reduce daily smoking consumption, and to quit smoking or avoid relapsing.[19] E-cigarette users report perceptions that E-cigarettes are less harmful than traditional cigarettes.[19] There are also a growing number of dual tobacco users who supplement combustible (traditional) cigarettes cigarette smoking with E-cigarettes in environments in which traditional combustible smoking is prohibited.[20] Many smokers report using E-cigarettes to help them quit using combustible cigarettes and smokers with strong intentions to quit are significantly more likely to have ever used E-cigarettes than those with no intentions of quitting.[21,22] Vickerman et al found that 31% of a total of 2758 quitline callers had tried E-cigarettes, and of those 52% reported using E-cigarettes to help them quit smoking combustible cigarettes.[23]

Although smokers report expectations that E-cigarettes facilitate cessation, there is currently a lack of adequate evidence that the use of E-cigarettes actually helps smokers cut down or quit smoking. Two recent clinical trials, one conducted in New Zealand[24] and the other conducted in Italy,[25] have examined the potential usefulness of E-cigarettes in helping smokers quit. Based on a relatively small sample, Bullen et al demonstrated that E-cigarettes were about as useful as the nicotine patch in helping individuals quit smoking.[24] Caponnetto et al demonstrated that E-cigarettes may be useful in helping smokers to reduce the number of cigarettes per day, but the study results are not definitive.[25]

At the time of this publication, E-cigarettes are not approved by the FDA for use as a cessation treatment in the United States. In the absence of adequate clinical data regarding the safety and efficacy of E-cigarettes, the Tobacco Control and Smoking Cessation Committee of the International Association for the Study of Lung Cancer has recently published a policy statement counseling physicians against recommending the use of E-cigarettes among patients with cancer who are advised to quit.[26]

To guide oncologists' communication with smokers regarding E-cigarettes, the current study was intended to provide much-needed data regarding E-cigarette use among patients with cancer. The specific objectives were: 1) to identify the prevalence of E-cigarette use among smokers referred to an on-site tobacco treatment program at a comprehensive cancer center; 2) to examine recent temporal trends in E-cigarette use; 3) to identify the characteristics of E-cigarette users and compare these characteristics with those of non–E-cigarette users, and 4) to examine whether E-cigarette use is associated with smoking cessation outcomes.

MATERIALS AND METHODS

Participants

All patients who presented for cancer treatment at Memorial Sloan Kettering Cancer Center (MSKCC) from January 2012 to December 2013 were screened and identified as current smokers. Referrals are made to the Tobacco Cessation Program (TCP) from all oncology clinics and those patients who completed a TCP intake assessment were the focus of this investigation. Figure 1 presents patient flow from patient referral to the TCP through program intake and outcomes assessment.

Procedures

This study was approved by the Institutional Review Board at MSKCC. As a standard of care, all new MSKCC patients are screened for current smoking status and asked whether they have smoked cigarettes or used other tobacco products within the past 30 days. Current smoking status is documented in the electronic medical record. Patients who report any tobacco use within the past 30 days are systematically referred to the MSKCC TCP. TCP staff make up to 3 attempts to contact referrals either by telephone or at bedside for hospitalized patients. Multicomponent, evidence-based behavioral and pharmacologic treatment for tobacco dependence is provided. Patients who accept tobacco treatment are offered up to 5 sessions of individual telephone or in-person behavioral counseling with one of MSKCC's Certified Tobacco Treatment Specialists (CTTS), designated oncology nurses, and nurse practitioners who have undergone specialized training and met requirements for certification as a tobacco treatment specialist (attudaccred.org/). An intake assessment is completed and an evidence-based tobacco dependence treatment plan including behavior modification and cessation medication recommended by the

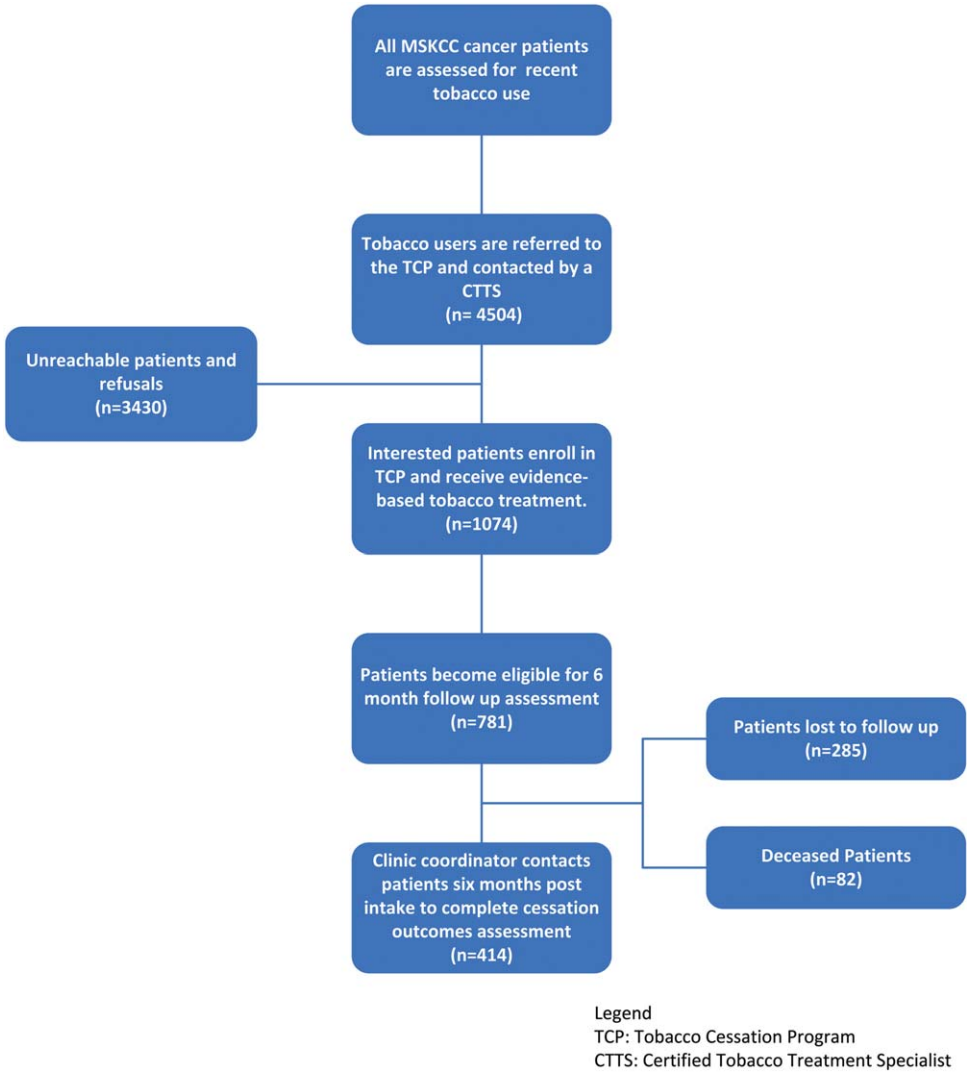

Figure 1. Patient flow is shown from patient referral to the Tobacco Cessation Program (TCP) through program intake and outcomes assessment. MSKCC indicates Memorial Sloan-Kettering Cancer Center; CTTS, Certified Tobacco Treatment Specialists.

clinical practice guidelines for treating tobacco use and dependence[10] are developed in coordination with the patients' cancer treatment team. Approximately 6 to 12 months after each patient enrolls in the TCP, tobacco cessation outcomes data are collected by a Clinic Coordinator.

Measures

The intake assessment includes standard demographic characteristics, tobacco use history (including E-cigarette use), and clinical characteristics as well as the following measures.

Assessment of E-cigarette use

Current E-cigarette use was assessed at the intake for all newly referred patients. Patients were asked if they had used E-cigarettes within the past 30 days, with the response options being yes or no. For the sake of brevity, henceforth we call this variable "E-cigarette use" with the understanding that it was assessed at enrollment for the past 30 days.[3]

Fagerstrom Test for Nicotine Dependence

Nicotine dependence was assessed using the Fagerstrom Test for Nicotine Dependence (FTND),[27] a 6-item scale with scores ranging from 0 to 10, with scores of 0 to 4 coded as indicating lower nicotine dependence and scores of ≥ 5[27] indicating higher nicotine dependence.

Cessation outcome

At approximately 6 to 12 months after the initial intake, a trained Clinical Coordinator made up to 3 attempts to

contact patients by telephone to collect smoking cessation outcomes. Patients were asked if they had smoked even a puff of a (traditional) cigarette within the last 7 days. Patients answering yes were then asked how many cigarettes per day they currently smoked. Patients were also asked "Since (date of intake assessment) have you gone at least 24 hours without a cigarette?" No biochemical verification of smoking cessation was obtained.

Data Analysis

Data were first described graphically and by descriptive statistics. Abstinence rates were calculated with 2 methods for handling missing data: 1) a modified intent-to-treat (ITT) analysis, assuming all participants lost to follow-up were smoking; and 2) complete case analysis (CCA), in which participants lost to follow-up were eliminated from the analysis.[28,29] Consistent with recommendations for handling missing data when reporting cessation outcomes,[30,31] we report both ITT and CCA results because they represent, respectively, the full range of conservative and liberal interpretations of smoking abstinence outcomes. We used the chi-square statistic to examine associations between E-cigarette use reported at intake and putative baseline contributors (eg, sex, education level, and cancer diagnosis). Continuous variables assessed at intake and outcome (eg, age, FTND score, and average number of cigarettes smoked per day) were evaluated using independent-sample Student *t* tests between E-cigarette users and nonusers. We also analyzed the influence of E-cigarette use at intake on tobacco abstinence assessed at 6 months to 12 months of follow-up in a logistic regression model. The logistic regression model also included participant characteristics that had a statistically discernible contribution to E-cigarette use, as shown in the chi-square statistics and Student *t* tests. For example, nicotine dependence, quitting history, and cancer diagnosis were included in the model. To minimize the impact of multicollinearity in model predictors, variables that were highly correlated with each other were excluded from the model (eg, nicotine dependence and average number of cigarettes smoked per day). The logistic regression was intended to examine whether E-cigarette use, as well as additional contributing factors of E-cigarette use, were associated with follow-up smoking abstinence outcomes. Analyses were performed using PASW statistical software (version 18; SPSS Inc, Chicago, Ill).

RESULTS

Patient Characteristics

From January 1, 2012 to December 31, 2013, the MSKCC TCP received 4504 referrals; 1074 of these patients accepted the referral, enrolled, and completed a clinical intake assessment. Table I presents patient characteristics.

Approximately one-half of the patients who completed an intake in 2012 and 2013 (n = 1074) were female (56.5%; n = 607), and 43.5% (n = 467) were male. The mean age was 56 years (standard deviation [SD], ± 11.6 years) (range, 18 years-87 years). The majority of patients were high school graduates (41.7%; n = 257) or college graduates (32.4%; n = 200). The majority of patients had tried quitting at least twice before entering the program (69.2%; n = 698). The mean FTND score was 3.7 (SD, ± 2.7) (range, 0-10). Approximately one-third of the patients reported high nicotine dependence, as evidenced by FTND scores ≥ 5 (37.2%; n = 371). At intake, the average number of cigarettes per day was 13.0 (SD, ± 9.4) (range, 0 cigarettes per day −50 cigarettes per day). The highest percentage of patients were diagnosed with thoracic cancer (19.8%; n = 210), breast cancer (14.9%; n = 158), head and neck cancers (9.7%; n = 103), or genitourinary cancers (8%; n = 85). Very few patients reported recent use of cigars (1.6%), and < 1% reported recent use of a pipe, snuff, or chewing tobacco.

Excluding deceased patients (n = 82), smoking cessation outcomes were collected from 414 (59.5%) of the subsample of 699 participants who were eligible for the follow-up assessment at the close of the study period (December 31, 2013). We examined potential correlates of loss to follow-up and found no differences in terms of age, sex, prior quit attempts, longest lifetime period of abstinence, nicotine dependence, or cancer diagnosis. A significantly higher percentage of E-cigarette users dropped out of tobacco treatment and were lost to follow-up than non–E-cigarette users (66.3% vs 32.4%; $P < 0.01$). Smoking cessation outcomes were collected on average approximately 10 months from the date of intake (mean, 291.9 days; SD, 86.5 days). There was no significant difference in smoking cessation outcome noted based on time to follow-up data collection.

Prevalence and temporal pattern of E-cigarette use

At the time of enrollment, approximately one-fourth (26.5%; n = 285) of the total sample reported that they had used E-cigarettes within the past 30 days. The majority of E-cigarette users (92%) reported dual use of combustible (traditional) cigarettes. To examine how the percentage of E-cigarette use changed over time, Figure 2 depicts changes in percentages per quarter, using all

TABLE I. Prevalence of E-Cigarette Use at Intake by Patient Characteristics (n=1074)

	Total (n = 1074)	E-Cigarette Use (n = 285)[a]	No E-Cigarette Use (n = 789)	*P*[b]
Sex	607 (56)	172 (60)	435 (55)	-
Female				
Education level				
7-11th grade	21 (3)	8 (4)	13 (3)	-
High school graduate	257 (42)	86 (43)	171 (41)	
Partial college	101 (17)	32 (16)	69 (17)	
College graduate	200 (32)	65 (32)	135 (32)	
Graduate degree/professional training	38 (6)	9 (4)	29 (7)	
No. of past quit attempts				.012
Never or 1 time	311 (31)	60 (24)	251 (33)	
≥2 times	698 (69)	195 (76)	503 (67)	
Cancer diagnosis				-
Breast	158 (15)	37 (13)	121 (16)	
Colorectal	64 (6)	20 (7)	44 (6)	
Genitourinary	85 (8)	25 (9)	60 (8)	
Gynecological	59 (6)	16 (6)	43 (6)	
Head and neck	103 (10)	35 (12)	68 (9)	
Hepatobiliary	65 (6)	16 (6)	49 (6)	
Thoracic	210 (20)	67 (24)	143 (18)	
Urology	55 (5)	10 (4)	45 (6)	
Other	264 (25)	56 (20)	208 (27)	

	Average ±SD	Average ±SD	
Age, y	56.3 ± 11.8	55.6 ± 10.9	-
Longest time without cigarette, d	5.8 ± 6.1	7.4 ± 9.8	.012
No. of cigarettes per d	13.7 ± 9.8	12.4 ± 9.2	.047
Nicotine dependence (Fagerstrom Test for Nicotine Dependence score)	4.6 ± 2.7	3.3 ± 2.7	<.001

Abbreviations: E-cigarette, electronic cigarette; SD, standard deviation.
[a] Data are shown as the sample size and percentages except when noted. Counts do not always add up to the total sample size due to missing responses.
[b] *P* values were calculated using chi-square statistics for categorical variables and the independent-sample Student *t* test for continuous variables; *P* values >.05 were omitted.

available intake data (n = 1074). Figure 2 shows a substantive increase in E-cigarette use between the first quarter of 2012 (Q1 2012) and the fourth quarter of 2013 (Q4 2013). In 2012, the quarterly prevalence of E-cigarette use was relatively stable and on average 10.6% of participants reported E-cigarette use. However, beginning in the first quarter of 2013, the percentage of E-cigarette use more than doubled from 2012 and peaked in the second quarter of 2013 at 56.9%. During 2013, 38.5% of patients reported E-cigarette use, representing a 3-fold increase in self-reported E-cigarette use from 2012 to 2013. The nonoverlapping confidence intervals indicate that the growth in E-cigarette use is statistically significant.

Differences between E-cigarette users and non–E-cigarette users

There were no significant demographic differences between E-cigarette users and nonusers in terms of age, sex, or education (Table I). A significantly higher percentage of E-cigarette users were patients with thoracic or head and neck cancer compared with non–E-cigarette users (36.2% vs 27.0%; $P < .01$). E-cigarette users appeared to be smoking more cigarettes per day than nonusers (median, 13.7 [SD, ± 9.8] vs 12.4 [SD, ± 9.2]; $P < .05$) and reporting higher FTND scores than nonusers (median, 4.6 [SD, ± 2.7] vs 3.3 [SD, ± 2.7]; $P < .01$). A significantly higher percentage of E-cigarette users were highly nicotine dependent (FTND score of ≥ 5) when compared with nonusers (51.8% vs 32.2%, respectively; $P < .01$). In terms of time to first cigarette, 55.1% of E-cigarette users reported smoking within 30 minutes of waking, compared with 39.3% of nonusers ($P < .01$). It is interesting to note that twice as many E-cigarette users reported that it was difficult to keep from smoking in places in which it is forbidden (17.7% vs 8.6%; $P < .01$). In terms of lifetime history of prior quit attempts, E-cigarette users reported more frequent and a longer

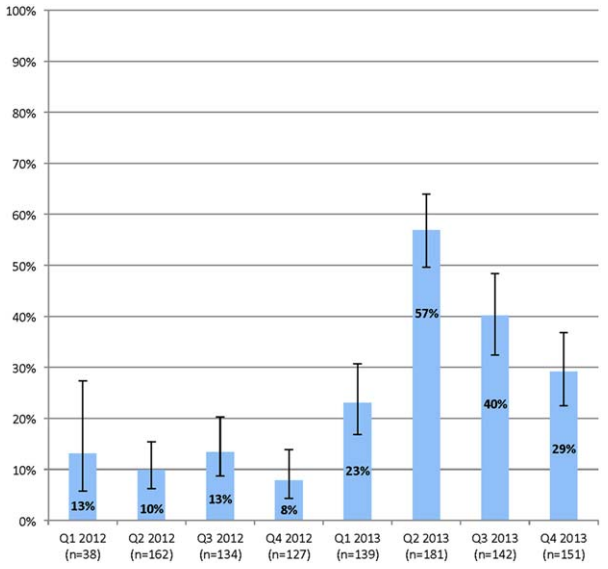

Figure 2. Percentage of patients who reported electronic cigarette use (n = 1074) per quarter (Q) is shown.

duration of prior quit attempts than nonusers. We found that 76.5% of E-cigarette users reported at least 2 prior quit attempts before entering the TCP, compared with 66.7% of nonusers ($P < .01$). E-cigarette users also reported a longer duration of prior (pre-TCP enrollment) cigarette smoking abstinence than nonusers (mean, 7.4 days [SD, ± 9.8] for E-cigarette users compared with 5.8 days [SD, ± 6.1] for nonusers; $P = .01$). E-cigarette users were no different from nonusers in terms of quitting motivation and quitting confidence.

E-cigarette use and smoking cessation outcomes

Using a CCA model (Table 2), the self-reported 7-day point prevalence smoking abstinence was equivalent for E-cigarette users and nonusers (44.4% vs 43.1%, respectively). It is interesting to note that only one-half of E-cigarette users reported that they had gone without smoking for ≥ 24 hours (made a 24-hour quit attempt) since enrolling in the TCP, compared with 76% of non–E-cigarette users, ($P = .02$). After adjusting for nicotine dependence, number of past quit attempts, and cancer diagnosis, E-cigarette users were as likely to be smoking at follow-up as nonusers ($P = .87$) (odds ratio, 1.0; 95% confidence interval, 0.5-1.7). At follow-up, E-cigarette users reported smoking a slightly higher average number of combustible cigarettes per day than nonusers, but the difference was not statistically significant (12.3 cigarettes per day [SD, ± 8.0] vs 10.1 cigarettes per day [SD, ± 6.6]; $P = .23$). Using an ITT model of analysis, the self-reported 7-day point prevalence abstinence rate was twice as high for non–E-cigarette users compared with E-cigarette users (30% vs 14.5%; $P < .01$). After adjusting for nicotine dependence, number of past quit attempts, and cancer diagnosis, E-cigarette users were twice as likely to be smoking at follow-up compared with nonusers (odds ratio, 2.0; 95% confidence interval, 1.2-3.3 [$P < .01$]).

DISCUSSION

We analyzed data regarding E-cigarette use from a large clinical sample of patients with cancer who enrolled in a TCP at a comprehensive cancer center. To our knowledge, these findings represent the first published data on E-cigarette use among patients with cancer. We observed a 3-fold increase in the prevalence of recent (within 30 days) E-cigarette use from 2012 to 2013. Furthermore, we found that, compared with nonusers, E-cigarette users were more highly dependent on nicotine, diagnosed with cancers of the lung and head and neck, and smoked more cigarettes per day than non–E-cigarette users. Finally, using both CCA and ITT analyses, we found no evidence that E-cigarette use was associated at follow-up with superior cessation outcomes.

We now discuss the implications and limitations of these findings. The markedly increased rate of E-cigarette use observed is consistent with recently published articles highlighting a dramatic rise in the use of E-cigarettes in the general population.[32-34] Consistent with recently published observational studies examining the use of E-cigarettes and smoking cessation outcomes in the general population,[23,35] the findings of the current study raise some doubt about the usefulness of E-cigarettes for facilitating smoking cessation among patients with cancer. Accounting for factors that are commonly associated with smoking cessation, using both CCA and ITT analyses, the results of the current study demonstrated that E-cigarette use does not appear to be associated with a greater likelihood of achieving abstinence from smoking combustible cigarettes. Indeed, in the more conservative ITT analyses, E-cigarette users were twice as likely as nonusers to be persistent smokers of combustible cigarettes. There is also no evidence that the use of E-cigarettes helped patients to reduce their smoking rate. The data from the current study also indicate that fewer E-cigarette users than nonusers reported being abstinent for ≥ 24 hours (made a quit attempt) during the observation period, suggesting that the use of E-cigarettes may have averted or delayed quit attempts. Although we speculate that patients may be drawn to E-cigarette use for harm reduction, the findings

TABLE 2. Results of 2 Logistic Regression Models Predicting Smoking Cessation Outcomes

	Complete Case Analysis (n=414[a])[b]			Intent-to-Treat Analysis (n=699[a])[c]		
	OR	95% CI	P[d]	OR	95% CI	P[d]
E-cigarette						
E-cigarette use	.95	0.53-1.72	-	2.00	1.23-3.26	.005
No E-cigarette use[e]	1.00	-		1.00	-	
Nicotine dependence						
High nicotine dependence	1.22	0.78-1.91	-	1.14	0.77-1.69	-
Low nicotine dependence[e]	1.00	-		1.00	-	
No. of past quit attempts						
Tried quitting at least twice	1.77	1.14-2.74	.010	1.83	1.25-2.67	.002
Tried quitting $\leq$1[e]	1.00	-		1.00	-	
Cancer diagnosis						
Thoracic or head and neck	0.56	0.36-0.89	.014	0.71	0.48-1.04	-
Other[e]	1.00	-		1.00	-	

Abbreviations: 95% CI, 95% confidence interval; E-cigarette, electronic cigarette; OR, odds ratio.
[a] Data are shown as the sample size except when noted. Counts do not always add up to the total sample size due to missing responses and deceased patients.
[b] Complete case analysis: self-reported 7-day point prevalence abstinence at 6 months, excluding patients who were lost to follow-up.
[c] Intent-to-treat analysis: self-reported 7-day point prevalence abstinence at 6 months; patients who were lost to follow-up were assumed to be smoking.
[d] P values were calculated using the Wald statistic, which is asymptotically distributed as a chi-square distribution. P values $>$ .05 were omitted.
[e] Reference category.

of the current study provide no evidence to support oncologists recommending E-cigarette use among patients with cancer who are advised to quit smoking.

Although E-cigarette users and nonusers were similar with regard to many demographic and clinical characteristics, E-cigarette users were more likely to be diagnosed with either thoracic or head and neck cancer, cancers that are widely associated with cigarette smoking. Indeed, the prevalence of E-cigarette use increased more rapidly for patients with thoracic and head or neck cancer than for those diagnosed with other cancers. Previous literature has shown that patients with thoracic or head and neck cancer are highly motivated to quit smoking,[36,37] and the findings of the current study suggest that patients with thoracic or head and neck cancer who smoke cigarettes may be more influenced by any claims implying that E-cigarettes may help them quit or reduce the harm associated with smoking combustible cigarettes. E-cigarette users were more nicotine dependent than nonusers. Twice as many E-cigarette users than nonusers indicated that it was difficult to keep from smoking in places in which it was forbidden. Considering that the overwhelming majority of patients reported dual use, it is plausible that these patients were using E-cigarettes in addition to combustible cigarettes to manage nicotine withdrawal symptoms and the challenges of smoke-free environments. It is hard to know what to make of the observation that E-cigarette users reported a more frequent and longer duration of prior quit attempts than nonusers. Although it may indicate that E-cigarette users may be more motivated to quit, conversely, E-cigarette use may represent a well-intended effort to "try something new" after multiple failed quitting efforts.

The results of the current study demonstrated that among patients with cancer in this sample, dual tobacco use is common and E-cigarettes are much more commonly used in conjunction with traditional cigarettes than any other tobacco product. Although the prevalence of E-cigarette use increased dramatically during the study period, the prevalence of other types of tobacco products remained quite low in comparison. Although we did not specifically assess risk perceptions regarding the use of E-cigarettes, these findings suggest that patients with cancer may perceive E-cigarettes to be less harmful than combustible cigarettes.

The current study is not without limitations. First, the findings are drawn from a clinical cohort of patients being treated by a single comprehensive cancer center with a well-established program for treating tobacco dependence in patients with cancer. Second, cessation (abstinence) outcome was not biochemically verified, reflecting routine clinical practice rather than outcomes procedures that would commonly be used in a controlled clinical trial. Third, although our follow-up rate exceeds or meets that observed in many clinical cohort cessation reports (eg, quitline outcomes),[31,38] a higher percentage of E-cigarette users were lost to follow-up such that the results of ITT analyses should be interpreted with caution.

These findings should not be interpreted to indicate that E-cigarettes will never help patients quit smoking. There is a clear need for well-controlled research examining the efficacy of E-cigarette use to promote the long-term cessation of combustible tobacco among patients with cancer. There also remain unanswered questions regarding the toxicity of E-cigarettes and any specific safety concerns for E-cigarette use among patients with cancer. Given the high rate of use observed, E-cigarette use should be included in comprehensive tobacco use assessment for both clinical trials and routine clinical care. Future studies should assess ever-use and current use (within the past 30 days) as well as frequency, patterns, reasons, and duration of E-cigarette use.

E-cigarette use appears increasingly common among patients with cancer who smoke. E-cigarette users are more dependent on nicotine and appear to have been more engaged in prior quitting efforts than nonusers, but are equally or less likely to have quit smoking combustible cigarettes at follow-up. Given the increasing popularity and availability of E-cigarettes in the general population and the strong advice to quit smoking combustible cigarettes given at the time of diagnosis, patients with cancer are likely to consider the use of E-cigarettes. Further controlled research is needed to evaluate the safety and efficacy of E-cigarettes as a cessation treatment for patients with cancer. In the meantime, oncologists should advise smokers to quit smoking combustible cigarettes, encourage the use of FDA-approved cessation medications, refer patients for tobacco cessation counseling, and provide education regarding the potential risks and lack of known benefits of E-cigarette use with regard to long-term cessation. Hospitals should include restrictions on E-cigarette use in their tobacco-free campus and clean indoor air policies. Environmental studies have identified nicotine and other constituents in the vapor emitted by E-cigarette users and some of these chemical constituents may result in respiratory irritation and other as-yet unknown health effects.[39] Until more is known concerning the risks and benefits of E-cigarettes for patients with cancer, oncologists are likely to struggle with these complexities and have more questions than answers regarding E-cigarette use. The Tobacco Control and Smoking Cessation Committee of the International Association for the Study of Lung Cancer has recently published a commentary providing guidance for oncologists as to what to recommend to their patients who might be struggling to stop smoking or wondering about E-cigarettes.[26] At MSKCC, in response to staff requests for guidance on how to respond to patient inquiries about E-cigarettes, we have prepared and disseminated responses to a series of Frequently Asked Questions (available from the authors) (What is an electronic cigarette? Are E-cigarettes safe for use? Are E-cigarettes effective in helping patients quit smoking? Are patients permitted to use E-cigarettes in the hospital? What should I tell my patients about the E-cigarette? What are some of the other concerns about the E-cigarette?). Given the importance of promoting tobacco cessation among patients with cancer,[1] it is imperative to examine whether E-cigarettes help or hinder these efforts.

FUNDING SUPPORT

No specific funding was disclosed.

CONFLICT OF INTEREST DISCLOSURES

The authors made no disclosures.

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