Published in final edited form as:

J Cancer Surviv. 2018 December ; 12(6): 828–834. doi:10.1007/s11764-018-0720-x.

Correlates of Smoking Status in Cancer Survivors

Melissa A. Little, PhD,

Center for Addiction and Prevention Research, University of Virginia Medical School, 59 MDW/ 59 SGOWMP, 1100 Wilford Hall Loop, Bldg 4554, Lackland AFB, TX 78236

Robert C. Klesges, PhD,

Department of Public Health Sciences, Center for Addiction and Prevention Research, University of Virginia, 560 Ray C. Hunt Drive, PO Box 800717, Charlottesville, VA 22908

Zoran Bursac, PhD,

Division of Biostatistics, Department of Preventive Medicine, University of Tennessee Health Science Center, 633 Doctors Office Building, Suite 307, Memphis, Tennessee 38163

Jennifer P. Halbert, MSPH,

Department of Public Health Sciences, Center for Addiction and Prevention Research, University of Virginia, 560 Ray C. Hunt Drive, PO Box 800717, Charlottesville, VA 22908

Jon Ebbert, MD, MSc,

Mayo Clinic, 200 First Street SW, Rochester, MN 55905

G. Wayne Talcott, PhD, and

Department of Public Health Sciences, Center for Addiction and Prevention Research, University of Virginia, 2200 Bergquist Dr Ste 1, Lackland AFB, TX 78236

Benny Weksler, MD, MBA

University of Tennessee Health Science Center, 1325 East Moreland Ave., Memphis, Tennessee 38104

Abstract

Purpose: To determine the characteristics associated with cancer survivors which indicate continued cigarette smoking at or around the time of cancer diagnosis.

Methods: 631 survivors were recruited in four cancer centers in Memphis, TN, between March 2015 and June 2016. To increase the probability of accurate reporting, surveys were conducted anonymously. 112 respondents reported they were current smokers and 202 reported they were former smokers (n=314), who comprised the sample.

Results: We found that the rate of daily e-cigarette use among cancer survivors who smoked was 15.2% versus 3.9% in cancer survivors who no longer smoked. (The national rate of adult e-

corresponding author: 210-292-5995, mal7uj@virginia.edu.

Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

cigarette use is 3.5%.) Multivariate models correlated the characteristics of current versus former smokers and revealed that increasing age (aOR=0.97, $p<.0001$), decreasing education (aOR=2.39, $p<.02$) and current use of e-cigarettes (aOR=3.74, $p<.00045$) were frequently associated with current cigarette smoking.

Conclusions: While age and gender were associated with continued smoking, current use of e-cigarettes was associated with almost four times higher odds of being a current smoker. Further research is needed to determine if use of e-cigarettes deters or promotes the smoking cessation process, at least in cancer survivors.

Implications for Cancer Survivors: Among cancer survivors who continue to smoke after a cancer diagnosis, use of e-cigarettes is highly prevalent; research is needed to determine whether use of e-cigarettes promotes, has no effect, or hinders smoking cessation efforts among this vulnerable population.

Keywords

Smoking cessation; e-cigarettes; tobacco use; cancer survivors who smoke

Introduction

Cigarette smoking is the single most important preventable cause of morbidity, mortality, and excess health care costs in the United States, causing approximately 480,000 premature deaths annually and accounting for 30% of all cancer deaths [1]. Despite numerous public health and anti-smoking campaigns, the prevalence of current smoking among US adults is approximately 15% [2]. Smoking increases the risk of the following types of cancer: nasopharynx, nasal cavity and sinuses, lip, oral cavity, pharynx, larynx, lung, esophagus, pancreas, uterine cervix, ovary, kidney, bladder, stomach, colorectum, and acute myeloid leukemia [1]. Over 90% of lung cancer mortality [3] and 80% of deaths from chronic obstructive lung disease is attributable to smoking [4].

No population is in more need of quitting smoking than cancer survivors. Since 1996, the National Coalition for Cancer Survivorship defines “cancer survivor” as any person diagnosed with cancer from the time of initial diagnosis until his or her death [5]. In 2016, an estimated 15.5 million individuals were cancer survivors [6].

Approximately 50% of cancer survivors continue to smoke after their diagnosis [7], and smoking cessation among cancer survivors is an escalating concern as their numbers in the US grow [8]. Smoking cessation carries numerous benefits, even after a cancer diagnosis, including a greater response to cancer treatment [1, 9, 10] and reduced risk of mortality [1, 3, 9]. Cancer survivors who continue to smoke are at a higher risk than non-smoking survivors for secondary primary cancers as well as a wide range of other conditions causally associated with smoking, including diabetes, cardiovascular disease, impaired immune function, rheumatoid arthritis, dental disease, pain-related impairment, and more [1, 11]. Given the large population of cancer survivors who smoke and the importance of smoking cessation in this population, a critical need exists to understand both the barriers and facilitators of smoking cessation in this very high risk population, particularly since

conventional behavioral and pharmacologic smoking cessation programs are not effective at increasing the smoking cessation in cancer survivors [12]. That is, while about half of all smokers quit upon learning their cancer diagnosis [7], relapse rates among those that quit are high and the remaining half are recalcitrant to even aggressive behavioral and pharmacologic smoking cessation programs [12].

Previous studies have found that cancer survivors continue to smoke due to lower self-efficacy, lower perceived risk perceptions [13], higher exposure to second hand smoke [14], less extensive disease and less severe treatment [15]. We build upon this previous work in the current study by identifying factors that prevent cancer survivors from successfully quitting. Our sample comprises cancer survivors who were either current (n=112) or former (n=202) smokers.

Methods

Design and Setting.

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

Participants and Eligibility.

We defined a cancer survivor as recommended in the literature, i.e., any person diagnosed with cancer, from the time of initial diagnosis until his or her death [5]. Subjects were eligible to participate if they were: 1) 18 years of age; 2) currently receiving treatment at one of the West Cancer Centers; and 3) have received, understood, and signed the informed consent. Patients interested in participating were referred to a research associate to assess eligibility and describe their participation in the study. Cancer diagnosis and type of cancer were self-reported. We did not limit participation based on type of cancer or tumor site. Once consent was obtained, the participant had the option to complete the survey individually or have the research associate read the survey to them. To increase the probability of honest responding, the survey was completely anonymous, and was approved by the oversight Institutional Review Board.

Measures.

The survey assessed (1) demographics, (2) smoking history, (3) readiness to quit smoking (including stages of change), (4) self-efficacy to quit (measured on a five-point scale with 5 being extremely confident), (5) reasons for smoking (measured on a five-point scale with 5 being extremely true), (6) perceived benefit of quitting smoking (measured on a five point scales with 5 being strongly agree) and (7) cancer diagnosis and status (being evaluated, diagnosed but not started treatment, receiving treatment, diagnosed with surgical removal, diagnosed with treatment and now in remission). Other smoking history questions included the Fagerstrom Test for Nicotine Dependence (FTND) [16], years smoked, prior quit attempts, and prior methods used to quit smoking. Current smokers were defined as those who reported smoking at least 100 cigarettes in their lifetime and are currently smoking, as compared to those that have quit smoking.

Statistical Data Analysis.

Statistical analyses were conducted using SAS/STATv14.1 (SAS Institute Inc., Cary, NC). Descriptive statistics including means and their standard deviations, or frequencies and proportions of key demographic and tobacco variables were computed for the overall study population, and by readiness to quit. Differences in means between the respective groups were tested using two-sample t-test while differences in proportions were compared using a χ^2 test or Fishers Exact test, respectively. We applied a multivariable logistic regression model to determine the relative odds with which demographic variables and other factors (cancer diagnosis, cancer status, smoking history, and self-efficacy) were associated with current smoking status. Covariates significant at $p < 0.1$ in the univariate analyses (see Table 1) were considered and entered into a multivariate model. Variables included age, education, cancer status, non-cigarette tobacco product use, number of tobacco products used, years smoked, trying to quit now, tried to quit in the past, believed quitting would increase chances of cancer survival, and believed quitting would decrease cancer recurrence. FTND was not included in the final model, as it was a priori assumed it would strongly predict differences between current and former smokers, with current smokers more likely to have higher FTND scores. The model was reduced using a manual backwards selection approaches to retain only significant variables and important confounders. In the final model, associations were considered significant at the alpha level of 0.05.

Results

We surveyed a total of 631 cancer survivors at four locations around the Memphis, TN area. Participants were predominantly female (63.8%), white (59.8%), non-Hispanic (99.5%), with average age of 60.7 years (SD=14.2), and a little over half were married (54.1%), had greater than a high school education (57.4%) and were currently being treated for cancer (51.3%).

Nearly half of the sample reported smoking at least 100 cigarettes in their lifetime with 17.8% self-identifying as current smokers and 32.0% as former smokers. Our analytical sample consisted of only current and former smokers (N=314), therefore current smokers made up 35.7% of observations and former smokers 64.3%. Current smokers (N= 112) reported smoking an average of 34.3 years (SD=13.5), with an average of 13.3 (SD=10.3) cigarettes per day for the previous seven days. Even though former smokers reported not currently using cigarettes, they did report using other tobacco products such as smokeless tobacco (5.9%), snus (2.5%), hookah (1.9%), and electronic cigarettes (3.9%).

Univariate comparisons (see Table 1) indicated that current smokers were more likely to be younger (58.9 vs. 64.4 years; $p=0.0002$), have lower education (18% vs. 11% less than high school; $p=0.0562$), currently undergo treatment (60% vs. 47.8%; $p=0.0076$), currently use electronic cigarettes (15.2% vs. 3.9%; $p=0.0004$), having received a doctor's advice to quit (74.5% vs 62.8%; $p=0.0548$), having received information on stop smoking resources (42.9% vs. 26.4%; $p=0.0072$), and trying to quit cold turkey (68% vs. 9.6%; $p<0.0001$). They were less likely to try other methods as means of quitting such as prescription medication (81.3% vs. 94.5%; $p=0.0009$), tobacco quit line (95.2% vs. 99.4%; $p=0.0326$), and electronic

cigarettes (88.9% vs. 96.3%; $p=0.0301$). Smokers also had higher scores on the FTND (3.8 vs. 1.8; $p=0.0068$).

Multivariable models confirmed some of the univariate findings (see Table 2). When univariate comparisons were adjusted for other variables in the model, three significant differences remained. First, increase in age was associated with decreased odds of current smoking (aOR=0.97; 95% CI 0.95-0.99; $p<0.0001$). Second, those cancer survivors with less than high school education had over 2 times higher odds of being a current smoker (aOR=2.39; 95% CI 1.17-4.93; $p=0.0172$), compared to those with more than high school education. Finally, those currently using e-cigarettes were associated with almost 4 times higher odds of being a current smoker (aOR=3.74; 95% CI 1.51-9.29; $p=0.0045$), as compared to those not using e-cigarettes.

Discussion

It is critical for tobacco researchers to determine methods of understanding and intervening on cancer survivors who continue to smoke, despite a cancer diagnosis. While the current investigation identified several univariate correlates of current versus former cigarette use, in the multivariate model, three independent correlates of smoking status in cancer survivors were identified. First, as age of the participant increased, the probability of smoking decreased. Second, education was inversely related to tobacco use – as education increased, the use of current cigarettes decreased. However, the strongest (and only modifiable) characteristic associated with current tobacco use was the concomitant use of e-cigarettes. That is, those currently using e-cigarettes had nearly four-times higher odds of being a current smoker.

The findings that age and education are inversely related to current smoking is not surprising, and is consistent with the rest of the literature on tobacco use in the general adult U.S. population. Indeed, several studies show that tobacco prevalence decreases as people age [17–20]. This is probably a combination of adults quitting smoking along with smoking-related morbidity and mortality, although the precise mechanism between the inverse relationship between age and tobacco prevalence is not fully known.

The finding that tobacco prevalence is inversely related to education is also consistent with the smoking literature in general. Both levels of education and income have been shown to be inversely related to tobacco intake [17, 18, 21–25]. While the mechanism(s) are not fully understood, perhaps people with higher education (and, in general, higher income) have the resources to invest in stop smoking aids, whether it be over the counter products such as nicotine replacement therapy or prescription products like varenicline (Chantix™) [23].

However, the most dramatic set of results from the current study is the finding that cancer survivors that are current smokers had a nearly four times higher odds of using e-cigarettes (OR=3.74). Over 15% (15.2%) of cancer survivors who smoked were concomitantly using e-cigarettes, compared with 3.9% of cancer survivors who were former smokers. The rate of e-cigarette use among cancer survivors who smoke is several fold higher the latest estimate of e-cigarette use in the general adult population of 3.5% [26]. While the results are clear –

the use of e-cigarettes among current cancer survivors is extremely high – what is not clear is the interpretation of these findings. One possibility is that since this was a cross-sectional study, the smokers using e-cigarettes might be in the process of using e-cigarettes to quit and, had we followed this sample over time, we would see these smokers begin to quit smoking. However, equally plausible is just the opposite interpretation – that is, survivors are using e-cigarettes as a way to “cut down” on smoking and they wind up simultaneously using both products.

There is enormous controversy and debate in the literature regarding whether e-cigarettes promote, hamper, or have no effects on the smoking-cessation process in the general population of smokers [27–36]. On the one hand, many smokers report using e-cigarettes to help them quit. In a study conducted in Great Britain, 33% of smokers making a quit attempt used e-cigarettes to assist them in this process [37, 38]. On the other hand, in a small clinical trial, those receiving e-cigarettes were no more likely to quit smoking than those who received traditional nicotine replacement therapy in the form of the patch, or to placebo e-cigarettes [39]. In a 2015 policy statement, the American Association for Cancer Research (AACR) and the American Society of Clinical Oncology (ASCO) called for oncologists to avoid recommending using e-cigarettes as a first-line therapy for smoking cessation and for strategic research on how ENDS use impacts the treatment and outcomes for cancer patients [40].

What is clear, however, is that (a) Cancer survivors who smoke are using e-cigarettes at rates several fold higher than the adult population; and (b) Cancer survivors who do not quit following the initial diagnosis of cancer are recalcitrant to smoking cessation interventions that have been shown to be effective in other populations [12]. An important next step would be to determine the efficacy and safety of using e-cigarettes in promoting cessation in the special population of cancer survivors who continue to smoke. On the one hand, if e-cigarettes provide an effective “stepping stone” to smoking cessation in this group who, medically, need to quit smoking, this would be a major advancement in the field of tobacco control for smoking cessation. If, on the other hand, e-cigarettes actually deter (decrease) smoking-cessation success in this population, or the chemicals inhaled pose a significant danger to cancer survivors (e.g., interfering with treatment, increasing tumor growth), this is equally important to know. It is clear that a prospective, properly-powered randomized clinical trial is needed to answer these important questions.

There are several limitations to this study that can be viewed as potential opportunities for further research. First, we asked detailed questions of current smokers about their smoking habits, but did not ask former smokers about the timing of, motivations for, and methods of quitting. Asking questions on if and how their cancer diagnosis impacted their decision to quit could inform new methods of motivating other survivors to set quit dates. Second, participants were able to self-select to complete the survey or not, leading us to skew female. In the US, more men smoke than women [41]. It would be helpful to have more information from men to improve the generalizability of our findings. We surveyed participants who were at a cancer clinic. Most cancer survivors who are past the five-year survival mark do not receive care at a cancer-focused clinic, limiting the information we gather from survivors further removed from their diagnosis. Additionally, we did not collect information on

participants who were approached but did not consent to participate, limiting the generalizability of our results. Finally, we did not measure pack years smoked in the current study. Future studies should examine differences in pack years among cancer survivors, as this may be an indicator of tobacco cessation.

In summary, the concomitant use of e-cigarettes and cigarettes is very high among cancer survivors who continue to smoke after a cancer diagnosis. Future research should help determine if the use of e-cigarettes in this high risk population promotes, has no effect, or hinders smoking cessation efforts.

Acknowledgements:

This study was supported by a grant from the National Cancer Institute (R01CA127964) awarded to the Dr. Klesges, as well as funding from the University of Virginia Center for Addiction Prevention Research. The authors gratefully acknowledge Methodist Health Systems and the West Cancer Center for their assistance in providing access to their facilities and patients.

References:

1. U.S. Department of Health and Human Services. The health consequences of Smoking—50 years of progress: A report of the surgeon general. Atlanta: U.S. 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.
2. Centers for Disease Control and Prevention (CDC). Fact sheet: Current cigarette smoking among adults in the united states. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm. Updated 2016. Accessed 09/04, 2017.
3. 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. The BMJ. 2010;340:b5569 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2809841/>. doi: 10.1136/bmj.b5569. [PubMed: 20093278]
4. Smoking-attributable mortality, years of potential life lost, and productivity losses — united states, 2000-2004. MMWR Morb Mortal Wkly Rep. 2008;57(45):1226–1228. <http://www.proxv.its.virginia.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=105715504&site=ehost-live&scope=site>. [PubMed: 19008791]
5. NCI dictionary of cancer terms. <https://www.cancer.gov/publications/dictionaries/cancer-terms/cdrd=450125>. Accessed August 14, 2017.
6. American Cancer Society. Cancer treatment & survivorship facts & figures 2016-2017. Atlanta: American Cancer Society; 2016 <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/cancer-treatment-and-survivorship-facts-and-figures/cancer-treatment-and-survivorship-facts-and-figures-2016-2017.pdf>. Accessed November 20, 2017.
7. Cox LS, Africano NL, Tercyak KP, Taylor KL. Nicotine dependence treatment for patients with cancer. Cancer. 2003;98(3):632–644. doi: 10.1002/cncr.11538. [PubMed: 12879483]
8. de Moor JS, Mariotto AB, Parry C, et al. Cancer survivors in the united states: Prevalence across the survivorship trajectory and implications for care. Cancer Epidemiol Biomarkers Prev. 2013;22(4): 561 <http://cebp.aacrjournals.org/content/22/4/561.abstract>. [PubMed: 23535024]
9. Browman GP, Wong G, Hodson I, et al. Influence of cigarette smoking on the efficacy of radiation therapy in head and neck cancer. N Engl J Med. 1993;328(3):159–163. 10.1056/NEJM199301213280302. doi: 10.1056/NEJM199301213280302. [PubMed: 8417381]
10. Kumar B, Cordell KG, Lee JS, et al. EGFR, p16, HPV titer, bcl-xL and p53, sex, and smoking as indicators of response to therapy and survival in oropharyngeal cancer. JCO. 2008;26(19):3128–3137. 10.1200/JCO.2007.12.7662. doi: 10.1200/JCO.2007.12.7662.

11. Florou AN, Gkiozos IC, Tsagouli SK, Souliotis KN, Syrigos KN. Clinical significance of smoking cessation in subjects with cancer: A 30-year review. *Respir Care*. 2014;59(12):1924–1936. doi: 10.4187/respcare.02559 [doi]. [PubMed: 25185148]
12. Nayan S, Gupta MK, Strychowsky JE, Sommer DD. Smoking cessation interventions and cessation rates in the oncology population. *Otolaryngol Head Neck Surg*. 2013;149(2):200–211. 10.1177/0194599813490886. doi: 10.1177/0194599813490886. [PubMed: 23715685]
13. Schnoll RA, Calvin J, Malstrom M, et al. Longitudinal predictors of continued tobacco use among patients diagnosed with cancer. *Annals of Behavioral Medicine*. 2003;25(3):214–221. 10.1207/S15324796ABM2503_07. doi: 10.1207/S15324796ABM2503_07. [PubMed: 12763716]
14. Eng L, Su J, Qiu X, et al. Second-hand smoke as a predictor of smoking cessation among lung cancer survivors. *J Clin Oncol*. 2014;32(6):564–570. doi: 10.1200/JCO.2013.50.9695 [doi]. [PubMed: 24419133]
15. 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(2):569–576. [PubMed: 7812925]
16. Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO. The fagerstrom test for nicotine dependence: A revision of the fagerstrom tolerance questionnaire. *Br J Addict*. 1991;86(9):1119–1127. [PubMed: 1932883]
17. Jamal A, King BA, Neff LJ, Whitmill J, Babb SD, Graffunder CM. Current cigarette smoking among adults - united states, 2005-2015. *MMWR Morb Mortal Wkly Rep*. 2016;65(44):1205–1211. <http://www.proxy.its.virginia.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=119452652&site=ehost-live&scope=site>. doi: 10.15585/mmwr.mm6544a2. [PubMed: 27832052]
18. Garrett BE, Dube SR, Trosclair A, Caraballo RS, Pechacek TF, Centers for Disease Control and Prevention (CDC). Cigarette smoking - united states, 1965-2008. *MMWR Suppl*. 2011;60(1):109–113. doi: su6001a24 [pii]. [PubMed: 21430635]
19. Singh T, Arrazola RA, Corey CG, et al. Tobacco use among middle and high school students-- united states, 2011-2015. *MMWR Morb Mortal Wkly Rep*. 2016;65(14):361–367. doi: 10.15585/mmwr.mm6514a1 [doi]. [PubMed: 27077789]
20. Tam J, Warner KE, Gillespie BW, Gillespie JA. Impact of changing U.S. demographics on the decline in smoking prevalence, 1980-2010. *Nicotine Tob Res*. 2014;16(6):864–866. doi: 10.1093/ntr/ntt223 [doi]. [PubMed: 24401731]
21. Escobedo LG, Peddicord JP. Smoking prevalence in US birth cohorts: The influence of gender and education. *Am J Public Health*. 1996;86(2):231–236. [PubMed: 8633741]
22. Zhu BP, Giovino GA, Mowery PD, Eriksen MP. The relationship between cigarette smoking and education revisited: Implications for categorizing persons' educational status. *Am J Public Health*. 1996;86(11):1582–1589. [PubMed: 8916524]
23. Lillard DR, Plassmann V, Kenkel D, Mathios A. Who kicks the habit and how they do it: Socioeconomic differences across methods of quitting smoking in the USA. *Social Science & Medicine*. 2007;64(12):2504–2519. doi: 10.1016/j.socscimed.2007.02.036. [PubMed: 17418470]
24. Wagenknecht LE, Perkins LL, Cutter GR, et al. Cigarette smoking behavior is strongly related to educational status: The cardia study. *Preventive Medicine*. 1990;19(2):158–169. doi: 10.1016/0091-7435(90)90017-E. [PubMed: 2193307]
25. Stringhini S, Sabia S, Shipley M, et al. Association of socioeconomic position with health behaviors and mortality. *JAMA*. 2010;303(12):1159–1166. doi: 10.1001/jama.2010.297 [doi]. [PubMed: 20332401]
26. QuickStats: Cigarette smoking status* among current adult E-cigarette users, dagger by age group - national health interview survey, section sign united states, 2015. *MMWR Morb Mortal Wkly Rep*. 2016;65(42):1177. doi: 10.15585/mmwr.mm6542a7 [doi]. [PubMed: 27787495]
27. Grana RA, Popova L, Ling PM. A longitudinal analysis of electronic cigarette use and smoking cessation. *JAMA Intern Med*. 2014;174(5):812–813. doi: 10.1001/jamainternmed.2014.187 [doi]. [PubMed: 24664434]

28. Pericot-Valverde I, Gaalema DE, Priest JS, Higgins ST. E-cigarette awareness, perceived harmfulness, and ever use among U.S. adults. *Preventive Medicine*. 2017. doi: 10.1016/j.ypmed.2017.07.014.
29. Giovenco DP, Delnevo CD. Prevalence of population smoking cessation by electronic cigarette use status in a national sample of recent smokers. *Addictive Behaviors*. 2018;76:129–134. doi: 10.1016/j.addbeh.2017.08.002. [PubMed: 28802179]
30. Little MA, Bursac Z, Derefinko KJ, et al. Types of dual and poly-tobacco users in the US military. *Am J Epidemiol*. 2016;184(3):211–218. doi: 10.1093/aje/kwv321 [doi]. [PubMed: 27421292]
31. Tobacco Advisory Group of the Royal College of Physicians. Nicotine without smoke: Tobacco harm reduction. <https://www.rcplondon.ac.uk/projects/outputs/nicotine-without-smoke-tobacco-harm-reduction-0>. Updated 2016. Accessed 09/04, 2017.
32. Smokefree.gov. What we know about E-cigarettes. <https://smokefree.gov/quitting-smoking/e-cigs-menthol-dip-more/what-we-know-about-e-cigarettes>. Accessed September 4, 2017.
33. Hartmann-Boyce J, McRobbie H, Bullen C, Begh R, Stead LF, Hajek P. Electronic cigarettes for smoking cessation. *Cochrane Database Syst Rev*. 2016;9:CD010212. doi: 10.1002/14651858.CD010216.pub3.
34. McNeill A, Brose L, Calder R, Hitchman S, Hajek P, McRobbie H. E-cigarettes: An evidence update. *Public Health England*. 2015;3.
35. Biener L, Hargraves JL. A longitudinal study of electronic cigarette use among a population-based sample of adult smokers: Association with smoking cessation and motivation to quit. *Nicotine Tob Res*. 2015;17(2):127–133. doi: 10.1093/ntr/ntu200 [doi]. [PubMed: 25301815]
36. Kalkhoran S, Glantz SA. E-cigarettes and smoking cessation in real-world and clinical settings: A systematic review and meta-analysis. *The Lancet Respiratory Medicine*. 2016;4(2):116–128. doi: 10.1016/S2213-2600(15)00521-4. [PubMed: 26776875]
37. Fidler JA, Shahab L, West O, et al. ‘The smoking toolkit study’: A national study of smoking and smoking cessation in england. *BMC Public Health*. 2011;11:479-2458-11-479. doi: 10.1186/1471-2458-11-479 [doi].
38. West R, Beard E, Brown J. Trends in electronic cigarette use in england. *Smoking Toolkit Study: Latest Statistics*. 2017(7 7).
39. Bullen C, Howe C, Laugesen M, et al. Electronic cigarettes for smoking cessation: A randomised controlled trial. *The Lancet*. 2013;382(9905):1629–1637. doi: 10.1016/S0140-6736(13)61842-5.
40. Brandon TH, Goniewicz ML, Hanna NH, et al. Electronic nicotine delivery systems: A policy statement from the american association for cancer research and the american society of clinical oncology. *J Clin Oncol*. 2015;33(8):952–963. doi: 10.1200/JCO.2014.59.4465 [doi]. [PubMed: 25572671]
41. Jamal A, Phillips E, Gentzke AS, et al. Current cigarette smoking among adults - united states, 2016. *MMWR Morb Mortal Wkly Rep*. 2018;67(2):53–59. doi: 10.15585/mmwr.mm6702a1 [doi]. [PubMed: 29346338]

Table 1.**Univariate Comparisons Between Current Smokers and Former Smokers**

	Current Smokers (N=112)	Former Smokers (N=202)	p-value*
Age (mean, SD)	58.9(12.1)	64.4(12.5)	0.0002
Gender (male)	48.7	48.2	0.9228
Race			0.1174
White	59.6	68.5	
Non-white	40.4	31.5	
Marital status (married)	44.1	53.7	0.1049
Education			0.0562
Less than high school	18.0	11.0	
diploma or GED	40.6	34.5	
Some college	41.4	54.5	
Cancer status			0.0076
Being evaluated	8.2	7.5	
Diagnosed only	10.0	3.5	
Receiving treatment	60.0	47.8	
Surgery only	4.6	11.9	
Treatment and remission	13.6	24.4	
Never diagnosed	3.6	4.9	
Cancer type			
Breast	14.3	10.4	0.3058
Prostate	7.1	4.5	0.3134
Lung and/or bronchus	29.5	26.7	0.6044
Colon and/or rectum	7.1	10.4	0.3402
Lymphoma	6.3	2.9	0.1623
Tobacco products			
Smokeless tobacco	8.9	5.9	0.3204
Snus (Camel & Marlboro)	5.4	2.5	0.2085
Hookah	3.6	1.9	0.4623
Roll your own cigarettes	11.6	1.0	0.0001
Cigarillo	4.5	0.0	0.0054
Electronic cigarettes (e-cigarettes, vapes)	15.2	3.9	0.0004
Number of tobacco products			0.0001
None	0.0	84.7	
Mono	67.9	13.4	
Dual	20.5	1.0	
Poly	11.6	1.0	
Years smoked currently [mean (SD)]	32.1 (13.7)	38.2 (12.4)	0.0240
Trying to quit now	84.5	28.9	<0.0001
Tried to quit in the past	84.7	56.8	0.0014
Fagerstrom Test for Nicotine Dependence	3.8(2.0)	1.8(2.1)	0.0068

	Current Smokers (N=112)	Former Smokers (N=202)	p-value*
Perceived benefit of quitting ^a	3.8(1.4)	4.3(1.1)	0.3318
Quitting would increase chances of cancer survival ^a	3.1(1.4)	4.3(1.1)	0.033
Quitting would decrease cancer recurrence ^a	3.1(1.3)	3.8(1.3)	0.0836
I continued to smoke because... ^a			
I never intended to stay tobacco free	1.8(1.4)	1.3(07)	0.2326
I was too stressed and anxious about my cancer	3.2(1.7)	2.8(1.8)	0.5038
To alleviate boredom	2(1.4)	1.8(1.1)	0.6049
Other smokers around me continued to smoke	27(1.6)	27(1.9)	0.9858
I was feeling depressed	2.4(1.6)	1.8(1.1)	0.2589
I was drinking alcohol	2(1.5)	1.8(1.4)	0.6807
I was concerned about gaining weight	1.8(1.4)	1.3(07)	0.1365

Mean (SD) or %

* Chi-square or exact p-value for %; or t-test for means

^a Measured on a five-point Likert scale with 5 being a higher endorsement for the item.

Table 2.Results from the Final Multivariate Model^a

	Odds Ratio	95% CI	p-value
Age	0.97	0.95-0.99	0.0027
Education (Ref: >High School)			
<High School	2.39	1.17-4.93	0.0172
High School / GED	1.66	0.98-2.83	0.0618
Use E-cigarettes	3.74	1.51-9.29	0.0045

^aPredictors entered into the final multivariate model that were not retained included age, education, cancer status, non-cigarette tobacco product use, number of tobacco products used, years smoked, trying to quit now, tried to quit in the past, believed quitting would increase chances of cancer survival, and believed quitting would decrease cancer recurrence.