HHS Public Access

Author manuscript

Cancer Epidemiol Biomarkers Prev. Author manuscript; available in PMC 2016 October 01.

Published in final edited form as:

Cancer Epidemiol Biomarkers Prev. 2015 October ; 24(10): 1450–1461. doi: 10.1158/1055-9965.EPI-15-0257.

Systematic Review of Tobacco Use After Lung or Head/Neck Cancer Diagnosis: Results and Recommendations for Future Research

Jessica L. Burris[1,2], **Jamie L. Studts**[1,3], **Antonio P. DeRosa**[4], and **Jamie S. Ostroff**[5]

[1]Lucille P. Markey Cancer Center, Cancer Prevention and Control Program – Lexington, Kentucky, USA

[2]University of Kentucky, Department of Psychology – Lexington, Kentucky, USA

[3]University of Kentucky, Department of Behavioral Science – Lexington, Kentucky, USA

[4]Memorial Sloan Kettering Cancer Center, Medical Library – New York, New York, USA

[5]Memorial Sloan Kettering Cancer Center, Psychiatry and Behavioral Sciences Service – New York, New York, USA.

Abstract

Tobacco use after cancer diagnosis is associated with adverse cancer outcomes, yet reliable prevalence estimates for this behavior are lacking. We conducted a systematic literature review of the prevalence of current tobacco use among individuals with a history of lung or head/neck cancer (CRD #42012002625). An extensive search of electronic databases (MEDLINE, EMBASE, Cochrane Library, CINAHL, PsycINFO, Web of Science) identified 7,777 potentially relevant papers published between 1980 and 2014, and 131 of these yielded pertinent information. Aggregating results across heterogeneous study designs and diverse patient samples, the overall mean prevalence rate of current tobacco use (mostly cigarette smoking) was 33.0% (median=31.0%). Among current tobacco users at cancer diagnosis, the mean prevalence rate of current tobacco use (mostly cigarette smoking) was 53.8% (median=50.3%). In many cases, an operational definition of “current” tobacco use was absent, and biochemical verification of self-reported smoking status was infrequent. These and other observed methodological limitations in the assessment and reporting of cancer patients’ tobacco use underscore the necessity of uniform tobacco use assessment in future clinical research and cancer care.

Keywords

cancer; head and neck neoplasm; lung neoplasm; smoking; tobacco use

Correspondence concerning this article should be addressed to: Jessica L. Burris, Ph.D., University of Kentucky, 206 Combs Research Building, Lexington, KY 40536-0092, USA; +1 (859) 218-4092 (phone); +1 (859) 323-1979 (fax); burris.jessica@gmail.com..

J.L. Burris, J.L. Studts, and A.P. DeRosa have no conflict of interests to disclose.

Introduction

Tobacco use is well established as a leading cause of cancer (1, 2). In addition to its etiological role, tobacco use carries substantial clinical significance after cancer diagnosis. Tobacco use following cancer diagnosis is causally related to second primary cancer and both all-cause and cancer-specific mortality, and it is a risk factor for cancer recurrence, poorer treatment response, and treatment-related toxicity (2). Tobacco use is also correlated with poor quality of life outcomes, including symptoms of depression and indicators of stress (3-6). Consequently, the American Association for Cancer Research, American Society of Clinical Oncology, and International Society of Nurses in Cancer Care all advocate for systematic assessment and routine treatment of tobacco use among cancer patients (6-8).

Despite the objective importance of tobacco use after cancer diagnosis, methodological limitations in the assessment and reporting of tobacco use make it difficult to determine the true scope of the problem. Studies on the prevalence of persistent smoking after cancer diagnosis often yield highly divergent results. In head and neck (head/neck) cancer studies, for example, Lin and colleagues (9) found an 18% prevalence rate of current cigarette smoking while Duffy and colleagues (10) found a 30% prevalence rate. Reasons for such variation include heterogeneity in study design, outcome measurement, and sample characteristics.

While the relevant literature has grown recently, to our knowledge, no systematic review addresses the prevalence of tobacco use after cancer diagnosis. With ever-increasing demands on oncologists' time and limited resources in most cancer centers, resource allocation toward tobacco use treatment must be firmly grounded in scientific evidence. Consequently, we conducted a systematic literature review to a) determine the prevalence of tobacco use after lung or head/neck cancer diagnosis and b) identify the methodological characteristics of existing studies in order to provide recommendations for future work. While the number of cancers attributable to tobacco use continues to expand, we focus on lung and head/neck cancers because they are the most widely known "tobacco-related malignances" (1, 2).

Materials and Methods

Search Strategy and Data Sources

Following best practices for systematic reviews (11), we registered our study with PROSPERO International (Centre for Reviews and Dissemination #42012002625, http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42012002625) and then conducted an extensive electronic search to identify pertinent published papers. Searches were conducted by a reference librarian (APD) in the following databases with publication dates ranging from January 1, 1980 to December 31, 2011: CINAHL, Cochrane Library, EMBASE, MEDLINE (via PubMed), PsycINFO, and Web of Science. Both controlled vocabulary and text word searches were conducted, as appropriate. Search terms included, but were not limited to: head and neck neoplasm; lung neoplasm; smoking; snuff; tobacco; tobacco, smokeless; cessation; quit; smoking cessation; and tobacco use cessation products.

A complete description of our Medical Subject Headings (MeSH) and keyword terms, as well as our exact MEDLINE search strategy, is available upon request. After the aforementioned search, but before data synthesis, several relevant studies were published. Consequently, we performed another MEDLINE search for publication dates ranging from January 1, 2012 to June 31, 2014.

Inclusion-Exclusion Criteria

For inclusion in this systematic review, papers needed to meet these criteria: a) include a sample of at least 25% lung and/or head/neck cancer patients, b) measure the prevalence of *current* tobacco use *after* cancer diagnosis, and c) be written in English. Case studies, commentaries, editorials, abstracts, dissertations, and review articles were excluded. In addition, we excluded 14 papers that described clinical trials to promote tobacco cessation (12-25), as we intended to provide valid estimates of the natural history of tobacco use after cancer diagnosis. Readers interested in such interventions may see a recently published meta-analysis on the subject (26).

Search Results and Data Extraction

Search results were combined in a bibliographic reference management tool (EndNote X7). After elimination of duplicates, our search strategy yielded 7,777 citations. The titles and abstracts of these papers were reviewed to identify those that addressed plausibly relevant topics. Papers judged by at least one of 3 reviewers (JLB, JLS, and JSO) to be worthy of further consideration advanced to the next stage of review. The second step involved reviewing full-length papers. Data were extracted and entered into a Research Electronic Data Capture (REDCap) (27) database. We extracted data on the sample, methods, and results of each paper, and we coded data as “missing” whenever appropriate. In addition to those variables that were easily identifiable in a given article (e.g., gender composition), we computed some variables based on available information in text or tables (see “Measurement of Select Variables” below). The first author (JLB) independently coded each full-length paper using a detailed manual. Half of the papers were *a priori* randomly selected for independent double coding by another author (JLS or JSO) to ensure the first author’s strict adherence to the coding manual. Discussions among the authors were used to resolve disagreements and achieve consensus. Figure 1 shows our search results.

Measurement of Select Variables

We coded two variables based on where participants were along the cancer trajectory. First, we coded “phase of survivorship” based on participants’ number of months since cancer diagnosis *at the time current tobacco use was assessed* (e.g., 0-3 months). Second, we coded “phase of treatment” based on participants’ treatment phase *at the time current tobacco use was assessed* (e.g., during treatment). For both phase of survivorship and treatment, data were coded at the sample level. In the case of longitudinal studies, coding for these variables was based on baseline data. Additionally, we classified participants in longitudinal studies as falling into one of 4 categories based on their smoking status at each time-point: 1) persistent smoker: smoker at every assessment, 2) relapser: non-smoker at an earlier assessment, but smoker at the final assessment, 3) late quitter: smoker at an earlier

assessment, but non-smoker at the final assessment, or 4) persistent abstainer: non-smoker at every assessment.

Results

Summary of Studies

We identified 131 papers that reported the prevalence of tobacco use after lung or head/neck cancer diagnosis (4, 5, 9, 10, 28-154), with the earliest study published in 1980 (83). Most studies were conducted in the United States (60.3%, *n*=79; e.g., (74, 99, 101, 114, 134)), with the next most common study locations being in Canada (7.6%, *n*=10; (30, 38, 39, 44, 65, 84, 97, 104, 147, 148)) and France (4.6%, *n*=6; (32, 37, 100, 108, 113, 146)). Most papers described cross-sectional studies (75.6%, *n*=99), but some described longitudinal studies (24.4%, *n*=32) (10, 35, 38, 42, 45, 46, 52-54, 56, 62, 65, 69, 73, 75, 76, 80, 84, 89, 90, 98, 100, 103, 104, 118, 121, 123, 126, 129, 135, 149, 152). For the longitudinal studies, the number of tobacco use assessments ranged from two (e.g., (42, 100, 123)) to ≥ 5 (e.g., (69, 103, 121)); the number of assessments was sometimes unclear (e.g., (35, 118, 152)). Participant recruitment usually involved clinics or hospitals (88.5%, *n*=116; e.g., (50, 101, 139)), though some studies recruited through cancer registries (6.1%, *n*=8); (31, 56, 66, 100, 128, 138, 142, 150)) or relied on population-based survey data (1.5%, *n*=2; (85, 153)); only a handful of studies used multiple recruitment strategies (3.8%, *n*=5) (52, 53, 73, 103, 125).

Characteristics of Participants

Sample sizes ranged from 13 (105) to 7,990 (102) with a mean of 384.4 (*SD*=805.4; median=176.0) participants. Most studies consisted exclusively of either lung (48.1%, *n*=63; e.g., (53, 85, 86, 116, 121, 146)) or head/neck (42.7%, *n*=56; e.g., (38, 49, 59, 72, 79)) cancer patients. Other clinical characteristics are summarized in Table 1. Given the clinical population, the predominance of older, male samples was not unexpected. Indeed, participants' mean age at study enrollment was 61.8 (*SD*=3.6; median=61.6) years (range: 55.0 (9) – 71.0 (67, 128)) and in 85.0% (*n*=102/120) of papers, women made up fewer than half of the sample. Participants' racial and ethnic background was infrequently reported (missing: 59.5%, *n*=78), as was their educational attainment (missing: 76.3%, *n*=100) and relationship status (missing: 71.0%, *n*=93). In cases where such information was available, participants could typically be described as predominately White, non-Hispanic individuals with at least a high school education or equivalent. Marital status was more varied, with several studies including a fair number of single or unmarried participants. Lifetime history of tobacco use was the most frequently measured tobacco use history variable (compared to pack years, for example), with 80.1% (*n*=105) of studies reporting such data. We found 51.3% (48) to 100.0% (31, 36, 42, 44, 51, 54, 72, 73, 76, 80, 84, 117, 129-132, 135, 145, 147-149) of participants had a positive lifetime history, with nearly half of all relevant studies (47.6%, *n*=50/105) classifying ≥ 90.0% of participants as current or former smokers.

Measurement of Tobacco Use After Cancer Diagnosis

In 13.7% (*n*=18) of papers, the method used to measure tobacco use was unspecified (28, 29, 37, 58, 77, 102, 105, 107, 109, 116, 117, 119, 124, 134, 139, 140, 148, 154). When this information was reported, data were typically collected directly from participants (57.3%,

n=75; e.g., (59, 65, 86, 110, 136)). When chart reviews were used to measure tobacco use (14.5%, *n*=19) (9, 31, 33, 43, 48, 50, 66, 68, 79, 91, 93, 94, 98, 108, 118, 142, 146, 147, 150), it was often unclear whether the data arose from patient report and/or clinician ratings. Biochemical analysis was occasionally used to validate self-report data (14.5%, *n*=19) (39, 42, 52-54, 67, 73, 75, 76, 88, 89, 96, 101, 106, 122, 126, 128, 135, 149), with cotinine as the most frequent assay (89.5%, *n*=17/19). In no study employing biochemical validation was there 100% agreement between self-report and biochemical analysis. As examples, Browning and colleagues found a misreporting rate of 7% (42), Hay and colleagues found a rate of 3% (76), and Landi and colleagues found a rate less than 1% (96). Regardless of how tobacco use was ascertained, the specific definition used to calculate the prevalence of current tobacco use was often unavailable (61.1%, *n*=80); see Table 1. Finally, nicotine dependence measures like the *Fagerström Test of Nicotine Dependence* (155) and *Heaviness of Smoking Index* (156) were rarely used (9.2%, *n*=12; (36, 51-53, 65, 73, 75, 76, 106, 129, 135, 149)).

Prevalence of Tobacco Use After Cancer Diagnosis

Cross-Sectional Data—Based on the cross-sectional studies and the baseline assessments from longitudinal studies (*n*=117), the overall prevalence of tobacco use after lung or head/neck cancer diagnosis ranged from 0.0% (105) to 100.0% (42); the mean prevalence rate was 33.0% (*SD*=18.8; median=31.0%). Whether these prevalence data are analyzed by publication dates split into 5- or 10-year increments, no temporal trends emerged (data not shown). Notably, this prevalence rate varied between samples of exclusively lung (29.6% (*SD*=18.5)) versus head/neck (36.8% (*SD*=19.6)) cancer patients. The aforementioned prevalence rates refer almost entirely to cigarette smoking, as very few papers (4.6%, *n*=6) addressed other tobacco products (e.g., snus, cigar) (63, 73, 75, 77, 87, 103). Consequently, in the text that follows, we limit our discussion to cigarette smoking.

In 27.5% (*n*=36) of studies, there was sufficient information to determine the prevalence of current smoking among participants who were current smokers at cancer diagnosis (4, 5, 34-36, 39, 40, 44, 46, 56, 60, 65, 76, 80-84, 87, 97, 110, 112, 115, 117, 123, 125, 128, 129, 136-138, 142-144, 149, 153). In many cases, the definition used to classify current smokers at cancer diagnosis was unreported (38.9% (*n*=14/36) (e.g., (4, 31, 87, 110, 128))). When it was reported, the most common definition corresponded to a 1-year point prevalence rate (54.5%, *n*=12/22) (e.g., (60, 101, 136, 138, 144)), which reflects smoking in the year prior to cancer diagnosis. Collapsing data across all point prevalence measures, this modified prevalence rate of persistent smoking ranged from 13.8% (76) to 100.0% (65, 84, 149), with a mean of 53.8% (*SD*=24.3; median=50.3%). Again, no temporal trends emerged from the data, but the prevalence rate did appear to differ between exclusively lung (50.3% (*SD*=27.8)) versus head/neck (57.3% (*SD*=18.3)) cancer samples.

The prevalence of current smoking after lung or head/neck cancer diagnosis can also be calculated based on where participants were along the cancer trajectory (see Figure 2, Panels A and B). Results of both the survivorship- and treatment-specific analysis suggest the overall prevalence of smoking may be greatest near the time of cancer diagnosis, declining sharply in the months immediately thereafter (coinciding with the onset of treatment), with a

risk of increasing as individuals get further out from cancer diagnosis and treatment.[1] While the aforementioned behavioral pattern is possible, the results shown in Figure 2 is based on cross-sectional data, which precludes any definitive remarks about within-person change.

Longitudinal Data—As stated above, 32 papers included ≥ 1 assessment of participants' tobacco use following cancer diagnosis. However, half (*n*=16) of these papers reported data such that participants were either continuing smokers or not (35, 38, 45, 46, 56, 69, 75, 89, 90, 98, 100, 103, 118, 123, 126, 152). For this sub-group of longitudinal studies, the prevalence of smoking after lung or head/neck cancer diagnosis ranged from 8.2% (126) to 60.0% (75), with a mean of 30.5% (*SD*=15.0; median=26.8%). Among those participants who were current smokers at cancer diagnosis, the prevalence of persistent smoking ranged from 25.6% (46) to 57.3% (56), with a mean of 42.2% (*SD*=14.4; median=42.9%).

For the 16 studies that made full use of longitudinal data (10, 42, 52-54, 62, 65, 73, 76, 80, 84, 104, 121, 129, 135, 149), the prevalence of current smoking after lung or head/neck cancer diagnosis can be described in two ways. In 10 studies, there was sufficient information to create the 4-group categorical variable that captured change in smoking status over time (52, 53, 62, 65, 73, 76, 80, 84, 121, 129). As shown in Table 2, the largest category corresponds to persistent abstainers, though lung and head/neck cancer patients demonstrate some fluidity in their smoking behavior, as there is fair representation in the relapser and late quitter groups. In 11 studies, it was possible to calculate the prevalence of current smoking at distinct assessment time-points (10, 42, 52-54, 76, 80, 84, 129, 135, 149); two additional studies provided multiple prevalence estimates, but the length of time between assessments was unclear (65, 104). In an attempt to combine data across studies with major methodological differences, baseline was coded as "Month 0" and follow-ups were coded as baseline + X number of months. The prevalence of smoking at each assessment from Month 0 to 24 (the longest observation period was 24.5 months (84)) is shown in Figure 3. In regard to change over time, no clear pattern of increasing or decreasing prevalence emerged.

Other Tobacco Use Outcomes

Participants' amount of smoking (e.g., cigarettes per day) was reported in fewer than 10% (*n*=10) of studies (49, 61, 72, 73, 76, 84, 121, 135, 144, 157). Likewise, information on post-cancer diagnosis quit attempts, continuous abstinence, and/or tobacco cessation treatment use was omitted from all but a handful of papers (35, 39, 42, 44, 51-54, 56, 60, 73, 75, 80, 82, 83, 87, 90, 97, 103, 112, 129). Given limited data, we chose not to aggregate findings across studies.

Discussion

Based on our systematic review of 131 papers, we estimate that the overall prevalence of current smoking after lung or head/neck cancer diagnosis is about 30%. Thus, at any given time, about one-third of individuals with a history of lung or head/neck cancer can be

[1]The second drop in the prevalence rate of smoking shown in Figure 2, Panel A, we believe, is probably due to low representation of smokers in studies of "long-term cancer survivors" as opposed to a high rate of smoking cessation at this time.

classified as current smokers. This prevalence rate far exceeds what is now typically found in population-based studies of adults in the United States (18.1% in 2012 (158); 33.2% in 1980 (159)), the most common location for the studies reviewed herein. If one only considers individuals who were current smokers at cancer diagnosis, the prevalence rate we found (roughly 50%) is sufficiently high to classify smokers at cancer diagnosis as "high risk" for persistent smoking in the ensuing weeks, months, and years. Regardless of whether one considers the overall prevalence rate or the modified prevalence rate based on the current smoker subgroup analysis, our findings are striking given the clear, negative implications that persistent smoking has on cancer outcomes (2, 6, 160). The observed rate of current smoking underscores the clinical necessity of a "paradigm shift" that would bring assessment and treatment of tobacco use to the forefront of cancer care (161). Recent cancer provider (162, 163) and patient (52, 53) report surveys highlight critical gaps between recommended evidence-based guidelines (164-166) and actual delivery of tobacco cessation treatment in the cancer setting, which indicates there is much room for improvement for this aspect of quality cancer care.

This paper represents the first systematic review of a growing empirical literature on tobacco use after lung or head/neck cancer diagnosis. However, there remains an incomplete picture of this clinical problem, partly due to methodological limitations in the measurement and reporting of cancer patients' tobacco use. At minimum, accurate classification of cancer patients as "current," "former," or "never" tobacco users requires an operational definition for each category. Current tobacco users could be defined by 1-year, 30-day, 7-day, or 24-hour point prevalence (167), so specificity is necessary. Given that a larger window of observation allows greater heterogeneity in smoking behavior at both the individual and sample level, and relapse curves for smoking differ based on time since quit attempt (53, 149, 168, 169), there is strong need to standardize tobacco use assessment (6). Reliable and valid measurement of tobacco use should be required for clinical trials so as to advance the scientific knowledge on the risks of persistent tobacco use on clinical outcomes (170, 171). In addition, for clinical practice, proper assessment is essential to identify current tobacco users and provide evidence-based treatment (7, 8). Although we recognize the pitfalls of a "one size fits all" approach, we recommend adoption of a 30-day point prevalence definition of current tobacco user, consistent with the National Cancer Institute – American Association for Cancer Research Cancer Patient Tobacco Use Assessment Taskforce (172) and National Comprehensive Cancer Network Clinical Practice Guidelines for Smoking Cessation (173). Furthermore, in some research and clinical settings, we believe it necessary to employ biochemical verification of tobacco use status since nicotine may impact the course of cancer treatment (174-176) and misreporting is a well-documented problem in the context of cancer care (e.g., (42, 177)).

Due to the changing landscape of tobacco products, we suggest cigarette smoking *not* be measured in isolation. With the advent of potentially reduced exposure products (178), cancer patients – like smokers in the general population (179-183) – might consider use of non-combustible tobacco products. Motivation for snus use, in particular, might arise due to a) the perception that it is less harmful than cigarette smoking, b) the desire to reduce or quit smoking, and/or c) the ability to circumvent smoking restrictions and mitigate nicotine

withdrawal when smoking is prohibited (184-188). Similarly, cancer patients may be motivated to use electronic cigarettes as a substitute or complement to smoking, or perhaps as an aid to smoking cessation (182, 189). A paucity of the papers we reviewed provide information about non-cigarette tobacco products, so the prevalence of non-cigarette tobacco use among lung and head/neck cancer patients is unclear. But, if one generalizes from the general population (179, 190-192), dual or poly tobacco use may be on the rise among cancer patients.

A final comment about methodology pertains to the need to collect data on post-cancer diagnosis quit attempts (e.g., time to relapse) and tobacco cessation treatment use (e.g., nicotine replacement therapy). Some data suggests cancer patients attempt tobacco cessation without formal assistance (166), which decreases the likelihood of long-term abstinence (165, 169). Given the potential value of designing interventions that capitalize on the "teachable moment" of cancer diagnosis (20, 193, 194), there is dire need to better understand the naturalistic process of smoking cessation after cancer diagnosis (e.g., the nature of the relapse curve, the amount of time that passes between quit attempts), as there currently exist only a handful of longitudinal studies on the subject (53, 73, 149). Similarly, further research identifying demographic, clinical, and psychosocial factors associated with persistent smoking is needed for targeting and tailoring tobacco cessation treatment.

Limitations of this systematic review deserve comment. First, the decision to focus on lung and head/neck cancer limits the generalizability of our findings. It is quite possible the prevalence rates we found may be higher or lower than what would be observed in other samples. Thus, as the literature matures, it will be important to consider tobacco use patterns in cancer patients with other diagnoses. Second, there is selection bias since we did not include the "grey literature" nor did we include papers published in languages other than English. Third, we did not formally rate the quality of each paper, instead judging the overall methodological strengths and weaknesses of the extant body of published literature. Finally, due to the wide heterogeneity of studies, we did not conduct a meta-analysis.

Conclusions

This systematic review found roughly one-third of lung and head/neck cancer patients continue to smoke after cancer diagnosis. The rate of current smoking is even higher (approximately half) among those individuals who were current smokers at cancer diagnosis. Generally low rates of misreporting smoking status were observed in the studies reviewed here, but failures to biochemically validate self-reported tobacco use data are known to occur in some cancer settings. Estimates of the overall prevalence of smoking seem to rise and fall at different points across the cancer trajectory. Similarly, within any given cancer patient, smoking status may fluctuate due to the chronic nature of nicotine dependence and the stressors of living with cancer. Due to the methodological limitations of prior studies, and great heterogeneity in the extant body of literature, however, we are not yet in a position to provide details about the process of smoking cessation after cancer diagnosis. As is, our findings only begin to document the magnitude of the problem of tobacco use after cancer diagnosis. To advance the field of cancer prevention and control,

we strongly support greater uniformity in tobacco use assessment and firm requirements to integrate tobacco cessation treatment into routine cancer care (6).

Acknowledgements

The authors would like to acknowledge Stephanie Land, Ph.D. for her insightful review of an earlier version of this manuscript.

J.S. Ostroff received commercial grant support from Pfizer.

Research reported in this publication was supported by grants K07 CA181351 from the National Cancer Institute of the National Institutes of Health (J.L. Burris), UL1 TR000117-02 from the National Center for Research Resources and the National Center for Advancing Translational Sciences of the National Institutes of Health (University of Kentucky), P30 CA08748-48 from the National Cancer Institute of the National Institutes of Health (J.S. Ostroff), and KLCRP12.13 from the Kentucky Lung Cancer Research Program (J.L. Studts). The content is solely the responsibility of the authors and does not necessarily represent the official views of the funding agencies.

References

1. International Agency for Research on Cancer (IARC) Monograph Working Group on the Evaluation of Carcinogenic Risks to Humans. A review of human carcinogens-Part A: Pharmaceuticals. IARC Monogr Eval Carcinog Risks Hum. 2012; 100A:1–448.
2. US Department of Health and Human Services. The health consequences of smoking-50 years of progress: a report of the Surgeon General. US Department of Health and Human Services, Centers for Chronic Disease and Control and Prevention, National Center for Chronic Disease Prevention and Control, Office on Smoking and Health; Atlanta (GA): 2014.
3. Duffy SA, Ronis DL, Valenstein M, Fowler KE, Lambert MT, Bishop C, et al. Depressive symptoms, smoking, drinking, and quality of life among head and neck cancer patients. Psychosomatics. 2007; 48:142–8. [PubMed: 17329608]
4. Balduyck B, Sardari Nia P, Cogen A, Dockx Y, Lauwers P, Hendriks J, et al. The effect of smoking cessation on quality of life after lung cancer surgery. Eur J Cardiothorac Surg. 2011; 40:1432–8. [PubMed: 21498082]
5. Garces YI, Yang P, Parkinson J, Zhao XH, Wampfler JA, Ebbert JO, et al. The relationship between cigarette smoking and quality of life after lung cancer diagnosis. Chest. 2004; 126:1733–41. [PubMed: 15596667]
6. Toll BA, Brandon TH, Gritz ER, Warren GW, Herbst RS, AACR Subcommittee on Tobacco and Cancer. Assessing tobacco use by cancer patients and facilitating cessation: an American Association for Cancer Research policy statement. Clin Cancer Res. 2013; 19:1941–8. [PubMed: 23570694]
7. Hanna NH, Mulshine J, Wollins DS, Tyne C, Dresler C. Tobacco cessation and control a decade later: American Society of Clinical Oncology policy statement update. J Clin Oncol. 2013; 31:3147–57. [PubMed: 23897958]
8. International Society of Nurses in Cancer Care. Position statement title: ISNCC tobacco position statement. International Society of Nurses in Cancer Care; Van Couver (BC): 2014.
9. Lin BM, Wang H, D'Souza G, Zhang Z, Fakhry C, Joseph AW, et al. Long-term prognosis and risk factors among patients with HPV-associated oropharyngeal squamous cell carcinoma. Cancer. 2013; 119:3462–71. [PubMed: 23861037]
10. Duffy SA, Khan MJ, Ronis DL, Fowler KE, Gruber SB, Wolf GT, et al. Health behaviors of head and neck cancer patients the first year after diagnosis. Head Neck. 2008; 30:93–102. [PubMed: 17685451]
11. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLoS Medicine. 2009; 6:e1000097. [PubMed: 19621072]

12. Browning KK, Ahijevych KL, Ross P Jr. Wewers ME. Implementing the Agency for Health Care Policy and Research's Smoking Cessation Guideline in a lung cancer surgery clinic. Oncol Nurs Forum. 2000; 27:1248–54. [PubMed: 11013905]
13. Cox LS, Patten CA, Ebbert JO, Drews AA, Croghan GA, Clark MM, et al. Tobacco use outcomes among patients with lung cancer treated for nicotine dependence. J Clin Oncol. 2002; 20:3461–9. [PubMed: 12177107]
14. Duffy SA, Ronis DL, Valenstein M, Lambert MT, Fowler KE, Gregory L, et al. A tailored smoking, alcohol, and depression intervention for head and neck cancer patients. Cancer Epidemiol Biomarkers Prev. 2006; 15:2203–8. [PubMed: 17119047]
15. Garces YI, Schroeder DR, Nirelli LM, Croghan GA, Croghan IT, Foote RL, et al. Tobacco use outcomes among patients with head and neck carcinoma treated for nicotine dependence - a matched-pair analysis. Cancer. 2004; 101:116–24. [PubMed: 15221996]
16. Gritz ER, Carr CR, Rapkin D, Abemayor E, Chang LJ, Wong WK, et al. Predictors of long-term smoking cessation in head and neck cancer patients. Cancer Epidemiol Biomarkers Prev. 1993; 2:261–70. [PubMed: 8318879]
17. Park ER, Japuntich S, Temel J, Lanuti M, Pandiscio J, Hilgenberg J, et al. A smoking cessation intervention for thoracic surgery and oncology clinics: a pilot trial. J Thorac Oncol. 2011; 6:1059–65. [PubMed: 21512406]
18. Schnoll RA, Martinez E, Tatum KL, Weber DM, Kuzla N, Glass M, et al. A bupropion smoking cessation clinical trial for cancer patients. Cancer Causes Control. 2010; 21:811–20. [PubMed: 20087643]
19. Schnoll RA, Rothman RL, Wielt DB, Lerman C, Pedri H, Wang H, et al. A randomized pilot study of cognitive-behavioral therapy versus basic health education for smoking cessation among cancer patients. Ann Behav Med. 2005:1–11. [PubMed: 16097900]
20. Sharp L, Johansson H, Fagerstrom K, Rutqvist LE. Smoking cessation among patients with head and neck cancer: cancer as a 'teachable moment'. Eur J Cancer Care. 2008; 17:114–9.
21. Stanislaw AE, Wewers ME. A smoking cessation intervention with hospitalized surgical cancer patients: a pilot study. Cancer Nurs. 1994; 17:81–6. [PubMed: 8020001]
22. Wewers ME, Bowen JM, Stanislaw AE, Desimone VB. A nurse-delivered smoking cessation intervention among hospitalized postoperative patients--influence of a smoking-related diagnosis: a pilot study. Heart Lung. 1994; 23:151–6. [PubMed: 8206773]
23. Wewers ME, Jenkins L, Mignery T. A nurse-managed smoking cessation intervention during diagnostic testing for lung cancer. Oncol Nurs Forum. 1997; 24:1419–22. [PubMed: 9380597]
24. Sanderson Cox L, Patten CA, Ebbert JO, Drews AA, Croghan GA, Clark MM, et al. Tobacco use outcomes among patients with lung cancer treated for nicotine dependence. J Clin Oncol. 2002; 20:3461–9. [PubMed: 12177107]
25. Schnoll RA, Zhang B, Rue M, Krook JE, Spears WT, Marcus AC, et al. Brief physician-initiated quit-smoking strategies for clinical oncology settings: a trial coordinated by the Eastern Cooperative Oncology Group. J Clin Oncol. 2003; 21:355–65. [PubMed: 12525530]
26. Nayan S, Gupta MK, Sommer DD. Evaluating smoking cessation interventions and cessation rates in cancer patients: a systematic review and meta-analysis. ISRN Oncol. 2011; 2011
27. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap) - a metadata-driven methodology and workflow process for providing translational research informatics support. Journal of Biomedical Information. 2009; 42:377–81.
28. Akerley W, Boucher KM, Bentz JS, Arbogast K, Walters T. A phase II study of erlotinib as initial treatment for patients with stage IIIB-IV non-small cell lung cancer. J Thorac Oncol. 2009; 4:214–9. [PubMed: 19179899]
29. Al-Mamgani A, van Rooij PH, Woutersen DP, Mehilal R, Tans L, Monserez D, et al. Radiotherapy for T1-2N0 glottic cancer: a multivariate analysis of predictive factors for the long-term outcome in 1050 patients and a prospective assessment of quality of life and voice handicap index in a subset of 233 patients. Clinical Otolaryngol. 2013; 38:306–12.
30. Allison PJ. Factors associated with smoking and alcohol consumption following treatment for head and neck cancer. Oral Oncol. 2001; 37:513–20. [PubMed: 11435178]

31. Asaph JW, Keppel JF, Handy JR Jr, Charles Douville E, Tsen AC, Ott GY. Surgery for second lung cancers. Chest. 2000; 118:1621–5. [PubMed: 11115449]
32. Bagan P, Berna P, De Dominicis F, Das Neves Pereira JC, Mordant P, De La Tour B, et al. Nutritional status and postoperative outcome after pneumonectomy for lung cancer. Ann Thorac Surg. 2013; 95:392–6. [PubMed: 22841015]
33. Bar-Ad V, Wang ZX, Leiby B, Tuluc M. Combination of p16 levels and preradiotherapy factors predicts outcome in patients treated for oropharyngeal carcinoma. J BUON. 2013; 18:982–8. [PubMed: 24344027]
34. Barrera R, Shi W, Amar D, Thaler HT, Gabovich N, Bains MS, et al. Smoking and timing of cessation: impact on pulmonary complications after thoracotomy. Chest. 2005; 127:1977–83. [PubMed: 15947310]
35. Baser S, Shannon VR, Eapen GA, Jimenez CA, Onn A, Lin E, et al. Smoking cessation after diagnosis of lung cancer is associated with a beneficial effect on performance status. Chest. 2006; 130:1784–90. [PubMed: 17166997]
36. Berg CJ, Thomas AN, Mertens AC, Schauer GL, Pinsker EA, Ahluwalia JS, et al. Correlates of continued smoking versus cessation among survivors of smoking-related cancers. Psychooncology. 2013; 22:799–806. [PubMed: 22488864]
37. Besse B, Planchard D, Veillard AS, Taillade L, Khayat D, Ducourtieux M, et al. Phase 2 study of frontline bortezomib in patients with advanced non-small cell lung cancer. Lung Cancer. 2012; 76:78–83. [PubMed: 22186627]
38. Bjarnason GA, Mackenzie RG, Nabid A, Hodson ID, El-Sayed S, Grimard L, et al. Comparison of toxicity associated with early morning versus late afternoon radiotherapy in patients with head-and-neck cancer: a prospective randomized trial of the National Cancer Institute of Canada Clinical Trials Group (HN3). Int J Radiat Oncol Biol Phys. 2009; 73:166–72. [PubMed: 18805649]
39. Browman GP, Mohide EA, Willan A, Hodson I, Wong G, Grimard L, et al. Association between smoking during radiotherapy and prognosis in head and neck cancer: a follow-up study. Head Neck. 2002; 24:1031–7. [PubMed: 12454940]
40. Browman GP, Wong G, Hodson I, Sathya J, Russell R, McAlpine L, et al. Influence of cigarette smoking on the efficacy of radiation therapy in head and neck cancer. NEJM. 1993; 328:159–63. [PubMed: 8417381]
41. Brown JK. Gender, age, usual weight, and tobacco use as predictors of weight loss in patients with lung cancer. Oncol Nurs Forum. 1993; 20:466–72. [PubMed: 8388561]
42. Browning KK, Wewers ME, Ferketich AK, Otterson GA, Reynolds NR. The self-regulation model of illness applied to smoking behavior in lung cancer. Cancer Nurs. 2009; 32:E15–E25. [PubMed: 19444080]
43. Canver CC, Cooler SD, Nichols RD. The influence of cardiopulmonary function on outcome of veterans undergoing resectional therapy for lung cancer. J Cardiovasc Surg. 1998; 39:497–501. [PubMed: 9788800]
44. Chan Y, Irish JC, Wood SJ, Sommer DD, Brown DH, Gullane PJ, et al. Smoking cessation in patients diagnosed with head and neck cancer. J Otolaryngolog. 2004; 33:75–81.
45. Chen AM, Chen LM, Vaughan A, Sreeraman R, Farwell DG, Luu Q, et al. Tobacco smoking during radiation therapy for head-and-neck cancer is associated with unfavorable outcome. Int J Radiat Oncol Biol Phys. 2011; 79:414–9. [PubMed: 20399030]
46. Chen J, Qi Y, Wampfler JA, Jatoi A, Garces YI, Busta AJ, et al. Effect of cigarette smoking on quality of life in small cell lung cancer patients. Eur J Cancer. 2012; 48:1593–601. [PubMed: 22244802]
47. Cheville AL, Novotny PJ, Sloan JA, Basford JR, Wampfler JA, Garces YI, et al. Fatigue, dyspnea, and cough comprise a persistent symptom cluster up to five years after diagnosis with lung cancer. J Pain Symptom Manage. 2011; 42:202–12. [PubMed: 21398090]
48. Cho S, Song IH, Yang HC, Kim K, Jheon S. Predictive factors for node metastasis in patients with clinical stage I non-small cell lung cancer. Annals Thorac Surg. 2013; 96:239–45.

49. Christensen AJ, Moran PJ, Ehlers SL, Raichle K, Karnell L, Funk G. Smoking and drinking behavior in patients with head and neck cancer: effects of behavioral self-blame and perceived control. J Behav Med. 1999; 22:407–18. [PubMed: 10586379]
50. Colasanto JM, Haffty BG, Wilson LD. Evaluation of local recurrence and second malignancy in patients with T1 and T2 squamous cell carcinoma of the larynx. Cancer J. 2004; 10:61–6. [PubMed: 15000497]
51. Cooley ME, Emmons KM, Haddad R, Wang Q, Posner M, Bueno R, et al. Patient-reported receipt of and interest in smoking-cessation interventions after a diagnosis of cancer. Cancer. 2011; 117:2961–9. [PubMed: 21692055]
52. Cooley ME, Sarna L, Brown JK, Williams RD, Chernecky C, Padilla G, et al. Tobacco use in women with lung cancer. Ann Behav Med. 2007; 33:242–50. [PubMed: 17600451]
53. Cooley ME, Sarna L, Kotlerman J, Lukanich JM, Jaklitsch M, Green SB, et al. Smoking cessation is challenging even for patients recovering from lung cancer surgery with curative intent. Lung Cancer. 2009; 66:218–25. [PubMed: 19321223]
54. Cooley ME, Wang Q, Johnson BE, Catalano P, Haddad RI, Bueno R, et al. Factors associated with smoking abstinence among smokers and recent-quitters with lung and head and neck cancer. Lung Cancer. 2012; 76:144–9. [PubMed: 22093155]
55. Daniel M, Keefe FJ, Lyna P, Peterson B, Garst J, Kelley M, et al. Persistent smoking after a diagnosis of lung cancer is associated with higher reported pain levels. J Pain. 2009; 10:323–8. [PubMed: 19254679]
56. Day GL, Blot WJ, Shore RE, McLaughlin JK, Austin DF, Greenberg RS, et al. Second cancers following oral and pharyngeal cancers: role of tobacco and alcohol. J Natl Cancer Inst. 1994; 86:131–7. [PubMed: 8271296]
57. De Boer MF, Van den Borne B, Pruyn JF, Ryckman RM, Volovics L, Knegt PP, et al. Psychosocial and physical correlates of survival and recurrence in patients with head and neck carcinoma: results of a 6-year longitudinal study. Cancer. 1998; 83:2567–79. [PubMed: 9874465]
58. De Graeff A, De Leeuw JRJ, Ros WJG, Hordijk GJ, Blijham GH, Winnubst JAM. Sociodemographic factors and quality of life as prognostic indicators in head and neck cancer. Euro J Cancer. 2001; 37:332–9.
59. De Jesus RR, Meyer TN, Leite ICG, Pereira AAC, Armond MC. Epidemiologic profile and quality of life of patients treated for oral cancer in Juiz de Fora, Minas Gerais, Brazil. Med Oral Patol Oral Cir Bucal. 2010; 15:e20–e4. [PubMed: 19767695]
60. Des Rochers C, Dische S, Saunders MI. The problem of cigarette smoking in radiotherapy for cancer in the head and neck. Clin Oncol (R Coll Radiol). 1992; 4:214–6. [PubMed: 1622882]
61. Ditre JW, Gonzalez BD, Simmons VN, Faul LA, Brandon TH, Jacobsen PB. Associations between pain and current smoking status among cancer patients. Pain. 2011; 152:60–5. [PubMed: 21168758]
62. Do KA, Johnson MM, Lee JJ, Wu XF, Dong Q, Hong WK, et al. Longitudinal study of smoking patterns in relation to the development of smoking-related secondary primary tumors in patients with upper aerodigestive tract malignancies. Cancer. 2004; 101:2837–42. [PubMed: 15536619]
63. Duffy SA, Ronis DL, McLean S, Fowler KE, Gruber SB, Wolf GT, et al. Pretreatment health behaviors predict survival among patients with head and neck squamous cell carcinoma. J Clinic Oncol. 2009; 27:1969–75.
64. Duffy SA, Teknos T, Taylor JM, Fowler KE, Islam M, Wolf GT, et al. Health behaviors predict higher interleukin-6 levels among patients newly diagnosed with head and neck squamous cell carcinoma. Cancer Epidemiol Biomarkers Prev. 2013; 22:374–81. [PubMed: 23300019]
65. Eng L, Su J, Qiu X, Palepu PR, Hon H, Fadhel E, et al. Second-hand smoke as a predictor of smoking cessation among lung cancer survivors. J Clinic Oncol. 2014; 32:564–70.
66. Epstein JB, Lunn R, Le ND, Stevenson-Moore P, Gorsky M. Patients with oropharyngeal cancer: a comparison of adults living independently and patients living in long-term care facilities. Spec Care Dentist. 2005; 25:124–30. [PubMed: 15856920]
67. Evangelista LS, Sarna L, Brecht ML, Padilla G, Chen J. Health perceptions and risk behaviors of lung cancer survivors. Heart Lung. 2003; 32:131–9. [PubMed: 12734536]

68. Fox JL, Rosenzweig KE, Ostroff JS. The effect of smoking status on survival following radiation therapy for non-small cell lung cancer. Lung Cancer. 2004; 44:287–93. [PubMed: 15140541]
69. Fujisawa T, Iizasa T, Saitoh Y, Sekine Y, Motohashi S, Yasukawa T, et al. Smoking before surgery predicts poor long-term survival in patients with stage I non-small-cell lung carcinomas. J Clinic Oncol. 1999; 17:2086–91.
70. Funk GF, Karnell LH, Christensen AJ. Long-term health-related quality of life in survivors of head and neck cancer. Arch Otolaryngol Head Neck Surg. 2012; 138:123–33. [PubMed: 22248560]
71. Gosselin MH, Mahoney MC, Cummings KM, Loree TR, Sullivan M, King BA, et al. Evaluation of an intervention to enhance the delivery of smoking cessation services to patients with cancer. J Cancer Educ. 2011; 26:577–82. [PubMed: 21503842]
72. Gritz ER, Carr CR, Rapkin DA, Chang C, Beumer J, Ward PH. A smoking cessation intervention for head and neck cancer patients: trial design, patient accrual, and characteristics. Cancer Epidemiol Biomarkers Prev. 1991; 1:67–73. [PubMed: 1845173]
73. Gritz ER, Nisenbaum R, Elashoff RE, Holmes EC. Smoking behavior following diagnosis in patients with stage I non-small cell lung cancer. Cancer Causes Control. 1991; 2:105–12. [PubMed: 1651777]
74. Groth SS, Whitson BA, Kuskowski MA, Holmstrom AM, Rubins JB, Kelly RF. Impact of preoperative smoking status on postoperative complication rates and pulmonary function test results 1-year following pulmonary resection for non-small cell lung cancer. Lung Cancer. 2009; 64:352–7. [PubMed: 19019489]
75. Hald J, Overgaard J, Grau C. Evaluation of objective measures of smoking status--a prospective clinical study in a group of head and neck cancer patients treated with radiotherapy. Acta Oncol. 2003; 42:154–9. [PubMed: 12801134]
76. Hay J, Ostroff J, Burkhalter J, Li Y, Quiles Z, Moadel A. Changes in cancer-related risk perception and smoking across time in newly-diagnosed cancer patients. J Behav Med. 2007; 30:131–42. [PubMed: 17334916]
77. Hernando ML, Marks LB, Bentel GC, Zhou SM, Hollis D, Das SK, et al. Radiation-induced pulmonary toxicity: a dose-volume histogram analysis in 201 patients with lung cancer. Int J Radiat Oncol Biol Phys. 2001; 51:650–9. [PubMed: 11597805]
78. Hirao T, Nelson HH, Ashok TD, Wain JC, Mark EJ, Christiani DC, et al. Tobacco smoke-induced DNA damage and an early age of smoking initiation induce chromosome loss at 3p21 in lung cancer. Cancer Res. 2001; 61:612–5. [PubMed: 11212258]
79. Hocevar-Boltezar I, Zargi M, Strojan P. Risk factors for voice quality after radiotherapy for early glottic cancer. Radiother Oncol. 2009; 93:524–9. [PubMed: 19846231]
80. Hopenhayn C, Christian WJ, Christian A, Studts J, Mullet T. Factors associated with smoking abstinence after diagnosis of early stage lung cancer. Lung Cancer. 2013; 80:55–61. [PubMed: 23290222]
81. Jazieh AR, Foraida M, Ghouse M, Khalil MM, Kopp M, Savidge M. The impact of cancer diagnosis on the lifestyle and habits of patients served at a Veterans Administration Hospital. J Cancer Educ. 2006; 21:147–50. [PubMed: 17371179]
82. Jerjes W, Upile T, Radhi H, Petrie A, Abiola J, Adams A, et al. The effect of tobacco and alcohol and their reduction/cessation on mortality in oral cancer patients: short communication. Head Neck Oncol. 2012; 4:6. [PubMed: 22409767]
83. Johnston-Early A, Cohen MH, Minna JD. Smoking abstinence and small cell lung cancer survival: an association. JAMA. 1980; 244:2175–9. [PubMed: 6252357]
84. Kashigar A, Habbous S, Eng L, Irish B, Bissada E, Irish J, et al. Social environment, secondary smoking exposure, and smoking cessation among head and neck cancer patients. Cancer. 2013; 119:2701–9. [PubMed: 23765604]
85. Kawaguchi T, Matsumura A, Iuchi K, Ishikawa S, Maeda H, Fukai S, et al. Second primary cancers in patients with stage III non-small cell lung cancer successfully treated with chemo-radiotherapy. Jpn J Clin Oncol. 2006; 36:7–11. [PubMed: 16368713]
86. Kawahara M, Ushijima S, Kamimori T, Kodama N, Ogawara M, Matsui K, et al. Second primary tumours in more than 2-year disease-free survivors of small-cell lung cancer in Japan: the role of smoking cessation. Br J Cancer. 1998; 78:409–12. [PubMed: 9703291]

87. Kerawala CJ. Oral cancer, smoking and alcohol: the patients' perspective. Br J Oral Maxillofac Surg. 1999; 37:374–6. [PubMed: 10577751]

88. Khuri FR, Kim ES, Lee JJ, Winn RJ, Benner SE, Lippman SM, et al. The impact of smoking status, disease stage, and index tumor site on second primary tumor incidence and tumor recurrence in the head and neck retinoid chemoprevention trial. Cancer Epidemiol Biomarkers Prev. 2001; 10:823–9. [PubMed: 11489748]

89. Khuri FR, Lee JJ, Lippman SM, Kim ES, Cooper JS, Benner SE, et al. Randomized phase III trial of low-dose isotretinoin for prevention of second primary tumors in stage I and II head and neck cancer patients. J Natl Cancer Inst. 2006; 98:441–50. [PubMed: 16595780]

90. Kikidis D, Vlastarakos PV, Manolopoulos L, Yiotakis I. Continuation of smoking after treatment of laryngeal cancer: an independent prognostic factor? ORL J Otorhinolaryngol Relat Spec. 2012; 74:250–4. [PubMed: 23076368]

91. Kim AJ, Suh JD, Sercarz JA, Abemayor E, Head C, Funk G, et al. Salvage surgery with free flap reconstruction: factors affecting outcome after treatment of recurrent head and neck squamous carcinoma. Laryngoscope. 2007; 117:1019–23. [PubMed: 17545864]

92. Kim JS, Kim H, Shim YM, Han J, Park J, Kim DH. Aberrant methylation of the FHIT gene in chronic smokers with early stage squamous cell carcinoma of the lung. Carcinogenesis. 2004; 25:2165–71. [PubMed: 15231689]

93. Kim JS, Lee H, Kim H, Shim YM, Han J, Park J, et al. Promoter methylation of retinoic acid receptor beta 2 and the development of second primary lung cancers in non-small-cell lung cancer. J Clin Oncol. 2004; 22:3443–50. [PubMed: 15277540]

94. Koczywas M, Cristea M, Thomas J, McCarty C, Borneman T, Del Ferraro C, et al. Interdisciplinary palliative care intervention in metastatic non-small-cell lung cancer. Clin Lung Cancer. 2013; 14:736–44. [PubMed: 23871439]

95. Lambert MT, Terrell JE, Copeland LA, Ronis DL, Duffy SA. Cigarettes, alcohol, and depression: characterizing head and neck cancer survivors in two systems of care. Nicotine Tob Res. 2005; 7:233–41. [PubMed: 16036280]

96. Landi MT, Dracheva T, Rotunno M, Figueroa JD, Liu H, Dasgupta A, et al. Gene expression signature of cigarette smoking and its role in lung adenocarcinoma development and survival. PLoS One. 2008; 3

97. Lebel S, Feldstain A, McCallum M, Beattie S, Irish J, Bezjak A, et al. Do behavioural self-blame and stigma predict positive health changes in survivors of lung or head and neck cancers? Psychol Health. 2013; 28:1066–81. [PubMed: 23544675]

98. Leon X, Venegas MDP, Orus C, Lopez M, Garcia J, Quer M. Influence of the persistence of tobacco and alcohol use in the appearance of second neoplasm in patients with a head and neck cancer: a case-control study. Cancer Causes Control. 2009; 20:645–52. [PubMed: 19067191]

99. Logan HL, Fillingim RB, Bartoshuk LM, Sandow P, Tomar SL, Werning JW, et al. Smoking status and pain level among head and neck cancer patients. J Pain. 2010; 11:528–34. [PubMed: 20015696]

100. Magn N, Marcy PY, Chamorey E, Guardiola E, Pivot X, Schneider M, et al. Concomitant twice-a-day radiotherapy and chemotherapy in unresectable head and neck cancer patients: a long-term quality of life analysis. Head Neck. 2001; 23:678–82. [PubMed: 11443751]

101. Marin VP, Pytynia KB, Langstein HN, Dahlstrom KR, Wei Q, Sturgis EM. Serum cotinine concentration and wound complications in head and neck reconstruction. Plast Reconstr Surg. 2008; 121:451–7. [PubMed: 18300961]

102. Mason DP, Subramanian S, Nowicki ER, Grab JD, Murthy SC, Rice TW, et al. Impact of smoking cessation before resection of lung cancer: a Society of Thoracic Surgeons general thoracic surgery database study. Ann Thorac Surg. 2009; 88:362–71. [PubMed: 19632374]

103. Mayne ST, Cartmel B, Kirsh V, Goodwin WJ Jr. Alcohol and tobacco use prediagnosis and postdiagnosis, and survival in a cohort of patients with early stage cancers of the oral cavity, pharynx, and larynx. Cancer Epidemiol Biomarkers Prev. 2009; 18:3368–74. [PubMed: 19959684]

104. Meyer F, Bairati I, Fortin A, Gelinas M, Nabid A, Brochet F, et al. Interaction between antioxidant vitamin supplementation and cigarette smoking during radiation therapy in relation to

long-term effects on recurrence and mortality: a randomized trial among head and neck cancer patients. Int J Cancer. 2008; 122:1679–83. [PubMed: 18059031]

105. Miller KL, Zhou SM, Barrier RC Jr, Shafman T, Folz RJ, Clough RW, et al. Long-term changes in pulmonary function tests after definitive radiotherapy for lung cancer. Int J Radiat Oncol Biol Phys. 2003; 56:611–5. [PubMed: 12788165]
106. Morales NA, Romano MA, Cummings KM, Marshall JR, Hyland AJ, Hutson A, et al. Accuracy of self-reported tobacco use in newly diagnosed cancer patients. Cancer Causes Control. 2013; 24:1223–30. [PubMed: 23553611]
107. Myrdal G, Lambe M, Gustafsson G, Nilsson K, Stahle E. Survival in primary lung cancer potentially cured by operation: influence of tumor stage and clinical characteristics. Ann Thorac Surg. 2003; 75:356–63. [PubMed: 12607639]
108. Nagy-Mignotte H, Guillem P, Vesin A, Toffart AC, Colonna M, Bonneterre V, et al. Primary lung adenocarcinoma: characteristics by smoking habit and sex. Eur Respir J. 2011; 38:1412–9. [PubMed: 21828037]
109. Nakamura H, Haruki T, Adachi Y, Fujioka S, Miwa K, Taniguchi Y. Smoking affects prognosis after lung cancer surgery. Surg Today. 2008; 38:227–31. [PubMed: 18306996]
110. Nia PS, Weyler J, Colpaert C, Vermeulen P, Van Marck E, Van Schil P. Prognostic value of smoking status in operated non-small cell lung cancer. Lung Cancer. 2005; 47:351–9. [PubMed: 15713518]
111. Osthus AA, Aarstad AK, Olofsson J, Aarstad HJ. Prediction of survival by pretreatment health-related quality-of-life scores in a prospective cohort of patients with head and neck squamous cell carcinoma. JAMA Otolaryngol Head Neck Surg. 2013; 139:14–20. [PubMed: 23329087]
112. Ostroff JS, Jacobsen PB, Moadel AB, Spiro RH, Shah JP, Strong EW, et al. Prevalence and predictors of continued tobacco use after treatment of patients with head and neck cancer. Cancer. 1995; 75:569–76. [PubMed: 7812925]
113. Paris C, Benichou J, Saunier F, Metayer J, Brochard P, Thiberville L, et al. Smoking status, occupational asbestos exposure and bronchial location of lung cancer. Lung Cancer. 2003; 40:17–24. [PubMed: 12660003]
114. Petty WJ, Laudadio J, Brautnick L, Lovato J, Dotson T, Streer NP, et al. Phase II trial of dose-dense chemotherapy followed by dose-intense erlotinib for patients with newly diagnosed metastatic non-small cell lung cancer. Int J Oncol. 2013; 43:2057–63. [PubMed: 24100924]
115. Poveda-Roda R, Bagan JV, Jimenez-Soriano Y, Margaix-Munoz M, Sarrion-Perez G. Changes in smoking habit among patients with a history of oral squamous cell carcinoma (OSCC). Med Oral Patol Oral Cir Bucal. 2010; 15:e721–6. [PubMed: 20383100]
116. Rades D, Setter C, Dahl O, Schild SE, Noack F. The prognostic impact of tumor cell expression of estrogen receptor-alpha, progesterone receptor, and androgen receptor in patients irradiated for nonsmall cell lung cancer. Cancer. 2012; 118:157–63. [PubMed: 21713768]
117. Rades D, Setter C, Dahl O, Schild SE, Noack F. Fibroblast growth factor 2--a predictor of outcome for patients irradiated for stage II-III non-small-cell lung cancer. Int J Radiat Oncol Biol Phys. 2012; 82:442–7. [PubMed: 20950963]
118. Rades D, Setter C, Schild SE, Dunst J. Effect of smoking during radiotherapy, respiratory insufficiency, and hemoglobin levels on outcome in patients irradiated for non-small-cell lung cancer. Int J Radiat Oncol Biol Phys. 2008; 71:1134–42. [PubMed: 18258387]
119. Rice D, Kim HW, Sabichi A, Lippman S, Lee JJ, Williams B, et al. The risk of second primary tumors after resection of stage I nonsmall cell lung cancer. Ann Thorac Surg. 2003; 76:1001–8. [PubMed: 14529975]
120. Richardson GE, Tucker MA, Venzon DJ, Linnoila RI, Phelps R, Phares JC, et al. Smoking cessation after successful treatment of small-cell lung cancer is associated with fewer smoking-related second primary cancers. Ann Intern Med. 1993; 119:383–90. [PubMed: 8393311]
121. Sanderson Cox L, Sloan JA, Patten CA, Bonner JA, Geyer SM, McGinnis WL, et al. Smoking behavior of 226 patients with diagnosis of stage IIIA/IIIB non-small cell lung cancer. Psychooncology. 2002; 11:472–8. [PubMed: 12476429]

122. Sandhu S, Humphris G, Whitley S, Cardozo A, Sandhu A. Smoking habits in patients who have been treated for an oral cancer: validation of self-report using saliva cotinine. Oral Oncol. 2004; 40:576–8. [PubMed: 15063384]
123. Sandoval M, Font R, Manos M, Dicenta M, Quintana MJ, Bosch FX, et al. The role of vegetable and fruit consumption and other habits on survival following the diagnosis of oral cancer: a prospective study in Spain. Int J Oral Maxillofac Surg. 2009; 38:31–9. [PubMed: 18951763]
124. Sarihan S, Ercan I, Saran A, Cetintas SK, Akalin H, Engin K. Evaluation of infections in non-small cell lung cancer patients treated with radiotherapy. Cancer Detect Prev. 2005; 29:181–8. [PubMed: 15829379]
125. Sarna L. Smoking behaviors of women after diagnosis with lung cancer. Image J Nurs Sch. 1995; 27:35–41. [PubMed: 7721308]
126. Sarna L, Cooley ME, Brown JK, Chernecky C, Padilla G, Danao L, et al. Women with lung cancer: quality of life after thoracotomy: a 6-month prospective study. Cancer Nurs. 2010; 33:85–92. [PubMed: 20142740]
127. Sarna L, Lindsey AM, Dean H, Brecht ML, McCorkle R. Weight change and lung cancer: relationships with symptom distress, functional status, and smoking. Res Nurs Health. 1994; 17:371–9. [PubMed: 8090948]
128. Sarna L, Padilla G, Holmes C, Tashkin D, Brecht ML, Evangelista L. Quality of life of long-term survivors of non-small-cell lung cancer. J Clin Oncol. 2002; 20:2920–9. [PubMed: 12089220]
129. Schnoll RA, James C, Malstrom M, Rothman RL, Wang H, Babb J, et al. Longitudinal predictors of continued tobacco use among patients diagnosed with cancer. Ann Behav Med. 2003; 25:214–22. [PubMed: 12763716]
130. Schnoll RA, Malstrom M, James C, Rothman RL, Miller SM, Ridge JA, et al. Processes of change related to smoking behavior among cancer patients. Cancer Pract. 2002; 10:11–9. [PubMed: 11866704]
131. Schnoll RA, Malstrom M, James C, Rothman RL, Miller SM, Ridge JA, et al. Correlates of tobacco use among smokers and recent quitters diagnosed with cancer. Patient Educ Couns. 2002; 46:137–45. [PubMed: 11867244]
132. Schnoll RA, Subramanian S, Martinez E, Engstrom PF. Correlates of continued tobacco use and intention to quit smoking among Russian cancer patients. Int J Behav Med. 2011; 18:325–32. [PubMed: 21076900]
133. Shuman AG, Duffy SA, Ronis DL, Garetz SL, McLean SA, Fowler KE, et al. Predictors of poor sleep quality among head and neck cancer patients. Laryngoscope. 2010; 120:1166–72. [PubMed: 20513034]
134. Siddiqui F, Pajak TF, Watkins-Bruner D, Konski AA, Coyne JC, Gwede CK, et al. Pretreatment quality of life predicts for locoregional control in head and neck cancer patients: a radiation therapy oncology group analysis. Int J Radiat Oncol Biol Phys. 2008; 70:353–60. [PubMed: 17889449]
135. Simmons VN, Litvin EB, Jacobsen PB, Patel RD, McCaffrey JC, Oliver JA, et al. Predictors of smoking relapse in patients with thoracic cancer or head and neck cancer. Cancer. 2013; 119:1420–7. [PubMed: 23280005]
136. Spitz MR, Fueger JJ, Chamberlain RM, Goepfert H, Newell GR. Cigarette smoking patterns in patients after treatment of upper aerodigestive tract cancers. J Cancer Educ. 1990; 5:109–13. [PubMed: 2206932]
137. Sridhar KS, Raub WA Jr. Present and past smoking history and other predisposing factors in 100 lung cancer patients. Chest. 1992; 101:19–25. [PubMed: 1729068]
138. Stevens MH, Gardner JW, Parkin JL, Johnson LP. Head and neck cancer survival and life-style change. Arch Otolaryngol. 1983; 109:746–9. [PubMed: 6639443]
139. Su CK, Wang CC. Prognostic value of Chinese race in nasopharyngeal cancer. Int J Radiat Oncol Biol Phys. 2002; 54:752–8. [PubMed: 12377327]
140. Terhaard CH, Snippe K, Ravasz LA, van der Tweel I, Hordijk GJ. Radiotherapy in T1 laryngeal cancer: prognostic factors for locoregional control and survival, uni- and multivariate analysis. Int J Radiat Oncol Biol Phys. 1991; 21:1179–86. [PubMed: 1938516]

141. Thompson TL, Pagedar NA, Karnell LH, Funk GF. Factors associated with mortality in 2-year survivors of head and neck cancer. Arch Otolaryngol Head Neck Surg. 2011; 137:1100–5. [PubMed: 22106233]
142. Tomek MS, McGuirt WF. Second head and neck cancers and tobacco usage. Am J Otolaryng. 2003; 24:24–7.
143. Tromp DM, Brouha XDR, Hordijk GJ, Winnubst JAM, Gebhardt WA, Van Der Doef MP, et al. Medical care-seeking and health-risk behavior in patients with head and neck cancer: the role of health value, control beliefs and psychological distress. Health Educ Res. 2005; 20:665–75. [PubMed: 15863624]
144. Tsao AS, Liu D, Lee JJ, Spitz M, Hong WK. Smoking affects treatment outcome in patients with advanced nonsmall cell lung cancer. Cancer. 2006; 106:2428–36. [PubMed: 16634096]
145. Vander Ark W, DiNardo LJ, Oliver DS. Factors affecting smoking cessation in patients with head and neck cancer. Laryngoscope. 1997; 107:888–92. [PubMed: 9217125]
146. Vergnenegre A, Monnet I, Chouaid C, Hureaux J, Mazieres J, Quere G, et al. Multicenter observational study of erlotinib therapy (OBSTAR) for non small-cell lung cancer: A GFPC study. Lung Cancer. 2011; 74:264–7. [PubMed: 21571389]
147. Videtic GM, Stitt LW, Dar AR, Kocha WI, Tomiak AT, Truong PT, et al. Continued cigarette smoking by patients receiving concurrent chemoradiotherapy for limited-stage small-cell lung cancer is associated with decreased survival. J Clin Oncol. 2003; 21:1544–9. [PubMed: 12697879]
148. Videtic GMM, Truong PT, Ash RB, Yu EW, Kocha WI, Vincent MD, et al. Does sex influence the impact that smoking, treatment interruption and impaired pulmonary function have on outcomes in limited stage small cell lung cancer treatment? Can Respir J. 2005; 12:245–50. [PubMed: 16107912]
149. Walker MS, Vidrine DJ, Gritz ER, Larsen RJ, Yan Y, Govindan R, et al. Smoking relapse during the first year after treatment for early-stage non-small-cell lung cancer. Cancer Epidemiol Biomarkers Prev. 2006; 15:2370–7. [PubMed: 17132767]
150. Westra WH, Offerhaus GJA, Goodman SN, Slebos RJC, Polak M, Baas IO, et al. Overexpression of the p53 tumor suppressor gene product in primary lung adenocarcinomas is associated with cigarette smoking. Am J Surg Pathol. 1993; 17:213–20. [PubMed: 8434702]
151. Yano T, Shoji F, Baba H, Koga T, Shiraishi T, Orita H, et al. Significance of the urinary 8-OHdG level as an oxidative stress marker in lung cancer patients. Lung Cancer. 2009; 63:111–4. [PubMed: 18676055]
152. Zevallos JP, Mallen MJ, Lam CY, Karam-Hage M, Blalock J, Wetter DW, et al. Complications of radiotherapy in laryngopharyngeal cancer: effects of a prospective smoking cessation program. Cancer. 2009; 115:4636–44. [PubMed: 19569250]
153. Park ER, Japuntich SJ, Rigotti NA, Traeger L, He Y, Wallace RB, et al. A snapshot of smokers after lung and colorectal cancer diagnosis. Cancer. 2012; 118:3153–64. [PubMed: 22271645]
154. Poullis M, McShane J, Shaw M, Shackcloth M, Page R, Mediratta N, et al. Smoking status at diagnosis and histology type as determinants of long-term outcomes of lung cancer patients. Eur J Cardiothorac Surg. 2013; 43:919–24. [PubMed: 22898398]
155. Heatherton TF, Kozlowski LT, Frecker RC, Fagerström KO. The Fagerström Test for Nicotine Dependence: a revision of the Fagerström Tolerance Questionnaire. Br J Addict. 1991; 86:1119–27. [PubMed: 1932883]
156. Heatherton TF, Kozlowski LT, Frecker RC, Rickert W, Robinson J. Measuring the heaviness of smoking: using self-reported time to the first cigarette of the day and number of cigarettes smoked per day. Addiction. 1989; 84:791–800.
157. Browning KK, Ferketich AK, Otterson GA, Reynolds NR, Wewers ME. A psychometric analysis of quality of life tools in lung cancer patients who smoke. Lung Cancer. 2009; 66:134–9. [PubMed: 19181418]
158. Agaku IT, King BA, Dube SR. Current cigarette smoking among adults - United States, 2005-2012. MMWR. 2014; 63:29–34. [PubMed: 24430098]
159. Giovino GA, Schooley MW, Zhu BP, Chrismon JH, Tomar SL, Peddicord JP, et al. Surveillance for selected tobacco-use behaviors--United States, 1900-1994. MMWR. 1994; 43:1–43.

160. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Tobacco smoking and involuntary smoking. IARC Monogr Eval Carcinog Risks Hum. 2004; 83:1–1438. [PubMed: 15285078]

161. Warren GW, Alberg AJ, Kraft AS, Cummings KM. The 2014 Surgeon General's Report: "The health consequences of smoking-50 years of progress": a paradigm shift in cancer care. Cancer. 2014; 120:1914–6. [PubMed: 24687615]

162. Warren GW, Marshall JR, Cummings KM, Toll B, Gritz ER, Hutson A, et al. Practice patterns and perceptions of thoracic oncology providers on tobacco use and cessation in cancer patients. J Thorac Oncol. 2013; 8:543–8. [PubMed: 23529191]

163. Warren GW, Marshall JR, Cummings KM, Toll BA, Gritz ER, Hutson A, et al. Addressing tobacco use in patients with cancer: a survey of American Society of Clinical Oncology members. J Oncol Prac. 2013; 9:258–62.

164. Fiore MC, Baker TB. Treating smokers in the health care setting. N Engl J Med. 2011; 365:1222–31. [PubMed: 21991895]

165. Fiore, MC.; Jaen, CR.; Baker, TB.; Bailey, WC.; Benowitz, WC.; Curry, SJ., et al. Treating tobacco use and dependence: 2008 update. United States Public Health Service; Rockville (MD): 2008.

166. Duffy SA, Louzon SA, Gritz ER. Why do cancer patients smoke and what can providers do about it? Community Oncol. 2012; 9:344–52. [PubMed: 23175636]

167. Hughes J, Keely J, Niaura R, Ossip-Klein D, Richmond R, Swan G. Measures of abstinence in clinical trials: issues and recommendations. Nicotine Tob Res. 2003; 5:13–26. [PubMed: 12745503]

168. Choi WS, Okuyemi KS, Kaur H, Ahluwalia JS. Comparison of smoking relapse curves among African-American smokers. Addictive Behav. 2004; 29:1679–83.

169. Hughes JR, Keely J, Naud S. Shape of the relapse curve and long-term abstinence among untreated smokers. Addiction. 2004; 99:29–38. [PubMed: 14678060]

170. Gritz ER, Dresler C, Sarna L. Smoking, the missing drug interaction in clinical trials: Ignoring the obvious. Cancer Epidemiol Biomarkers Prev. 2005; 14:2287–93. [PubMed: 16214906]

171. Peters EN, Torres E, Toll B, Cummings KM, Gritz ER, Hyland A, et al. Tobacco assessment in actively accruing National Cancer Institute cooperative group program clinical trials. J Clin Oncol. 2012; 30:2869–75. [PubMed: 22689794]

172. National Cancer Institute [Internet]. NCI-AACR cancer patient tobacco use questionnaire. National Cancer Institute; Bethesda (MD): Available from: https://www.gem-measures.org/Public/MeasureDetail.aspx?mid=2003&cat=2 [updated 2015 Jun 11; cited 2015 Jun 12]

173. National Comprehensive Cancer Network. National Comprehensive Cancer Network clinical practice guidelines in oncology: smoking cessation, version 1.2015. National Comprehensvie Cancer Network; Fort Washington (PA): 2015.

174. Dasgupta P, Kinkade R, Joshi B, DeCook C, Haura E, Chellappan S. Nicotine inhibits apoptosis induced by chemotherapeutic drugs by up-regulating XIAP and survivin. Proceedings of the National Academy of Sciences of the USA. 2006; 103:6332–7. [PubMed: 16601104]

175. Warren GW, Rangnekar VM, McGarry R, Arnold SA, Kudrimoti M. Pathways of resistance: potential effects of nicotine on cancer treatment response. Int J Radiat Oncol Biol Phys. 2008; 72(S715)

176. Warren GW, Romano MA, Kudrimoti MR, Randall ME, McGarry RC, Singh AK, et al. Nicotinic modulation of therapeutic response in vitro and in vivo. Int J Cancer. 2012; 131:2519–27. [PubMed: 22447412]

177. Warren GW, Arnold SM, Valentino JP, Gal TJ, Hyland AJ, Singh AK, et al. Accuracy of self-reported tobacco assessments in a head and neck cancer treatment population. Radiother Oncol. 103:45–8. [PubMed: 22119370]

178. Stratton K, Shetty P, Wallace RB, Bondurant S. Clearing the smoke: The science base for tobacco harm reduction--executive summary. Tob Control. 2001; 10:189–95. [PubMed: 11387543]

179. Boyle RG, Saint Claire AW, Kinney AM, D'Silva J, Carusi C. Concurrent use of cigarettes and smokeless tobacco in Minnesota. J Environ Public Health. 2012; 2012

180. Popova L, Ling PM. Alternative tobacco product use and smoking cessation: a national study. Am J Public Health. 2013; 103:923–30. [PubMed: 23488521]

181. Pearson JL, Richardson A, Niaura RS, Vallone DM, Abrams DB. E-cigarette awareness, use, and harm perceptions in US adults. Am J Public Health. 2012; 102:1758–66. [PubMed: 22813087]

182. Polosa R, Morjaria JB, Caponnetto P, Campagna D, Russo C, Alamo A, et al. Effectiveness and tolerability of electronic cigarette in real-life: a 24-month prospective observational study. Internal Emergency Med. 2013; 9:537–46.

183. Bhattacharyya N. Trends in the use of smokeless tobacco in United States, 2000-2010. Laryngoscope. 2012; 122:2175–8. [PubMed: 22777912]

184. Borland R, Li L, Cummings KM, O'Connor R, Mortimer K, Wikmans T, et al. Effects of a Fact Sheet on beliefs about the harmfulness of alternative nicotine delivery systems compared with cigarettes. Harm Reduction J. 2012; 9:19.

185. Hatsukami DK, Jensen J, Anderson A, Broadbent B, Allen S, Zhang Y, et al. Oral tobacco products: preference and effects among smokers. Drug Alcohol Depend. 2011; 118:230–6. [PubMed: 21515003]

186. Lund KE, McNeill A, Scheffels J. The use of snus for quitting smoking compared with medicinal products. Nicotine Tob Res. 2010; 12:817–22. [PubMed: 20622023]

187. Timberlake DS, Pechmann C, Tran SY, Au V. A content analysis of Camel Snus advertisements in print media. Nicotine Tob Res. 2011; 13:431–9. [PubMed: 21385907]

188. O'Connor RJ, Norton KJ, Bansal-Travers M, Mahoney MC, Cummings KM, Borland R. US smokers' reactions to a brief trial of oral nicotine products. Harm Reduction J. 2011; 8:1.

189. Borderud SP, Li Y, Burkhalter JE, Sheffer CE, Ostroff JS. Electronic cigarette use among patients with cancer: characteristics of electronic cigarette users and their smoking cessation outcomes. Cancer. 2014; 120:3527–35. [PubMed: 25252116]

190. Tomar SL, Alpert HR, Connolly GN. Patterns of dual use of cigarettes and smokeless tobacco among US males: findings from national surveys. Tob Control. 2010; 19:104–9. [PubMed: 20008157]

191. Lund KE, McNeill A. Patterns of dual use of snus and cigarettes in a mature snus market. Nicotine Tob Res. 2013; 15:678–84. [PubMed: 22990221]

192. Zhu S-H, Wang JB, Hartman A, Zhuang Y, Gamst A, Gibson JT, et al. Quitting cigarettes completely or switching to smokeless tobacco: do US data replicate the Swedish results? Tob Control. 2009; 18:82–7. [PubMed: 19168476]

193. Gritz ER, Fingeret MC, Vidrine DJ, Lazev AB, Mehta NV, Reece GP. Successes and failures of the teachable moment: smoking cessation in cancer patients. Cancer. 1006; 106:17–27. [PubMed: 16311986]

194. McBride CM, Emmons KM, Lipkus IM. Understanding the potential of teachable moments: the case of smoking cessation. Health Educ Res. 2003; 18:156–70. [PubMed: 12729175]

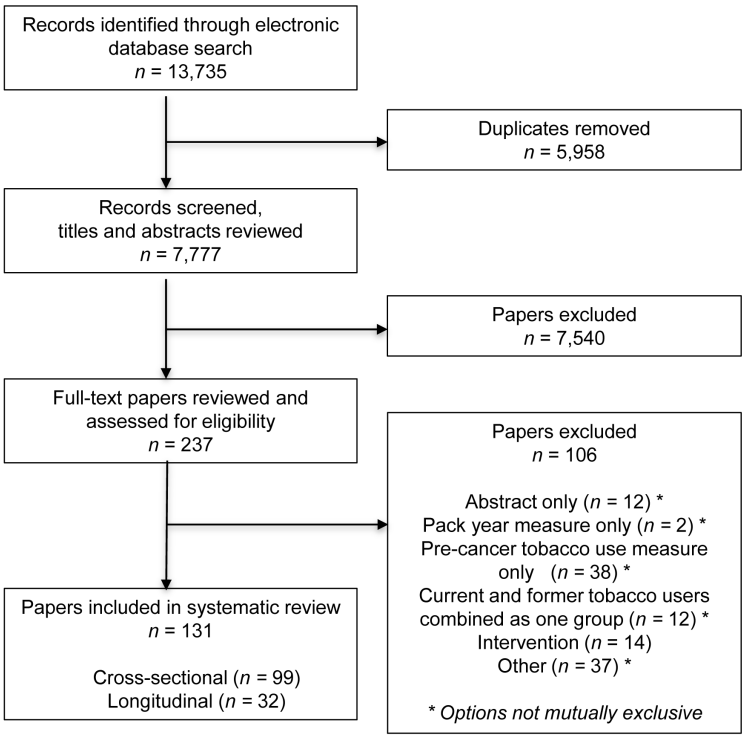

Figure 1.
Flow diagram for paper identification, retrieval, and inclusion in systematic review.

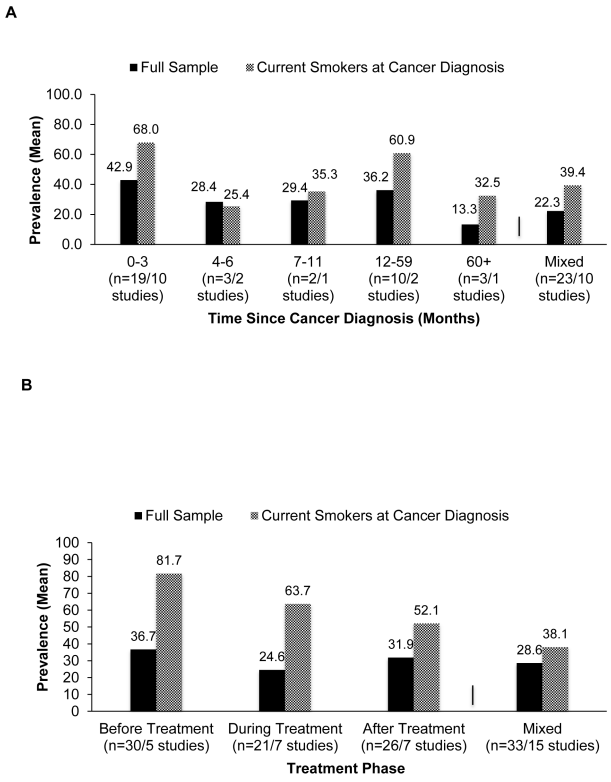

Figure 2.

A. Prevalence of current smoking after lung or head/neck cancer diagnosis by phase of survivorship. Ns denote number of studies in the analysis for Full Sample/Current Smokers at Cancer Diagnosis. Full Sample: 0-3 includes data from (4, 10, 34, 40, 42, 54, 63, 73, 80, 84, 110, 127, 132, 134, 135, 143, 145, 147, 154); 4-6 includes data from (51, 131, 153); 7-11 includes data from (49, 133); 12-59 includes data from (59, 79, 85, 86, 88, 91, 97, 100, 141, 152); 60+ includes data from (67, 70, 128); and Mixed includes data from (5, 29-31, 46, 52, 56, 62, 69, 90, 94, 95, 98, 103, 112, 115, 120-122, 125, 126, 130, 138). Current Smokers at Cancer Diagnosis: 0-3 includes data from (4, 34, 39, 40, 80, 82, 84, 110, 143, 149); 4-6 includes data from (76, 153); 7-11 includes data from (123); 12-59 includes data from (36, 97); 60+ includes data from (128); and Mixed includes data from (5, 35, 44, 46, 56, 112, 115, 125, 129, 138).

B. Prevalence of current smoking after lung or head/neck cancer diagnosis by phase of treatment. Ns denote number of studies in the analysis for Full Sample/Current Smokers at Cancer Diagnosis. Full Sample: Before Treatment includes data from (4, 10, 28, 32, 43, 45, 57, 59, 63-65, 68, 73, 74, 84, 99, 101, 102, 106, 108, 109, 111, 114, 127, 132, 134, 143, 148, 151, 154); During Treatment includes data from (34, 40, 75, 104, 110, 118, 121, 133, 145-147, 152) (33, 37, 38, 50, 78, 107, 124, 139, 150); After Treatment includes data from (29, 30, 49, 53, 58-60, 67, 69, 70, 79, 85-87, 89, 92, 97, 98, 100, 103, 105, 119, 122, 128, 138, 141); and Mixed includes data from (5, 41, 42, 46, 47, 52, 55, 61, 62, 73, 77, 80, 83, 90, 91, 93, 94, 96, 115, 126, 130, 131, 133, 140, 144, 153). Current Smokers at Cancer Diagnosis: Before Treatment includes data from (4, 65, 82, 84, 143); During Treatment includes data from (34, 39, 40, 110, 117, 142, 149); After Treatment includes data from (44,

60, 87, 97, 128, 136, 138); and Mixed includes data from (5, 35, 36, 46, 56, 76, 80, 83, 112, 115, 123, 125, 129, 144, 153).

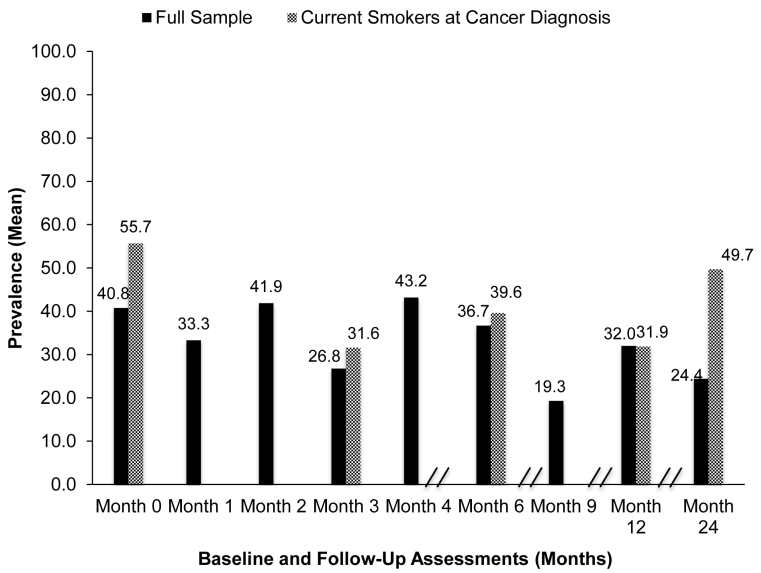

Figure 3.

Variation in the prevalence of current smoking after lung or head/neck cancer diagnosis across time. Baseline was centered at Month 0 for every study; Full Sample: Month 0 includes data from (10, 42, 52-54, 80, 84, 135); Month 1 includes data from (53); Month 2 includes data from (135); Month 3 includes data from (10, 52-54, 80); Month 4 includes data from (135); Month 6 includes data from (10, 42, 52, 54, 80, 135); Month 9 includes data from (10); Month 12 includes data from (10, 135); and Month 24 includes data from (84). Current Smokers at Cancer Diagnosis: Month 0 includes data from (76, 80, 84, 129, 149); Month 3 includes data from (76, 80, 129, 149); Month 6 includes data from (80, 149); Month 12 includes data from (76, 149); and Month 24 includes data from (84).

Table 1

Participants' Clinical Characteristics and Tobacco Use Measurement (n = 131 studies)

Clinical Variable	**Percent (n) of studies** [a]	***M, SD* across studies**
Cancer diagnosis		
Lung only	48.1 (63)	
Head/neck only	42.7 (56)	
Mixed	9.2 (12)	
Cancer stage		
Early or local only	13.7 (18)	
Regional only	1.5 (2)	
Late or advanced only	7.6 (10)	
Mixed	65.6 (86)	
Missing or unclear	11.5 (15)	
Treatment phase [b]		
Pre-treatment only	23.7 (31)	
In treatment only	19.1 (25)	
Post-treatment only	21.4 (28)	
Mixed	29.0 (38)	
Missing or unclear	6.9 (9)	
Treatment type [c]		
Surgery only	11.5 (15)	
Radiation only	9.9 (13)	
Chemotherapy only	2.3 (3)	
Mixed	61.1 (80)	
Missing or unclear	15.3 (20)	
Months since cancer diagnosis, mean [d]		21.4, 19.0
Tobacco Use Variable	Percent (n) of studies [a]	
Cigarette smoking		
1-year	12.2 (16)	
30-day	13.0 (17)	
7-day	9.9 (13)	
24-hour	2.3 (3)	
Missing or unclear [e]	61.1 (80)	
Other tobacco use		
1-year	0.0 (0)	
30-day	16.7 (1)	
7-day	0.0 (0)	
24-hour	16.7 (1)	
Missing or unclear [e]	66.7 (4)	

[a] Column percentages may not add up to 100.0 due to rounding.

[b] This variable refers to what was occurring at the time of tobacco use assessment. In the case of longitudinal studies, this variable corresponds to baseline.

[c] This variable includes treatment that may have occurred after the time of tobacco use assessment.

[d] This variable was missing or unclear in 89.3% (n=117) of studies, though some papers reported a median value and others reported time since treatment initiation or completion.

[e] This includes studies that reported the point prevalence of “current” tobacco users, without explicit mention of how “current” was operationalized.

Table 2

Longitudinal Classification of Smoking Status After Lung or Head/Neck Cancer Diagnosis

		Percent of Participants in Each Category [a]			
Study	**Sample Size**	**Persistent Smoker**	**Relapser**	**Late Quitter**	**Persistent Abstainer**
Cooley et al. (2007) (52)	230	6.7	1.2	0.6	91.5
Cooley et al. (2009) (53)	94	13.1	40.5	0.0	46.4
Do et al. (2004) (62)	1190	16.6	12.3	3.3	67.7
Eng et al. (2014) (65)	721	14.7	0.7	18.9	65.7
Gritz et al. (1991) (73)	840	6.8	21.5	8.2	63.5
Hay et al. (2007) (76)	188	11.9	8.4	4.2	75.5
Hopenhayn et al. (2013) (80)	142	11.9	13.4	4.9	69.7
Kashigar et al. (2013) (84)	295	24.4	0.0	24.7	50.8
Sanderson Cox et al. (2002) (121)	226	66.7	30.0	3.3	0.0
Schnoll et al. (2003) (129)	74	31.4	13.7	9.8	45.1

[a] Row percentages may not add up to 100.0 due to rounding.

Cancer Epidemiol Biomarkers Prev. Author manuscript; available in PMC 2016 October 01.