

Smoking Prevalence and Management Among Cancer Survivors

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PROBLEM IDENTIFICATION: Continued smoking after a cancer diagnosis can lead to development of potential treatment interactions, secondary cancers, and comorbid conditions. The purpose of this article is to examine the prevalence of smoking after diagnosis and present current management strategies.

LITERATURE SEARCH: The terms *cancer*, *survivorship*, *behavior*, *smoking*, and *quitlines* were searched in PubMed and CINAHL® from the start of the databases to December 2016. Statistics, guidelines, and background information were obtained from websites of organizations such as the American Cancer Society, National Cancer Institute, National Institutes of Health, and Centers for Disease Control and Prevention.

DATA EVALUATION: Of 17 relevant articles, 12 were analyzed to identify variables among survivors who continued to smoke versus those who successfully quit. Five articles were analyzed to identify characteristics of successful smoking cessation interventions.

SYNTHESIS: Survivors who are younger, female, and not partnered and those who report less socioeconomic and psychosocial support may be at greater risk for continued smoking. Peer counseling, cognitive behavioral therapy exercises, and use of frameworks to guide interventions are unique properties of successful cessation interventions.

IMPLICATIONS FOR RESEARCH: Continued research on cancer-specific tobacco cessation interventions and exploration of why current evidence-based therapies are not working in this population are warranted.

KEYWORDS cancer; survivors; health behaviors; smoking; smoking cessation; tobacco use cessation

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More than 36 million adults, about 15% of adults aged 18 years and older, reported being current cigarette users in 2015, despite it being the leading cause of preventable death in the United States (Jamal et al., 2016). Although the latest rate of smoking adults (15%) has decreased from 21% in 2008, the Healthy People 2020 target of 12% has yet to be reached (Office of Disease Prevention and Health Promotion, 2017). Current smoking rates in the United States are higher among men, people aged younger than 65 years, non-Hispanic American Indians/Alaska Natives or people of multiracial ethnicities, people with a high school degree or less, people living below the poverty level, and people with a disability or limitation (Centers for Disease Control and Prevention [CDC], 2017).

Tobacco use is a known risk factor for many types of cancer, including the following: acute myeloid leukemia, bladder cancer, cervical cancer, colon/rectal cancer, esophageal cancer, gastric cancer, laryngeal cancer, liver cancer, lung cancer, oral cancer, pancreatic cancer, pharyngeal cancer, renal cancer, and tracheal cancer. However, some cancer survivors continue to smoke cigarettes. The current smoking rate among cancer survivors is about 18%–27% (Harding, 2012; Mayer & Carlson, 2011; Sterba et al., 2017; Tseng, Lin, Martin, Chen, & Partridge, 2010; Underwood et al., 2012; Wang, McLoone, & Morrison, 2015). Smoking cessation is vital to the survival and quality of life of this population, because continued smoking can lead to development of potential treatment interactions, secondary cancers, or exacerbation of comorbid conditions, and it can have negative effects on quality of life (Armenian et al., 2016; Brown et al., 2003; CDC, 2017; Leach et al., 2015; Wang et al., 2015). Survivors who continue to smoke have a significantly lower overall survival rate compared to those with the same cancers who do not smoke, and outcomes, including total symptom burden, treatment toxicities, and

postoperative complications, are unfavorable in survivors undergoing radiation, chemotherapy, and surgical treatments (Clark et al., 2007; Duffy et al., 2013; Fortin, Wang, & Vigneault, 2009; Peppone et al., 2011; Szeszko et al., 2015). In addition, continued smoking can worsen the late and long-term sequelae of cancer treatment, which commonly include hypertension and cardiac disease (Leach et al., 2015). This is important because cancer increases the risk of subsequent cardiovascular disease, which is the leading cause of death in cancer survivors when examining all-cause mortality (Armenian et al., 2016; Brown et al., 2003).

Cancer survivors require care from a more supportive standpoint. Cancer can be a life-altering diagnosis for not only the patient, but also for family and friends (National Cancer Institute [NCI], 2017). For these patients, behavior modifications and healthy lifestyle choices are necessary to improve health, quality of life, and treatment outcomes. One barrier to smoking cessation for this population is that current standards of tobacco cessation are not specific for cancer survivors and have not demonstrated the same efficacy compared to the general adult population (Toll, Brandon, Gritz, Warren, & Herbst, 2013). Evidence-based tobacco cessation models and interventions involve assessments and treatments that lack evidence in studies specific to the oncology population (Toll et al., 2013). In addition, cessation rates among cancer survivors vary—not all patients are equally motivated to stop smoking—and cessation often requires multiple multimodal approaches (NCI, 2017). The purpose of this article is to examine the prevalence of cigarette smoking in and characteristics of survivors after a cancer diagnosis. Identifying survivors at risk for continued smoking is important, because, as a clinician providing quality cancer, failure to address their tobacco addiction and smoking cessation care is unjustified and could be considered negligent (Patsakhm, Ripley-Moffitt, & Goldstein, 2009). Current management strategies also will be presented.

Literature search terms included *cancer*, *survivorship*, *behavior*, *smoking*, and *quitlines*. Databases searched were PubMed and CINAHL®. Databases were searched from the start of the database to December 2016. Statistics, guidelines, and background information were obtained from national websites, such as the American Cancer Society, NCI, National Institutes of Health, and CDC. Data evaluation included a manual search of PubMed and CINAHL, which led to 17 relevant articles (see Table 1). Twelve articles were analyzed to identify variables among cancer survivors who continue to smoke versus cancer survivors

who successfully quit smoking after a diagnosis. Five articles were analyzed to identify characteristics of successful smoking cessation interventions among cancer survivors.

Variables in Continued Smoking for Cancer Survivors

Despite the known negative effects, 18%–27% of cancer survivors continue to smoke after a diagnosis (Harding, 2012; Mayer & Carlson, 2011; Sterba et al., 2017; Tseng et al., 2010; Underwood et al., 2012; Wang et al., 2015). Rates of smoking continuation vary according to age, sex, race, marital status, type of cancer, socioeconomic status, and psychosocial factors.

Gender

Higher rates of continued smoking are seen among female survivors. Multiple studies have identified higher smoking rates in women than men, as well as significantly greater odds of being a current smoker, versus a former smoker, in female survivors (adjusted odds ratio [AOR] = 1.4) (Burcu, Steinberger, & Sorkin, 2016; Kim, Kim, Park, Shin, & Song, 2015; Tseng et al., 2010; Underwood et al., 2012). Smoking prevalence, including rates of continued smoking after a diagnosis, were higher among female survivors (22%, 42%) compared to male survivors (13%, 28%), and women had a six-times higher risk of continued smoking after a diagnosis (Burcu et al., 2016; Kim et al., 2015; Tseng et al., 2010; Underwood et al., 2012). Associated variables, including cervical cancer, were linked to gender in many of the studies reviewed. Cervical cancer can be successfully diagnosed and treated in many women, and, like cigarette smoking, it is most prevalent in young, poor, and underserved women (Singh, Miller, Hankey, & Edwards, 2004).

Age

Younger patients are more likely to continue smoking after a diagnosis. Specifically, patients aged 40 years or younger had the highest rates of continued smoking (45%–46%) (Burcu et al., 2016; Harding, 2012; Kim et al., 2015; Shoemaker, White, Hawkins, & Hayes, 2016; Tseng et al., 2010). Compared to cancer survivors aged older than 40 years, survivors aged 18–40 years had significantly ($p < 0.001$) higher rates of continuing smoking after diagnosis (Harding, 2012; Shoemaker et al., 2016).

Race

Continued smoking rates vary among racial groups. In a cross-sectional study among tobacco-related

TABLE 1. Review of the Literature

Study	Purpose	Design	Participants	Results and Findings
Berg, Carpenter, et al., 2013	To examine quitting and reduction efforts and interest in cessation resources among survivors who self-identified as current smokers at diagnosis	Mixed-methods design: cross-sectional survey and semistructured interviews	798 total cancer survivors recruited; 139 total responses, of which 54 were current smokers and 85 were not current smokers	76% of current smokers identified as White. Current smoking rates were significantly higher in survivors not married or not living with their partner (59%, $p = 0.004$). Current smokers were less likely to be married ($p = 0.04$) and had lower perceived social support from their partner ($p = 0.04$). Survivors with a household income less than \$2,399 per month had a current smoking rate of 67%. Current smoking rate was 72% among survivors who were not employed. 23% of survivors reported a quit attempt in the past year.
Berg, Thomas, et al., 2013	To examine correlates of continued smoking versus cessation among survivors of smoking-related cancers who were current smokers at diagnosis	Mixed-methods design: cross-sectional survey and semi-structured interviews	798 total cancer survivors recruited; 139 total responses, of which 54 were current smokers and 85 were not current smokers	After controlling for age, gender, ethnicity, marital status, and household income, significant factors associated with continued smoking were a diagnosis with other smoking-related cancers versus lung or head and neck cancer (OR = 11.21, 95% CI [2.85, 44.02], $p = 0.001$) and screening positive for significant symptoms of depression (OR = 1.25, 95% CI [1.08, 1.45], $p = 0.003$).
Burcu et al., 2016	To examine prevalence of current smoking and assess association of health insurance and access to care with smoking cessation	Cross-sectional study; nationally representative data obtained from the Behavioral Risk Factor Surveillance System study	18,896 cancer survivors aged 18–64 years from the 2009 Behavioral Risk Factor Surveillance System survey	Prevalence of current smoking was higher among survivors without health insurance (41%) compared to those with it (20%). Survivors without insurance had twofold greater odds of not quitting. Those with insurance experiencing problems with access to care had 60%–80% greater odds of not quitting. Those with insurance had lower cessation rates if they experienced problems with access to care.
Cooley et al., 2012	To identify determinants of smoking outcomes and symptom-related, behavioral, and cognitive factors associated with smoking outcomes at 3 and 6 months	Prospective, longitudinal study	132 participants at 3 months and 121 at 6 months	The abstinence rate was 68% (lung cancer, 65%; head and neck cancer, 72%) at 3 months and 61% (lung cancer, 53%; head and neck cancer, 68%) at 6 months. The continuous abstinence rate was 71% (lung cancer, 71%; head and neck cancer, 70%) at 3 months and 52% (lung cancer, 40%; head and neck cancer, 64%) at 6 months. Lower cancer-related, psychological, and nicotine withdrawal symptoms were associated with increased abstinence rates. Decreased craving and increased self-efficacy were the most consistent factors associated with improved outcomes.
De Moor et al., 2008	To provide a systematic review of smoking prevention and cessation interventions that have been conducted with cancer survivors	Systematic review including 15 experimental or quasi-experimental designs	2,211 adult and childhood cancer survivors	Two interventions significantly increased smoking cessation rates among cancer survivors. Few interventions have been developed to improve smoking prevention and cessation rates in cancer survivors. Successful interventions included peer counseling, cognitive behavioral therapy exercises, and the use of frameworks to guide interventions.
Duffy et al., 2006	To develop and test a tailored smoking, alcohol, and depression intervention for patients with head and neck cancer	RCT measuring data collected, including smoking, alcohol use, and depressive symptoms at baseline and 6 months	184 total enrolled (91 in the control group and 93 in the intervention group)	Significant differences in 6-month smoking cessation rates were noted, with 47% quitting in the intervention group compared to 31% in usual care ($p < 0.05$). The intervention increased smoking cessation rates by 50% more than enhanced usual care. Treating comorbid depression and alcohol, both known to exacerbate smoking, may improve cessation rates.

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TABLE 1. Review of the Literature (Continued)

Study	Purpose	Design	Participants	Results and Findings
Emmons et al., 2005	To evaluate the impact of a peer-based telephone counseling intervention on smoking among childhood cancer survivors	RCT with follow-up at 8 and 12 months	796 smokers who were identified through the Childhood Cancer Survivors Study baseline questionnaire and invited to participate	The quit rate was significantly higher in the counseling group compared with the self-help group at the 8-month (17% versus 9%; $p < 0.01$) and 12-month follow-up (15% versus 9%; $p \leq 0.01$). The Partnership for Health intervention resulted in a doubling of quit rates. With controlling for baseline self-efficacy and readiness to change, the intervention group was twice as likely to quit. The smoking cessation rate increased with a greater number of counseling calls.
Harding, 2012	To determine whether cancer survivors engage in health-promotion behaviors, evaluate the extent of their experience of psychological distress, and investigate the relationship between the practice of health-promotion behaviors and psychological distress	Cross-sectional secondary data analysis	1,784 survey respondents who reported a previous cancer diagnosis	316 survivors (18%) indicated current smoking. The rate of current smoking was higher among younger cancer survivors aged 18–40 years (28%, 95% CI [23.1, 30.4]) compared to survivors aged 60–80 years (14%, 95% CI [11.5, 16.2]). Participants reporting smoking behaviors were significantly more likely to have reported feelings of anxiety, sadness, and hopelessness much more of the time compared to former or never smokers ($p < 0.01$). Survivors continued to smoke at a rate similar to the national average. Most respondents reported no symptoms of psychological distress. Age appeared to play a major role, showing significant differences in the prevalence of current smoking, participation in physical activity, alcohol use, and reported level of distress.
Kashigar et al., 2013	To evaluate sociodemographic predictors of smoking cessation in patients with head and neck cancer to support the development of a smoking cessation program	Prospective, longitudinal, single-center study	295 newly diagnosed patients with head and neck cancer who were treated with curative intent	49% were current smokers at diagnosis, and 50% quit after diagnosis. Quitters were more likely to have smoked for fewer years ($p = 0.0003$), never used other forms of tobacco ($p = 0.0003$), and consumed less alcohol ($p = 0.002$). No cigarette exposure at home (OR = 7.44, 95% CI [3.04, 18.2]), no spousal smoking (OR = 4.25, 95% CI [1.7, 10.6]), and having fewer friends who smoke (OR = 2.32, 95% CI [1, 5.37]) were consistent predictors of smoking cessation after diagnosis. Having none of these exposures and seeing a family physician were independently associated with smoking cessation. 68% of patients quit within 6 months of diagnosis. Patients who were ex-smokers at diagnosis were older, more likely to be female and married, more educated, and had fewer pack-years.
Kim et al., 2015	To figure out the patterns of smoking behavior and factors that are associated with persistent smoking in survivors	Stratified, multi-stage probability design	130 Korean men and women aged 19 years or older who smoked at time of diagnosis (57 smokers who quit and 73 persistent smokers)	Factors associated with persistent smoking after multivariable adjusted evaluation were female gender (OR = 5.99, 95% CI [1.38, 26.01], $p = 0.018$), low income (bottom 25%) (OR = 3.24, 95% CI [1.22, 8.62], $p = 0.019$), high-risk alcohol use (OR = 3.79, 95% CI [1.43, 10.03], $p = 0.008$), body mass index greater than 25 kg/m ² (OR = 2.91, 95% CI [1.01, 8.34], $p = 0.048$), smoker in the household (OR = 8.39, 95% CI [1.95, 36.07], $p = 0.005$), and longer duration of smoking (OR = 1.12, 95% CI [1.02, 1.22], $p = 0.015$).
Klesges et al., 2015	To determine the efficacy of two common types of tobacco quitlines in adult cancer survivors who regularly smoked	RCT, conducted over multiple facilities within a single cancer center	427 adult-onset cancer survivors	12-month self-reported abstinence was 22% and 26% for proactive and reactive groups. 48% of participants who were tested for cotinine failed biochemical verification, indicating a considerable falsification of self-reported cessation. Additional studies should include biochemical verification.

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TABLE 1. Review of the Literature (Continued)

Study	Purpose	Design	Participants	Results and Findings
Nayan et al., 2013	To evaluate tobacco smoking cessation interventions and cessation rates in patients with cancer	Systematic review of cessation interventions at 5-week and 6-month follow-up	1,301 adults aged older than 18 years with cancer who smoke	Interventions had a pooled OR of 1.54 (95% CI [0.909, 2.64]) in patients after 5 weeks and 1.31 (95% CI [0.931, 1.84]) after 6 months. Interventions in the perioperative period had a pooled OR of 2.31 (95% CI [1.32, 4.07]). Cessation interventions did not significantly affect cessation rates.
Shoemaker et al., 2016	To describe smoking and obesity prevalence among male and female cancer survivors in the United States	Cross-sectional survey	9,753 survey respondents who reported ever having a malignancy, excluding nonmelanoma skin cancers	17% of survivors reported current smoking, with higher rates among women ($p < 0.0001$). Women aged 18–34 years were almost twice as likely to smoke as men of that age ($p = 0.002$). After exclusion of cervical cancer survivors, significant gender differences in current smoking rates were not evident. Of survivors reporting smoking prior to diagnosis (24%), 11% quit within a year. Men were more likely to quit within a year ($p = 0.033$).
Sterba et al., 2017	To evaluate symptom burden and clinical, sociodemographic, and psychosocial factors associated with smoking in surgical patients to identify potential targets for supportive care services	Cross-sectional survey	103 individuals presenting for surgical management of squamous cell carcinoma of the oral cavity, larynx, or pharynx. Patients were excluded if they were younger than 21 years, were not surgical candidates, or had a cognitive impairment.	Smoking status was significantly associated with cancer-specific symptoms (7 of 17 symptoms assessed). Current or recent smokers were less likely than former smokers to have adequate finances (53% versus 89%, $p = 0.001$) and be married or partnered (55% versus 79%, $p = 0.03$). Current or recent smokers were more likely than former and never smokers to be unemployed (49% versus 40% and 13%; $p = 0.02$) and lack health insurance (17% versus 5% and 13%; $p \leq 0.04$). Fatalistic beliefs ($p = 0.03$) and lower religiosity ($p = 0.04$) were more common in current or recent than never smokers. In models adjusted for sociodemographic and clinical factors, current or recent smokers reported more issues with swallowing, speech, and cough ($p \leq 0.04$) and with social contact, feeling ill, and weight loss ($p \leq 0.02$).
Tseng et al., 2010	To examine smoking prevalence among all and specific cancer survivors, and compare demographic profiles of current smokers between individuals with and without cancer	Cross-sectional secondary data analysis	2,188 cancer survivors and 22,441 individuals without cancer who were aged 20 years or older and participated in the 10-year National Health and Nutrition Examination Survey	18% of those reporting a cancer history continued to smoke. The smoking rate was higher in survivors aged younger than 40 years (45%) than in young individuals without cancer (30%) ($p = 0.001$). Cervical cancer survivors had the highest current smoking rate (44%). Survivors of cervical cancer (23%) and melanoma (23%) had the lowest quit rate following diagnosis. Age, race, education, marital status, and time since diagnosis were important predictors of smoking status. Current smoking rates decreased with age in both populations. Survivors of cervical cancer, colon cancer, and melanoma had higher age-adjusted smoking rates than survivors of other cancers.
Underwood et al., 2012	To describe tobacco use behaviors among tobacco-related cancer survivors, other cancer survivors, and people without a history of cancer	Cross-sectional survey	3,161,908 non-institutionalized adults aged 18 years or older who could be contacted via telephone	Smoking prevalence was 27% among tobacco-related cancer survivors, 18% among respondents without cancer, and 16% among those with other cancers. The quit ratio was lowest among tobacco-related cancer survivors (55%). Prevalence was higher among women than men with cancer (31% versus 18% among tobacco-related cancer survivors and 12% versus 10% among those with other cancers). Prevalence decreased with age but increased with time since diagnosis in both survivor groups. Almost half of all multiracial and American Indian/Alaskan Natives were current smokers. Smoking prevalence was highest in cervical (33%), bladder (27%), lung (24%), and renal (23%) cancer. Smoking prevalence was significantly higher among tobacco-related cancer survivors compared to other survivors.

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TABLE 1. Review of the Literature (Continued)

Study	Purpose	Design	Participants	Results and Findings
Wang et al., 2015	To describe health behaviors (fruit and vegetable consumption, physical activity, smoking and alcohol consumption) and obesity in survivors compared to those with no history of cancer and those who subsequently developed cancer	Case control study	16,282 adults aged older than 45 years who were diagnosed with cancer (n = 922 diagnosed before survey; n = 1,257 diagnosed after survey)	4,512 (28%) reported currently smoking. 197 (21%) with a previous diagnosis reported currently smoking. 447 (36%) respondents who developed a subsequent cancer reported currently smoking. 147 (21%) current smokers were diagnosed before the survey with more than 2 years since diagnosis. 52 (23%) current smokers were diagnosed before the survey with less than 2 years since diagnosis. 80 (33%) current smokers were diagnosed after the survey with less than 2 years since diagnosis. 367 (36%) current smokers were diagnosed after the survey, with less than 2 years since diagnosis. Survivors were more likely to stop smoking compared to those with no cancer history. Breast cancer survivors were most likely to quit. Current smoking was least prevalent among those within 2 years of diagnosis and higher in those diagnosed more than 2 years before.

CI—confidence interval; OR—odds ratio; RCT—randomized, controlled trial

cancer survivors (lung, oral, pharynx, larynx, esophagus, bladder, stomach, cervix, kidney, pancreas, acute myeloid leukemia), 41 (76%) current smokers identified as being White (Berg, Carpenter, Jardin, & Ostroff, 2013; Berg, Thomas, et al., 2013). Additional studies revealed mixed reviews; other races (excluding White, Black, and Hispanic descent) were more likely to continue smoking (24%) (Tseng et al., 2010), and smoking rates were comparable across racial groups of cancer survivors (Burcu et al., 2016). In a secondary data analysis using data from the 2009 Behavioral Risk Factor Surveillance System, Alaskan Natives/American Indians and multiracial respondents had the highest rates of smoking prevalence among cancer survivors (Underwood et al., 2012). In fact, about half of Alaskan Natives/American Indians (more than 50%) and multiracial (50%) participants identified as current smokers after a cancer-related diagnosis (Underwood et al., 2012).

Marital Status

Cancer survivors who continue to smoke are less likely to be partnered. Rates of continued smoking were significantly higher in survivors who were unmarried or not living with their partner (59%, $p = 0.004$). Specifically, current or recent smokers were less likely than former smokers to be partnered ($p = 0.03$); 30% of patients with cancer who continued to smoke were never married, and 25% were widowed, divorced, or separated (Berg, Carpenter, et al., 2013; Berg, Thomas, et al., 2013; Sterba et al., 2017; Tseng et al., 2010). In

survivors who were partnered, those who had lower perceived social support from their significant other had significantly higher rates of continued smoking ($p = 0.04$) (Berg, Carpenter, et al., 2013; Berg, Thomas, et al., 2013). A significant dose effect occurred in the home, because smoking cessation was strongly and negatively associated with larger amounts of time exposed to secondhand smoke, meaning longer exposure led to less cessation ($p = 0.004$) (Kashigar et al., 2013). Social environments, including if one's spouse smoked and amount of time exposed to smoke in the home, were the most important social factors associated with continued smoking in survivors (Kashigar et al., 2013).

Socioeconomic Status

Socioeconomic status, including income, insurance, and employment, has been associated with continued smoking in cancer survivors. Survivors with a lower household income and a lower income-to-poverty ratio were found to have higher rates of continued smoking (Berg, Carpenter, et al., 2013; Berg, Thomas, et al., 2013; Burcu et al., 2016; Kim et al., 2015; Sterba et al., 2017; Tseng et al., 2010). In addition, smoking rates were higher among survivors who were not employed, were out of work, or were unemployed (Berg, Carpenter, et al., 2013; Burcu et al., 2016; Sterba et al., 2017). In addition, survivors with no reported health insurance had higher rates of continued smoking and were two times more likely to be current smokers (AOR = 2, 95% confidence interval [CI] [1.2, 3.2]) (Burcu et al., 2016; Sterba et al., 2017; Underwood et al., 2012).

Cancer Type

Cancer type is another variable associated with continued smoking; however, smoking rates vary across the studies reviewed. Among all those who smoked prior to diagnosis, 23% of cervical cancer survivors quit smoking and 44% continued smoking after diagnosis (Tseng et al., 2010). Survivors of melanoma had similar patterns: 23% of survivors quit smoking and 32% continued smoking after diagnosis (Tseng et al., 2010). In other studies, cancer survivors of smoking-related cancers, including cervical and lung, were found to have higher rates of continued smoking and lower abstinence rates; lung and head and neck cancer survivors had abstinence rates that decreased from three to six months (65% to 53% for lung, 72% to 68% for head and neck) (Cooley et al., 2012). In addition, survivors of tobacco-related cancers had a significantly higher tobacco use rate (27%) compared to survivors of other cancers or those with no cancer at all ($p < 0.001$) (Underwood et al., 2012). Within this tobacco-related cancer survivor population, women with cervical cancer reported a smoking prevalence of 35% (Underwood et al., 2012).

Time Since Diagnosis

Smoking prevalence increases with time since diagnosis and duration of smoking. Smoking cessation interventions seemed to have a small effect size for survivors after two or more years after a diagnosis; a longer duration of smoking was positively associated with an increased risk of persistent smoking (odds ratio [OR] = 1.12, 95% CI [1.02, 1.22], $p = 0.015$) (Kim et al., 2015; Wang et al., 2015). In addition, smoking prevalence among survivors increased to more than 20% following 10 years or more after a diagnosis (Underwood et al., 2012). In the study by Cooley et al. (2012), smoking abstinence decreased with time for survivors of lung and head and neck cancers. The researchers discovered that 71% of lung cancer survivors and 70% of head and neck cancer survivors remained abstinent at three months; however, cessation rates decreased in both groups after six months (40% for lung and 64% for head and neck cancer survivors) (Cooley et al., 2012).

Psychosocial Factors

Psychosocial factors have been associated with continued smoking in cancer survivors. Continued smoking rates were higher in survivors who had a lower confidence of quitting, and only 23% of long-term survivors reported attempting to quit within the past year (Berg, Carpenter, et al., 2013). In addition, continued smoking rates among survivors were significantly associated with fatalism ($p = 0.03$) and

problems with social contact ($p = 0.01$) (Sterba et al., 2017). Feelings of hopelessness, sadness, and anxiety most of the time ($p < 0.01$), moderate to severe stress ($p < 0.001$), symptoms of depression ($p < 0.001$), and lower reported physical and emotional well-being ($p = 0.01$) were significantly associated with continued smoking in multiple studies (Berg, Thomas, et al., 2013; Harding, 2012; Kim et al., 2015).

Variables in Successful Smoking Cessation

Although some patients with cancer continue smoking after a diagnosis, some survivors do successfully quit. Like continued smoking, smoking cessation rates vary by patient demographics, social support, socioeconomic status, cancer diagnosis, and psychosocial factors.

Patient Demographics

Sex, age, and ethnicity of survivors are associated with lower smoking rates and higher cessation rates. Most of the studies reviewed found that male survivors had higher cessation rates and were more likely to quit within one year of a diagnosis (Cooley et al., 2012; Harding, 2012; Tseng et al., 2010). Only one study found that women were significantly ($p < 0.0001$) more likely to be ex-smokers, compared to current smokers, at time of diagnosis; the investigators concluded that social smoking environments were stronger and more predictable factors for smoking cessation (Kashigar et al., 2013). Survivors aged 65 years or older had significantly lower smoking rates and significantly higher cessation rates in many of the studies reviewed (Harding, 2012; Kashigar et al., 2013; Shoemaker et al., 2016; Tseng et al., 2010; Underwood et al., 2012). Only one study identified race as a factor in smoking cessation and determined that 41% of White survivors quit smoking, compared to lower rates for Black survivors (35%), Hispanic survivors (27%), and other races (24%) of survivors (Tseng et al., 2010).

Social Support

Social support and nonsmoking environments are associated with higher cessation rates among cancer survivors. Survivors who were married or living with their partner had higher rates of smoking cessation (Berg, Carpenter, et al., 2013; Kashigar et al., 2013; Sterba et al., 2017; Tseng et al., 2010). Survivors recognized that cessation among loved ones and people close to them was helpful in maintaining a supportive and less tempting environment (Berg, Carpenter, et al., 2013). Specifically, having a spouse who did not smoke significantly increased the likelihood of

quitting at diagnosis ($p < 0.0001$) or within one year of diagnosis ($p \leq 0.0005$) (Kashigar et al., 2013). Positive social environments included no cigarette exposure in the home (AOR = 7.44, 95% CI [3.04, 18.2]), a non-smoking spouse (AOR = 4.25, 95% CI [1.7, 10.6]), and fewer smoking peers (AOR = 2.32, 95% CI [1, 5.37]) (Kashigar et al., 2013).

Socioeconomic Status

Socioeconomic status also affects rates of smoking cessation among cancer survivors. Survivors who reported adequate monthly finances had higher rates of smoking cessation (Berg, Carpenter, et al., 2013; Burcu et al., 2016; Sterba et al., 2017; Tseng et al., 2010). Specifically, survivors with incomes greater than \$50,000 per year or \$2,399 per month were associated with higher rates of cessation (Berg, Carpenter, et al., 2013; Burcu et al., 2016). A greater number of survivors who quit smoking were employed, had health insurance, and achieved an education level above high school (Burcu et al., 2016). Cancer survivors with a high school-level education or higher had significantly higher rates of cessation ($p = 0.02$) (Kashigar et al., 2013).

Cancer Diagnosis

Like smoking prevalence rates, smoking cessation rates vary among cancer type after a diagnosis. Some studies revealed that survivors of lung, larynx, tracheal, and other head and neck cancers had cessation rates that were higher than those with other smoking-related cancers (Berg, Carpenter, et al., 2013; Berg, Thomas, et al., 2013; Kim et al., 2015; Tseng et al., 2010). Continued smoking rates among patients with prostate (7%), colon (11%), and lung, larynx, and tracheal (15%) cancers also were low compared to those with other cancers and had the highest quit-smoking rates after a diagnosis (prostate, 56%; colon, 52%; lung, larynx, and windpipe, 68%) (Tseng et al., 2010). Breast cancer survivors were more likely to be former smokers compared to lung, bowel, and prostate cancer survivors, and smoking was least prevalent in survivors diagnosed within two years, because behavior changes occurred closer to a diagnosis (Wang et al., 2015). Similarly, abstinence rates were higher at three months, compared to six months, after diagnosis among survivors of head and neck cancer (72% versus 68%) who reported smoking prior to diagnosis (Cooley et al., 2012). Variations in abstinence rates across studies can be attributed to using data obtained via self-reported smoking status versus biochemical verification, variations in definitions of abstinence, and time points of abstinence verification (Cooley et al., 2012).

Psychosocial Factors

Finally, psychosocial factors, including intrapersonal issues and social support, influence smoking cessation rates. Greater self-efficacy (OR = 0.94, 95% CI [0.89, 1]) and less craving (OR = 0.52, 95% CI [0.31, 0.88]) were significant factors associated with abstinence (Cooley et al., 2012). Survivors were more likely to remain abstinent if they reported lower levels of anxiety and depression, absence of withdrawal symptoms, and lower cancer-related distress (Cooley et al., 2012). In addition, survivors who quit smoking reported having fewer peers who smoked (78%, $p < 0.0001$) and no exposure to smoke at home (84%, $p < 0.0001$) (Kashigar et al., 2013).

Tobacco Cessation Interventions

The gold standard of tobacco cessation treatment remains the same for those with cancer as the general population of adult and adolescent tobacco users (Karam-Hage, Cincirpini, & Gritz, 2014). To deliver effective interventions, clinicians must be familiar with and knowledgeable about tobacco cessation training. The U.S. Department of Health and Human Services (HHS) provides a guideline for tobacco treatment that can be adopted into practice for clinical use (Fiore et al., 2008). This guideline recommends a combination of advice and counseling, pharmacotherapy, follow-up, and assessment of difficulties (Fiore et al., 2008).

5 A's Model

The “5 A's” model is used for treating tobacco use and dependence. This model can help clinicians ask patients about tobacco use, advise patients to attempt to quit, assess their readiness to quit, assist in quit attempts, and arrange for follow-up (Fiore et al., 2008). At each clinic visit, clinicians should ask every patient about tobacco use and document the findings in the medical record (Fiore et al., 2008). For patients unmotivated to quit smoking, clinicians can use the “5 R's” of motivational intervention to help persuade patients to make a change (University of Michigan Health System [UMHS], 2012). Clinicians should ask patients to identify the specific relevance, risks, rewards, roadblocks, and repetition of tobacco use in their life (UMHS, 2012). Clinicians should repeat these strategies at every clinic visit to assist unmotivated patients with cessation (UMHS, 2012).

Pharmacologic Therapy

If clinicians decide to provide cessation therapy, pharmacologic therapy should be recommended to all patients who do not have any contraindication to

the treatment (UMHS, 2012). The U.S. Food and Drug Administration (FDA) approved pharmacologic agents for nicotine replacement therapy (NRT), as well as bupropion hydrochloride sustained-release (Zyban[®]) and varenicline (Chantix[®]), which have shown to significantly improve cessation rates (UMHS, 2012). In addition, cessation interventions should incorporate counseling along with pharmacologic treatments. Clinicians providing counseling should take a tailored approach by assessing a patient's barriers to tobacco cessation and motivation to quit (UMHS, 2012). Clinicians should be aware of common barriers to quitting, such as severe withdrawal, lower socioeconomic status, stress, environment, psychiatric comorbidities, and multiple quit attempts (UMHS, 2012). Knowing these barriers can better help clinicians tailor counseling cessations by focusing on specific, individual problems that prevent patients from successful smoking cessation.

Counseling

Clinicians can refer patients and encourage family members to receive counseling outside of the clinical setting if not available within the setting. Intense, person-to-person counseling comprising weekly sessions for the first four to seven weeks of treatment significantly enhances quit rates if the patient is motivated enough to quit (Fiore et al., 2008). These sessions often are held at local clinics, hospitals, or health departments. Tobacco treatment specialists, tobacco quit programs, tobacco quitlines, and counseling websites can provide further information, advice, and reinforcement, particularly for patients of special populations (Fiore et al., 2008). The U.S. national quitline, 1-800-QUITNOW, is a resource that clinicians can use to provide convenient, telephone-based counseling to further deliver cessation support. In addition, patients who use quitlines have greater odds of long-term smoking cessation and significantly higher abstinence rates compared to those with no counseling (Kaufman, Augustson, Davis, & Rutten, 2010). Because tobacco use is a chronic disease, multiple relapses may occur before a patient can become fully abstinent, and these lapses can be used as a learning experience.

Tobacco Cessation Interventions and Cancer Survivors

Few systematic reviews, meta-analyses, or randomized, controlled trials (RCTs) have focused on cancer-specific tobacco cessation interventions, or the efficacy of standard treatments for cancer

survivors. Current research is limited but suggests that smoking cessation interventions are less successful among cancer survivors and that cancer survivors require a more tailored approach to smoking cessation (Abrams, 2016; de Moor, Elder, & Emmons, 2008; Karam-Hage et al., 2014; Klesges et al., 2015).

In a systematic review on smoking cessation interventions in cancer survivors, de Moor et al. (2008) reviewed nine smoking cessation interventions for cancer survivors. The authors identified only two interventions that significantly increased smoking cessation rates. The first intervention, which was part of the Partnership for Health study, implemented peer counseling by childhood cancer survivors to current smokers who were childhood cancer survivors (Emmons et al., 2005). The second intervention incorporated cognitive behavioral therapy (CBT) and pharmacotherapy for survivors with concurrent smoking, alcohol use, and depression (Duffy et al., 2006). De Moor et al. (2008) concluded that higher-intensity interventions were more effective for cancer survivors. Specifically, longer contact and multiple sessions were associated with greater effectiveness for smoking cessation (de Moor et al., 2008). The authors suggested that attention should be paid to risky health behaviors and comorbidities that may affect smoking status and smoking cessation, such as alcohol use and depression (de Moor et al., 2008). Interventions also should be designed around a theoretical framework and tailored to the survivors' stage of readiness to quit smoking (de Moor et al., 2008). This could include motivating patients to quit during the precontemplation and contemplation phases of the transtheoretical model (Clark, Rakowski, Kviz, & Hogan, 1997).

In a systematic review of smoking cessation interventions in cancer survivors, Nayan, Gupta, Strychowsky, and Sommer (2013) identified that tobacco cessation interventions in the oncology population, compared to other smokers, do not significantly affect cessation rates. This review included 10 RCTs and three prospective cohort studies (Nayan et al., 2013). Interventions were considered usual care and included behavioral therapy and pharmacotherapy (Nayan et al., 2013). Specifically, interventions included CBT, self-help materials, education modules, motivational interviewing, NRT, bupropion, and varenicline (Nayan et al., 2013). The studies reviewed were single- or multicenter, and a total of 1,301 patients were enrolled with no baseline differences in characteristics. In a subgroup analysis, Nayan et al. (2013) found that smoking cessation interventions provided during the perioperative period had a pooled

OR of 2.31 (95% CI [1.32, 4.07]), which was the only significant finding of the review. The authors concluded that, although no significant differences were found between cessation interventions and usual care in the oncology population, the perioperative period may provide an important teaching moment for smoking cessation (Nayan et al., 2013).

Research suggests that older adults with health problems, family histories of cancer, and psychological distress are more likely to have ever called a quitline (Kaufman et al., 2010). Patients who use quitlines have a greater chance of long-term smoking cessation and significantly higher abstinence rates compared to those with no counseling (Kaufman et al., 2010). In the St. Jude Children's Research Hospital Cancer Survivors tobacco quit line study, smoking abstinence rates were compared between a counselor-initiated quitline and a participant-initiated quitline among adult survivors of childhood cancer who smoke (Asfar et al., 2010). Social cognitive theory and social determination theory were used to formulate the intervention in the St. Jude study (Asfar et al., 2010). This framework allowed participants in both intervention groups to practice short-term goal setting, modify expectations of cessation, self-monitor, and practice self-reinforcement (Asfar et al., 2010). Study participants were randomly assigned to the intervention and control groups and received six telephone-based counseling sessions and as many as eight weeks of NRT (Asfar et al., 2010). Participants in the intervention group received telephone calls under counselor-directed therapy, and participants in the control group were directed to initiate all six telephone calls (Asfar et al., 2010). The telephone counseling sessions supported participants through three linear phases of quitting: preparing to quit, the quitting process, and relapse prevention and maintaining abstinence (Asfar et al., 2010).

Self-reported smoking status was reassessed eight weeks and one year postintervention, and biochemical verification via salivary cotinine testing was obtained for those who reported abstinence (Asfar et al., 2010). Of the 65 participants who reported successful smoking cessation, 29 participants completed cotinine level testing (Asfar et al., 2010). In Klesges et al.'s (2015) study, 48% of participants reporting abstinence at one year failed biochemical verification, demonstrating that they were still using tobacco products. In addition, tobacco cessation rates in both groups were less than 5%, with no significant differences between intervention groups (Klesges et al., 2015). The authors concluded that the findings of this study were

consistent with previous research in that tobacco cessation interventions result in nonsignificant outcomes within the adult oncology population (Klesges et al., 2015).

Discussion

Clinicians need to be aware of the growing popularity of electronic nicotine delivery systems (ENDS), including electronic cigarettes. The number of adults using electronic cigarettes rose from 3% in 2010 to 14% in 2015 (U.S. Department of Health and Human Services [USDHHS], 2016). Although electronic cigarettes are promoted as a less harmful alternative to traditional cigarettes, the long-term effects of these devices, as well as secondhand smoke from them, are unknown (USDHHS, 2016). In 2013, the FDA announced its concern about the health effects of ENDS, including concerns of worsening nicotine addictions among users, influencing users to try other tobacco products, and concerns about the known toxic substances used in these products (FDA, 2013). In addition, ENDS may prevent current smokers from using evidence-based cessation therapies (USDHHS, 2016). According to the Tobacco Control and Smoking Cessation Committee from the International Association for the Study of Lung Cancer, providers should encourage survivors who use electronic cigarettes to switch to an evidence-based cessation treatment (Cummings et al., 2014). Clinicians should be aware of this trend in tobacco use among survivors, should not recommend electronic cigarettes as a cessation therapy, and should work to further explore and educate patients on the long-term and negative health effects of ENDS.

Implications for Nursing and Research

Despite the known negative effects of tobacco use, including potential treatment interactions, development of secondary cancers, exacerbation of comorbid conditions, and negative impact on quality of life, a number of cancer survivors continue to smoke after a diagnosis (Karam-Hage et al., 2014; Wang et al., 2015). Some populations of cancer survivors are more at risk for continued smoking, and a lack of efficacy in tobacco cessation treatment can make smoking cessation treatment difficult for clinicians and patients.

Nurses and advanced practice providers should be aware of survivors who are at a higher risk for continued smoking. Survivors at risk are more likely to be aged younger than 40 years, female, and not partnered, and have less socioeconomic and psychosocial support. These characteristics are similar to those of the general population of U.S. smokers.

Because of findings of the secondary data analysis, Mayer and Carlson (2011) concluded that survivors have a greater likelihood of being a current smoker if they are younger, widowed or divorced, have little to no access to health care, and have less than a college education. In addition, smoking prevalence rates are higher among survivors of tobacco-related cancers, like cervical cancer, which can be successfully treated in many women, and, like cigarette smoking, is most prevalent in the young, poor, and underserved (Cooley et al., 2012; Mayer & Carlson, 2011; Tseng et al., 2010; Underwood et al., 2012). Although a cancer diagnosis related to smoking may provide highly addicted survivors motivation for cessation, it warrants more intensive cessation interventions from providers. With this information, nurses can better identify survivors at risk for continued smoking and educate survivors on the negative impacts of continued tobacco use. Smoking is a risk factor for a number of chronic health problems in adults, and nurses also can use this information to identify people who are at risk for smoking initiation.

Clinicians can use the 5 A's model for treating tobacco use and dependence to assess survivors' current tobacco use and readiness to quit and use this information to tailor necessary interventions. For example, Abrams (2016) suggested tailoring treatments for lung cancer survivors by extending counseling to people with whom a patient lives who also use tobacco. Social support and environment have been shown to play a significant role in smoking cessation (Kashigar et al., 2013; Sterba et al., 2017). In addition, clinicians can tailor interventions and help prevent relapse of tobacco use by prescribing antidepressant medications that also aid in smoking cessation, such as bupropion, for survivors with depression. At every office visit, survivors should be screened for tobacco use and depression because survivors are more likely to remain abstinent with lower levels of anxiety and depression, absence of withdrawal, and lower cancer-related distress (Cooley et al., 2012). Because smoking prevention is a key factor in health promotion, education in tailored cessation methods, including the 5 A's model and motivational interviewing techniques, can be provided in undergraduate nursing curricula.

If providing smoking cessation interventions themselves, clinicians must be knowledgeable of the available pharmacotherapies and behavioral interventions. To avoid drug-drug interactions, inactivation, and the exacerbation of side effects of cancer-related treatments, providers must be knowledgeable of the medications in smoking cessation treatment. For

KNOWLEDGE TRANSLATION

- Advanced practice providers should be aware of the variables that place survivors at risk for continued smoking.
 - Failure to identify these survivors and to address tobacco addiction and smoking cessation in cancer care is unjustified.
 - Survivors may require more intense, tailored smoking cessation treatments that incorporate unique cessation interventions.
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example, providers should be aware of the potential nausea with varenicline use before prescribing this medication to a patient receiving chemotherapy (Karam-Hage et al., 2014). Varenicline also requires dose adjustments for patients with altered kidney function and has been associated with cardiovascular events. Therefore, clinicians must be knowledgeable of a patient's comorbid conditions and the long-term cardiovascular and renovascular effects of chemotherapy to weigh the risks and benefits of select pharmacotherapies. In addition, varenicline and bupropion can lower the seizure threshold and should be used with caution in patients treated with antidepressants and patients with a history of seizures, brain tumors, or metastases (UMHS, 2012).

Clinicians also should realize that cancer survivors may require more intense and tailored counseling. Survivors should be followed closely over time with multiple contact sessions because abstinence rates can begin to decline with time. Counseling may be more effective in the perioperative period (de Moor et al., 2008; Nayan et al., 2013).

The use of frameworks to guide interventions, such as the transtheoretical model and social cognitive/learning theory, can help patients focus on the importance of motivation to quit, barriers and benefits to quitting, self-efficacy, and attitudes and cues to actions (de Moor et al., 2008; Roberts, Kerr, & Smith, 2013). If unable to provide counseling services, clinicians should refer patients to a smoking behavioral specialist or counselor (Fiore et al., 2008). Although not demonstrating a significant change in long-term abstinence in the St. Jude study, quitlines, such as 1-800-QUITNOW, can provide survivors with accessible and cost-effective telephone counseling (Fiore et al., 2008; Klesges et al., 2015; Sarna & Bialous, 2016). In addition, quitlines can provide person-to-person counseling that may not be available to survivors facing barriers in access to care and increased risks of continued smoking, such as unemployment, poverty, and lack of insurance (Berg, Carpenter, et al., 2013;

Berg, Thomas, et al., 2013; Burcu et al., 2016; Kim et al., 2015; Sarna & Bialous, 2016; Tseng et al., 2010).

Individual clinician change is necessary for smoking cessation to occur among all patients with cancer. To support clinician change, systems-level changes are warranted. Such changes are identified in the HHS guideline and include implementing tobacco user identification systems; providing education, feedback, and resources to promote provider interventions; using dedicated staff to provide and evaluate tobacco treatment and its delivery; implementing hospital policies to support inpatient tobacco cessation services; and including coverage of tobacco cessation services (Fiore et al., 2008; Sarna & Bialous, 2016). Greater involvement of clinicians increases the chances of successful cessation; however, those providing cessation support must be knowledgeable about tobacco addiction and the evidence-based strategies of cessation treatment (Sarna & Bialous, 2016; Sarna, Wewers, Brown, Lillington, & Brecht, 2001). This is particularly important to oncology nurses, who can reinforce cessation treatments for unmotivated patients (Cooley, Sipples, Murphy, & Sarna, 2008). In addition, having a dedicated tobacco cessation program can provide support to busy clinicians who may not have the time or training to implement and personalize evidence-based tobacco cessation treatments (Sarna & Bialous, 2016; Warren & Ward, 2015). In a cross-sectional study by Goldstein, Ripley-Moffitt, Pathman, and Patasakam (2013), components of cancer centers with and without tobacco use treatment (TUT) services were compared. The authors revealed that having a TUT program within cancer centers increased providers' awareness of evidence-based tobacco support and treatments, ensured identification of all tobacco users, and provided more in-depth, individualized, and comprehensive treatment (Goldstein et al., 2013).

Finally, more research on cancer-specific tobacco cessation interventions is needed. According to the NCI (2017), few smoking intervention studies have been conducted in survivors because of survivors reporting nonsmoking status at diagnosis, medical histories or medications contraindicating smoking cessation interventions, noninterest in smoking cessation, comorbid psychiatric conditions, and loss to follow-up from travel, death, and contact problems. Despite these issues, data on survivor populations at risk for continued smoking and interventions most effective in tobacco use cessation should be gathered and analyzed.

Conclusion

Cigarette smoking is the leading cause of preventable death in the United States, and health behavior modifications are essential to the prevention of cancer and other chronic disease (CDC, 2016, 2017). Using the HHS tobacco treatment guideline via the Agency for Healthcare Research and Quality website, providers can assist smoking survivors in cessation through pharmacologic and behavioral interventions (Fiore et al., 2008). Although effective for the general population, many tobacco cessation interventions have not demonstrated the same efficacy for the oncology population (de Moor et al., 2008; Nayan et al., 2013). In addition, survivors who are aged 40 years and younger, are female, are not partnered, and report less socioeconomic and psychosocial support may be at greater risk for continued smoking after a diagnosis. Clinicians should use this information to identify survivors at risk for continued smoking, provide tailored cessation interventions, and follow survivors closely to prevent relapse and promote abstinence.

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