

NCI TOBACCO CONTROL
MONOGRAPH SERIES

23

**Treating Smoking in
Cancer Patients:
An Essential
Component of
Cancer Care**

NCI Tobacco Control Monograph 23

Treating Smoking in Cancer Patients: An Essential Component of Cancer Care

Citation

To use content, tables, or figures from this presentation, please use the following citation:

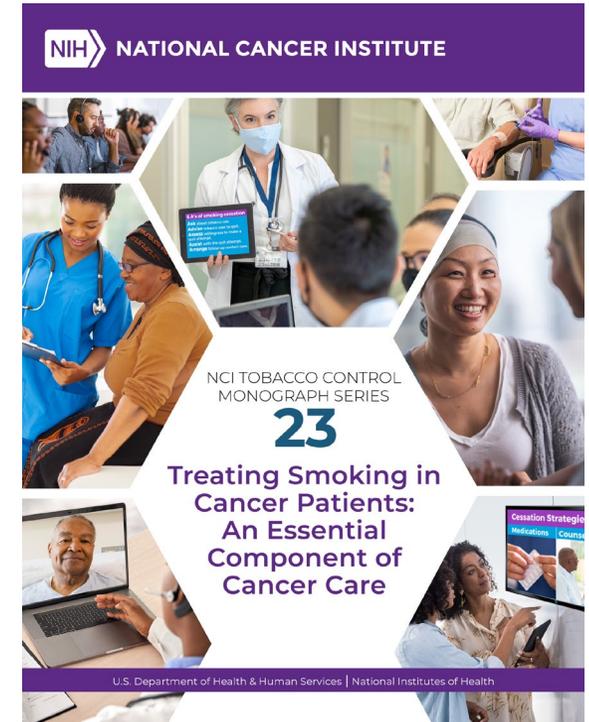
U.S. National Cancer Institute. *Treating Smoking in Cancer Patients: An Essential Component of Cancer Care*. National Cancer Institute Tobacco Control Monograph 23. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute; 2022.

Now Available!

NCI Tobacco Control Monograph #23

*Treating Smoking in Cancer Patients:
An Essential Component of Cancer Care*

is accessible online at cancercontrol.cancer.gov/monograph23



Contributors

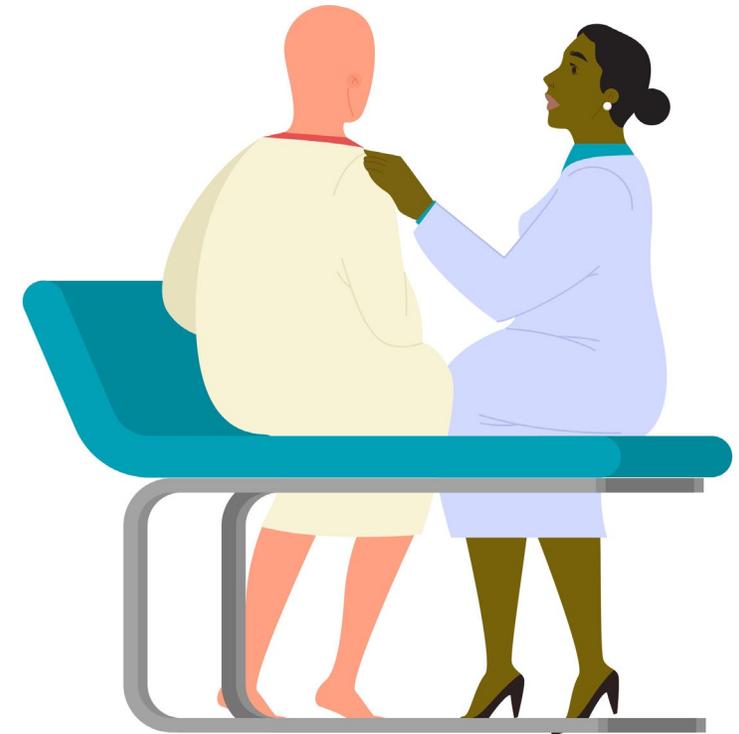
- Scientific editorial committee:
 - Timothy Baker, Ph.D., University of Wisconsin-Madison
 - Michael Fiore, M.D., M.P.H., M.B.A., University of Wisconsin-Madison
 - Anne Joseph, M.D., M.P.H., University of Minnesota Medical School
 - Monica Webb Hooper, Ph.D., National Institute on Minority Health and Health Disparities
 - Gordon Willis, Ph.D., National Cancer Institute

In addition to the scientific editorial committee, this monograph drew on the expertise of more than 20 subject matter specialists and was peer-reviewed by 52 scientific experts.

Monograph Contents

The monograph contains the following chapters:

1. Introduction and Overview
2. Smoking in Patients With Cancer: Biological Factors
3. Treating Tobacco Use and Dependence in Cancer Populations
4. Implementing Smoking Cessation Treatment Programs in Cancer Care Settings: Challenges, Strategies, Innovations, and Models of Care
5. Addressing Smoking in Medically Underserved and Vulnerable Cancer Populations
6. Monograph Conclusions and Future Research Directions



Topics Covered

The monograph presents evidence on:

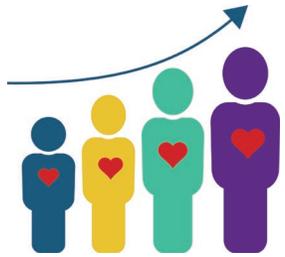
- Smoking and the biology of cancer.
- The effectiveness of smoking cessation treatment in the general population of individuals who smoke and in cancer populations specifically.
- How smoking cessation treatments can be modified to address the special challenges and needs of individuals with cancer.
- How smoking cessation treatment can be implemented in health care contexts generally and in cancer care contexts specifically.
- The opportunities for and challenges to enhancing smoking cessation success in medically underserved and vulnerable populations with cancer who smoke.

“

...quitting smoking is among the most effective treatment options [for people with cancer] in improving the likelihood of survival, quality of life, and overall health. ”

*Treating Smoking in Cancer Patients:
An Essential Component of Cancer Care*
NCI Tobacco Control Monograph 23

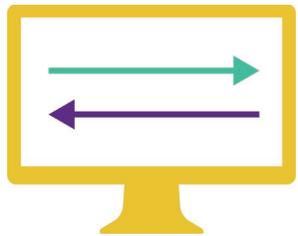
Major Conclusions



1. Smoking cessation after the diagnosis of cancer is highly likely to reduce all-cause mortality and cancer-specific mortality.



2. Research from the general population indicates that patients with cancer who smoke will benefit from smoking cessation treatments, including both counseling and U.S. Food and Drug Administration (FDA)–approved medications.

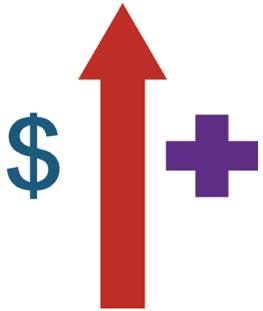


3. Effective strategies exist to increase the delivery of smoking cessation treatment in cancer care settings.

Major Conclusions (cont.)



4. Evidence-based smoking cessation treatment should be systematically provided to all patients with cancer, regardless of the type of cancer. However, patients with cancer are not consistently offered and provided such treatment.



5. Continued smoking after a cancer diagnosis is associated with higher health care utilization and greater health care costs in comparison with quitting smoking.



6. Medically underserved and vulnerable populations of cancer patients who smoke are very likely to benefit from using the evidence-based smoking cessation treatments identified as effective in the general population of people who smoke.

Major Conclusions (cont.)



7. The tobacco product marketplace and consumer use patterns are changing for both the general population and for patients with cancer, posing challenges for researchers and cancer care clinicians.



8. Continued research is needed to identify effective cessation interventions for patients with cancer who smoke and to better understand the effects of smoking cessation on cancer outcomes.

“

...all patients with cancer should have access to evidence-based smoking cessation treatment as a standard component of their care. ”

*Treating Smoking in Cancer Patients:
An Essential Component of Cancer Care*
NCI Tobacco Control Monograph 23

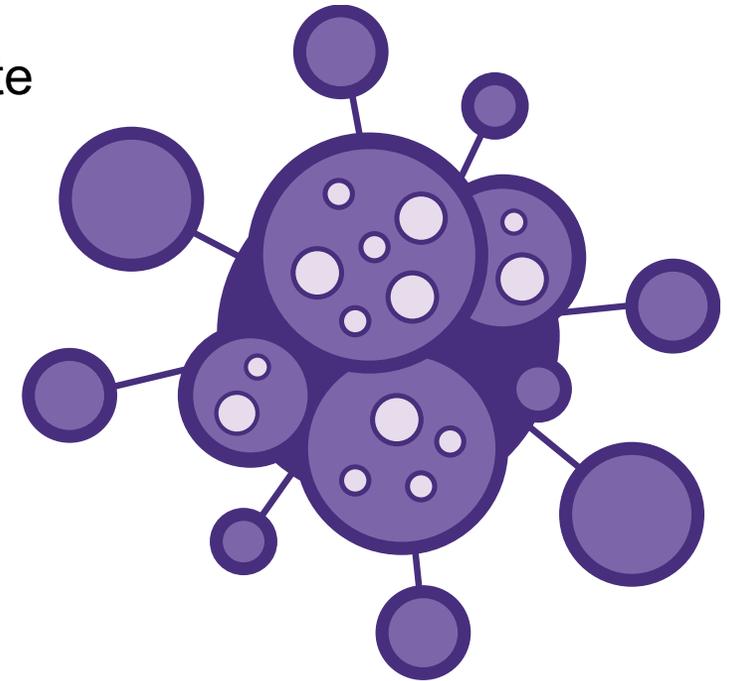
Future Research Needs

1. Clarifying the effects of continued smoking and smoking cessation treatment on cancer outcomes
2. Assessing the economic effects of continued smoking and cessation after a cancer diagnosis
3. Achieving better tobacco use assessment in cancer care
4. Addressing barriers to the implementation of effective treatment of tobacco use in cancer care
5. Understanding the effects of new tobacco products and other drug use in patients with cancer
6. Optimizing smoking cessation treatment for medically underserved and vulnerable populations with cancer

Chapter Conclusions

Chapter 2 Conclusions: *Smoking in Patients with Cancer: Biological Factors*

1. Tobacco smoke contains more than 7,000 chemical compounds including approximately 70 that are carcinogenic. Continued exposure to tobacco smoke after a cancer diagnosis may promote the continued growth and transformation of tumor cells through a variety of mechanisms.
2. Tumors in smokers are often biologically distinct from tumors in nonsmokers. In the case of lung cancer, these differences have important implications for cancer treatment and prognosis.
3. Laboratory studies of cancer cells exposed to tobacco smoke or tobacco smoke constituents provide experimental evidence that continued smoking by patients with cancer increases tumor aggressiveness and reduces therapeutic response.



Chapter 3 Conclusions: *Treating Tobacco Use and Dependence in Cancer Populations*

1. Despite the heightened risks for adverse cancer-related outcomes due to continued smoking after a cancer diagnosis, too few patients with cancer who smoke are offered evidence-based smoking cessation treatment and too few engage in such treatment.
2. Patients with cancer who smoke generally have strong motivation to quit, and a high percentage make one or more quit attempts during their cancer treatment.
3. Research with the general population of individuals who smoke has identified effective smoking cessation intervention strategies, including counseling, medications, and web-based and short message service (SMS) (text) digital interventions.



Chapter 3 Conclusions (cont.)

4. Although more research on the effectiveness of smoking cessation treatments in cancer populations is needed, the consistent effects of these treatments across diverse populations who smoke suggests that they are likely effective in cancer populations as well. Smoking cessation treatments may benefit from adaptation (e.g., addressing fatalism and depression) to best meet the needs of cancer populations and provide optimal benefit.
5. The combination of cognitive behavioral therapy (CBT) counseling with either nicotine replacement therapy (NRT) or varenicline is an especially effective smoking cessation treatment among the general population of people who smoke. CBT counseling has been shown to be effective in the general population when delivered via several different routes such as in-person, in groups, and by phone. These treatments are recommended for use with patients in general in the Public Health Service (PHS) Clinical Practice Guideline, *Treating Tobacco Use and Dependence: 2008 Update*, and for patients with cancer who smoke in the National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines in Oncology.

Chapter 3 Conclusions (cont.)

6. Patients who have been diagnosed with cancer face significant patient-level barriers to smoking cessation that include competing demands due to their cancer treatment, complications and side effects of cancer treatment, pain, psychological distress, and guilt regarding tobacco use. These barriers should be assessed and addressed in strategies used to offer and deliver smoking cessation treatment to patients with cancer.
7. Clinician-level barriers to providing smoking cessation treatment to patients with cancer include limited time per encounter, clinicians' beliefs that FDA-approved cessation medications are ineffective, and lack of confidence or training in providing smoking cessation treatment.

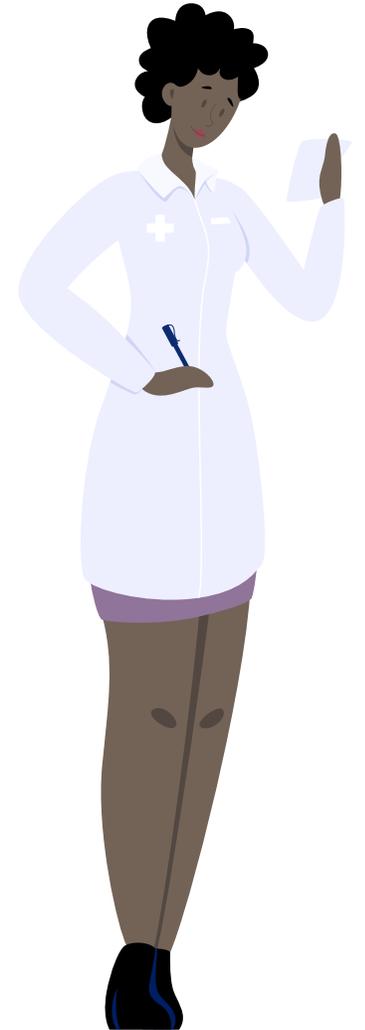
Chapter 3 Conclusions (cont.)

8. The efficacy of electronic nicotine delivery systems (ENDS) as an aid for smoking cessation for patients with cancer is not established. Additionally, the short- and long-term health effects of ENDS use (alone or in combination with cigarettes) by patients with cancer remain to be determined.
9. Many patients with cancer who try to quit smoking will relapse. Data from the general population suggest that periodic, repeated offers of additional smoking cessation treatment to patients with cancer diagnoses who have relapsed will lead to increased quit attempts and quitting success.



Chapter 4 Conclusions: *Implementing Smoking Cessation Treatment Programs in Cancer Care Settings*

1. Challenges to implementing smoking cessation treatment in cancer care settings persist at the patient, clinician, and health care system levels. It is important that these multilevel barriers be understood and addressed so that health care systems can provide cessation treatment equitably and effectively to all patients with cancer who smoke.
2. Successful implementation of smoking cessation treatment in cancer care settings requires health care system changes designed to increase the reach, effectiveness, adoption, implementation, and maintenance (i.e., the RE-AIM framework) of smoking cessation treatment interventions.
3. Effective strategies to improve smoking cessation treatment reach and engagement in oncology care start with the consistent and accurate assessment of tobacco use status for all patients across the cancer care continuum. Assessment of tobacco use for all patients with cancer needs to be empathic and nonjudgmental to reduce patient anxiety, embarrassment, or guilt, and to encourage accurate disclosure of tobacco use status.



Chapter 4 Conclusions (cont.)

4. Clinic-wide opt-out (as opposed to opt-in) smoking cessation treatment engagement strategies show promise as a means of enhancing the reach and delivery of smoking cessation treatments to patients with cancer who smoke.
5. Clinical decision supports, prompts, and order sets embedded in electronic health records (EHRs) can improve the rate of both screening for tobacco use and delivering smoking cessation treatments. Such EHR tools can aid in the delivery of smoking cessation treatment, either as part of the cancer care or via a referral to an internal health care system tobacco treatment specialist or to an external option, such as a state tobacco quitline, state quitline-provided texting program, or the National Cancer Institute's (NCI) SmokefreeTXT.

Chapter 4 Conclusions (cont.)

6. Health care system accreditation guidelines, publicly reported quality metrics, and pay-for-performance programs can encourage health care systems to improve the frequency of tobacco use screening and treatment for all patients who smoke, including those with cancer.
7. Research has identified multiple smoking cessation treatment program models (e.g., smoking cessation treatment delivered during cancer care or via referral to internal or external smoking cessation treatment services) that can be effectively implemented in a variety of cancer clinical settings.
8. Continued smoking after a cancer diagnosis is associated with increased health care costs relative to not smoking. Smoking cessation interventions provided to patients with cancer are highly likely to be cost-effective.

Chapter 4 Conclusions (cont.)

9. The NCI Cancer Center Cessation Initiative (C3I) has developed a variety of implementation strategies to enhance the reach and effectiveness of smoking cessation treatment delivery in NCI-Designated Cancer Centers. These approaches exemplify how smoking cessation treatment strategies can be implemented broadly in cancer care settings.
10. Strategies to reduce system-level barriers to cessation among patients with cancer who smoke include ensuring that evidence-based cessation treatments are provided as a covered benefit by health insurers and other payers, without barriers to access and/or use.



Chapter 5 Conclusions: *Addressing Smoking in Medically Underserved and Vulnerable Cancer Populations*

1. Medically underserved and vulnerable populations face challenges at the individual, community, health care system, and societal levels that affect the likelihood that individuals will smoke, that they will develop cancer, and/or that they will receive effective smoking cessation treatment.
2. Challenges shared by many medically underserved and vulnerable individuals who smoke, including those with cancer, include poverty, high levels of stress, discrimination, lack of health insurance coverage, competing priorities, inadequate access to health care and smoking cessation treatment, and frequent exposure to smoking in their social networks and to tobacco industry marketing.
3. Patients with cancer who are also members of medically underserved and vulnerable populations are motivated to quit smoking but some of these groups tend to be less likely to be successful in their attempts to quit smoking than are cancer patients from the general population. More research is needed regarding the effectiveness of smoking cessation treatment among medically underserved and vulnerable groups of cancer patients who smoke and regarding strategies for increasing the reach and cost-effectiveness of such treatment.

Selected Monograph Figures and Tables

Table 1.3 Studies That Compare All-Cause Mortality in Patients Who Quit Smoking After a Cancer Diagnosis With Patients Who Continued After Diagnosis (2017–2021)

Study	Design/population	Follow-up period	Definition of groups	All-cause mortality findings
Barnett et al. 2020	<ul style="list-style-type: none"> Retrospective cohort 369 patients with nonmetastatic cancer who were current smokers at time of diagnosis United States 	3 years	<ul style="list-style-type: none"> <i>Quit</i>: Smoking cessation within 6 months of diagnosis <i>Continued smoking</i>: No smoking cessation within 6 months of diagnosis 	Adjusted RR: <ul style="list-style-type: none"> <i>Quit</i>: 0.72 (95% CL, 0.37–1.4) Continued smoking: 1.0 (referent)
Day et al. 2020	<ul style="list-style-type: none"> Prospective cohort 117 patients with head and neck squamous cell carcinoma who were current smokers and enrolled in a tobacco treatment program United States 	Median follow-up of 5.2 years (among survivors)	<ul style="list-style-type: none"> <i>Quit</i>: Abstinence (7-day point prevalence) at 9 months after tobacco treatment program enrollment <i>Continued smoking</i>: Nonabstinence at 9 months 	Adjusted HR, Stage I-II patients: <ul style="list-style-type: none"> <i>Quit</i>: 0.15 (95% CI, 0.03–0.82) Continued smoking: 1.0 (referent) Adjusted HR, Stage III-IV patients: <ul style="list-style-type: none"> <i>Quit</i>: 1.51 (95% CI, 0.75–3.07) Continued smoking: 1.0 (referent)
Gemine et al. 2019	<ul style="list-style-type: none"> Prospective cohort 1,124 patients with newly diagnosed non-small cell lung cancer, including 364 patients who were current smokers at the time of diagnosis United Kingdom 	1 year	<ul style="list-style-type: none"> <i>Quit</i>: Smoking cessation within 3 months of diagnosis and sustained abstinence during the follow-up period <i>Continued smoking</i>: No smoking cessation within 3 months of diagnosis 	Adjusted HR: <ul style="list-style-type: none"> <i>Quit</i>: 0.75 (95% CI, 0.46–1.20) Continued smoking: 1.0 (referent)

Note. CI = confidence interval, CL = confidence limit, HR = hazard ratio, NHS = Nurses' Health Study, RR = risk ratio

Table 1.3 Studies That Compare All-Cause Mortality in Patients Who Quit Smoking After a Cancer Diagnosis With Patients Who Continued After Diagnosis (2017–2021) (cont.)

Study	Design/population	Follow-up period	Definition of groups	All-cause mortality findings
Hansen et al. 2020	<ul style="list-style-type: none"> • Prospective cohort • 678 patients with invasive epithelial ovarian cancer, including 512 patients with postdiagnosis data available • Australia 	4 years	<ul style="list-style-type: none"> • <i>Quit</i>: Smoking cessation after diagnosis • <i>Continued smoking</i>: No smoking cessation after diagnosis • <i>Never or former smoking</i>: Never or former smoking before and after diagnosis 	Adjusted HR: <ul style="list-style-type: none"> • <i>Quit</i>: 0.99 (95% CI, 0.57–1.72) • Continued smoking: 1.90 (95% CI, 1.08–3.37) • Never or former smoking: 1.0 (referent)
Hawari et al. 2019	<ul style="list-style-type: none"> • Retrospective cohort • 2,387 cancer patients who were current smokers with survival data available • Jordan 	2 years	<ul style="list-style-type: none"> • <i>Quit at two or more time points</i>: More than one visit to smoking cessation clinic and smoking abstinence at two or more follow-up points (3, 6, and 12 months) • <i>Quit at one time point</i>: More than one visit to smoking cessation clinic and abstinence at only one-follow-up point • <i>Continued smoking</i>: More than one visit to smoking cessation clinic and no abstinence recorded at any follow-up point • <i>No follow-up</i>: No visits or only one visit to smoking cessation clinic, or smoking cessation clinic visit occurred more than a year after diagnosis 	Adjusted HR: <ul style="list-style-type: none"> • <i>Quit at two or more time points</i>: 1.0 (referent) • <i>Quit at one time point</i>: 1.3 (95% CI, 0.65–2.6) • Continued smoking: 2.7 (95% CI, 1.4–5.0) • No follow-up: 2.8 (95% CI, 1.7–4.6)

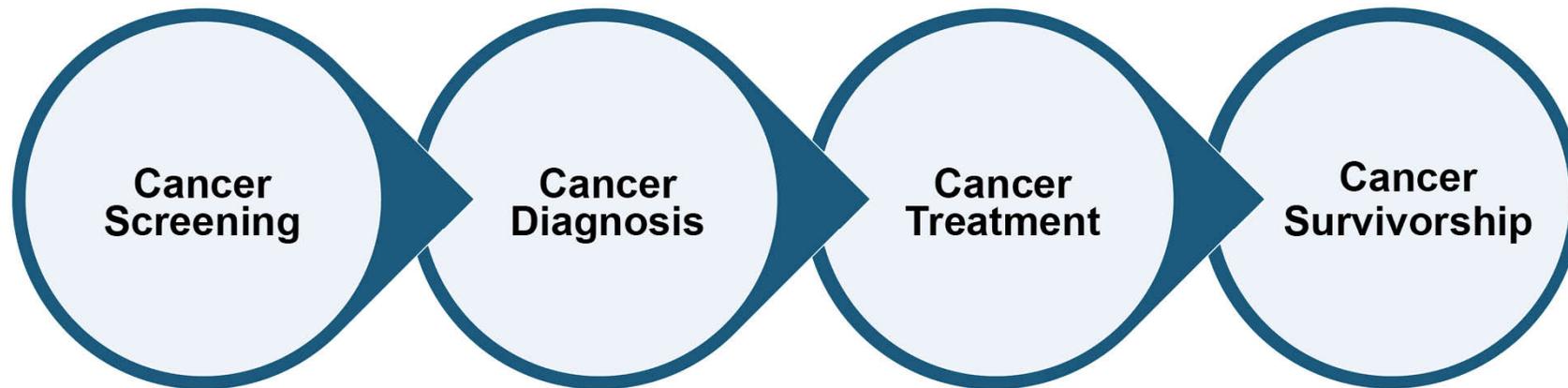
Note. CI = confidence interval, CL = confidence limit, HR = hazard ratio, NHS = Nurses' Health Study, RR = risk ratio

Table 1.3 Studies That Compare All-Cause Mortality in Patients Who Quit Smoking After a Cancer Diagnosis With Patients Who Continued After Diagnosis (2017–2021) (cont.)

Study	Design/population	Follow-up period	Definition of groups	All-cause mortality findings
Romaszko-Wojtowicz et al. 2018	<ul style="list-style-type: none"> Retrospective cohort 111 patients with multiple primary malignancies, including 108 ever-smokers Poland 	Survival assessed for eligible patients identified from 2013 to 2017	<ul style="list-style-type: none"> <i>Quit</i>: Quit smoking after first cancer and before new cancer <i>Continued smoking</i>: Continued to smoke after first cancer <i>Nonsmoking</i>: Never smoking or smoked fewer than 100 cigarettes in lifetime 	Average survival time after first cancer: <ul style="list-style-type: none"> <i>Quit</i>: 13.75 years <i>Continued smoking</i>: 6.57 years
Sheikh et al. 2021	<ul style="list-style-type: none"> Prospective cohort 517 patients with non-small cell lung cancer who were current smokers Russia 	Average 7 years	<ul style="list-style-type: none"> <i>Quit</i>: Smoking cessation during follow-up period (annual follow-ups) <i>Continued smoking</i>: No smoking cessation during follow-up 	Adjusted HR: <ul style="list-style-type: none"> <i>Quit</i>: 0.67 (95% CI, 0.53–0.83) <i>Continued smoking</i>: 1.0 (referent)
Wang et al. 2020	<ul style="list-style-type: none"> Prospective cohort (Nurses' Health Study [NHS] and NHSII) 1,279 patients with ovarian cancer, including 1,133 patients with postdiagnosis data United States 	Median survival time of 4.5 years in NHS and 6.6 years in NHSII	<ul style="list-style-type: none"> <i>Quit smoking</i>: Smoking status of current smoking before diagnosis and former smoking after diagnosis <i>Continued smoking</i>: Smoking status of current smoking at both pre- and post-diagnosis assessments <i>Former smoking</i>: Former smoking at both pre- and post-diagnosis assessments <i>Never smoking</i>: Never smoking at both pre- and post-diagnosis assessments 	Adjusted HR: <ul style="list-style-type: none"> <i>Quit</i>: 0.91 (95% CI, 0.62–1.35) <i>Continued smoking</i>: 1.43 (95% CI, 1.11–1.86) <i>Former smoking</i>: 1.19 (95% CI, 1.01–1.40) <i>Never smoking</i>: 1.0 (referent)

Note. CI = confidence interval, CL = confidence limit, HR = hazard ratio, NHS = Nurses' Health Study, RR = risk ratio

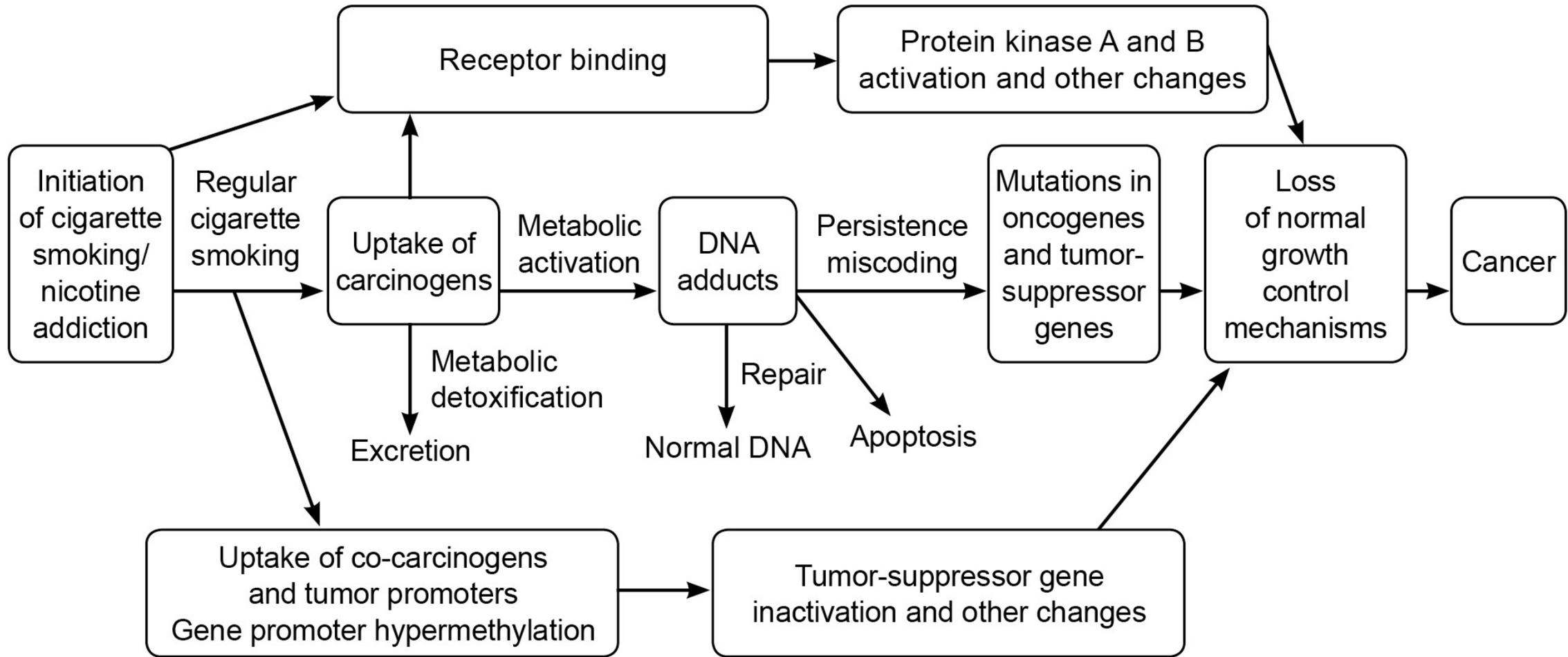
Figure 1.1 Opportunities for Smoking Intervention Across the Cancer Care Continuum



- Lung cancer screening is an especially important window of opportunity. Patients with abnormal test results have higher rates of cessation, but over half continue to smoke long term.
 - Active clinician interventions (e.g., “Assist” and “Arrange” steps) remain key to motivating and supporting cessation efforts.
- Cessation rates tend to be higher among those with a cancer diagnosis than in the general population.
 - Cessation rates vary by cancer type.
 - Cancer patients are highly motivated to try to quit smoking after their cancer diagnosis.
- Smoking interventions in the perioperative period may be especially effective.
 - Patients with later stages of cancer or requiring extensive treatment tend to quit at higher rates.
 - Pain may be a barrier to cessation.
 - Relapse rates after treatment are high, underscoring the need for ongoing clinician vigilance.
- Smoking remains prevalent among cancer survivors.
 - Self-reported smoking status is especially prone to misreporting.
 - As patients enter long-term survivorship, achieving continuity of care for smoking treatment requires partnership with primary care providers.

Note: Intervention to promote smoking cessation is critical across the cancer care continuum. Cancer screening, diagnosis, treatment, and survivorship are all candidate stages for “teachable moments” that hold the potential for positive behavior change. Specific challenges to smoking cessation treatment implementation may vary by stage.

Figure 2.1 Major Pathways of Cancer Causation by Cigarette Smoking



Source: 2010 Surgeon General's report.

Figure 3.2 Examples of Patient-, Clinician-, and Systems-Level Barriers to the Use of Smoking Cessation Treatment in Cancer Care Settings

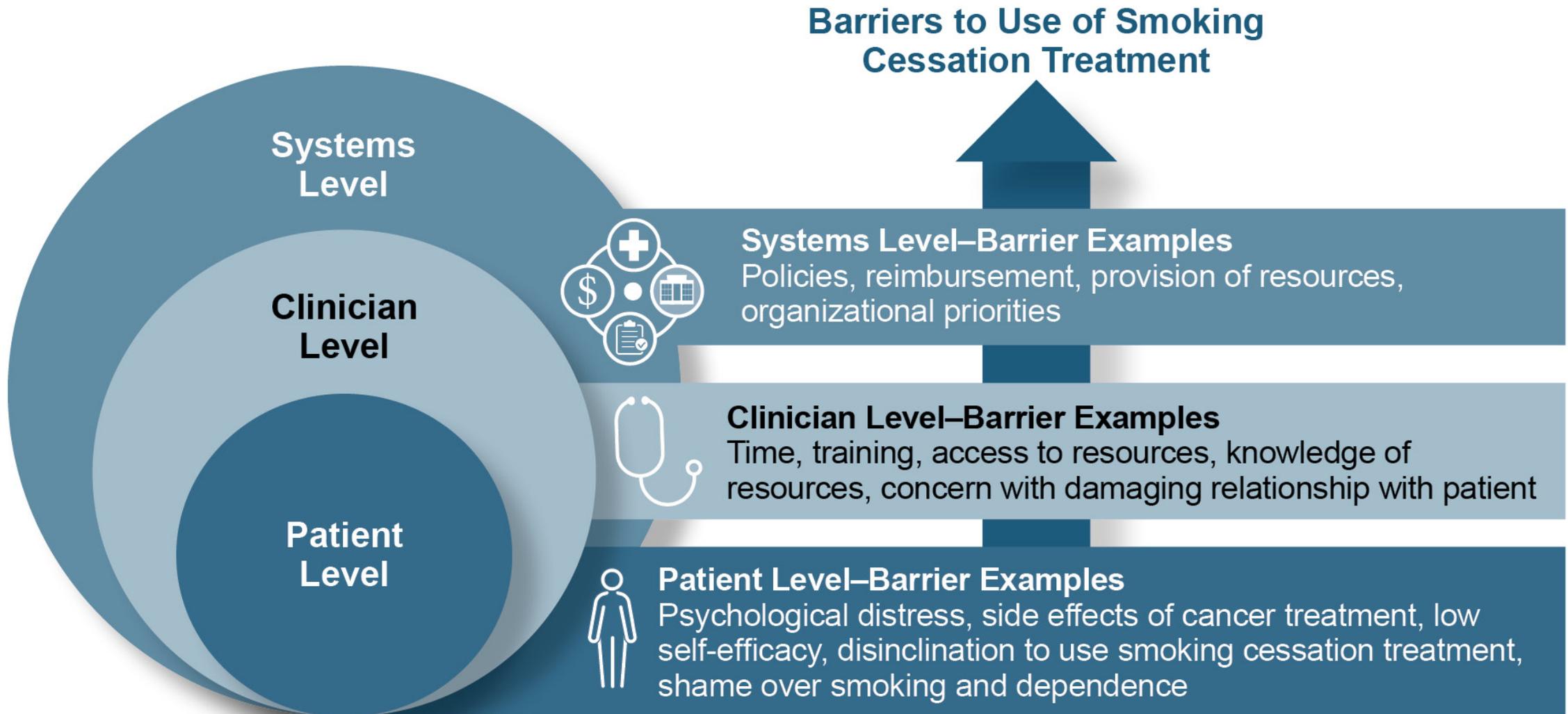


Table 3.2 Effectiveness and Abstinence Rates for Various Medications and Medication Combinations Compared to Placebo at 6-Months Post-quit

Medication	Number of arms	Estimated odds ratio (95% CI)	Estimated abstinence rate (95% CI)
Placebo	80	1.0	13.8
Monotherapies			
Varenicline	5	3.1 (2.5–3.8)	33.2 (28.9–37.8)
Nicotine nasal spray	4	2.3 (1.7–3.0)	26.7 (21.5–32.7)
High-dose nicotine patch (> 25 mg) (these included both standard or long-term duration)	4	2.3 (1.7–3.0)	26.5 (21.3–32.5)
Long-term nicotine gum (>14 weeks)	6	2.2 (1.5–3.2)	26.1 (19.7–33.6)
Varenicline (1 mg/day)	3	2.1 (1.5–3.0)	25.4 (19.6–32.2)
Nicotine inhaler	6	2.1 (1.5–2.9)	24.8 (19.1–31.6)
Clonidine	3	2.1 (1.2–3.7)	25.0 (15.7–37.3)
Bupropion SR	26	2.0 (1.8–2.2)	24.2 (22.2–26.4)
Nicotine patch (6–14 weeks)	32	1.9 (1.7–2.2)	23.4 (21.3–25.8)
Long-term nicotine patch (> 14 weeks)	10	1.9 (1.7–2.3)	23.7 (21.0–26.6)
Nortriptyline	5	1.8 (1.3–2.6)	22.5 (16.8–29.4)
Nicotine gum (6–14 weeks)	15	1.5 (1.2–1.7)	19.0 (16.5–21.9)

Note. *N* = 86 studies. Visit <https://www.ahrq.gov/prevention/guidelines/tobacco/clinicians/references/meta/meta03.html#t626> for the studies used in this meta-analysis. NRT = nicotine replacement therapy. *Source:* Adapted from Fiore et al. 2008 (Table 6.26).

Table 3.2 Effectiveness and Abstinence Rates for Various Medications and Medication Combinations Compared to Placebo at 6-Months Post-quit (cont.)

Medication	Number of arms	Estimated odds ratio (95% CI)	Estimated abstinence rate (95% CI)
Combination therapies			
Patch (long-term; >14 weeks) + ad lib NRT (gum or spray)	3	3.6 (2.5–5.2)	36.5 (28.6–45.3)
Patch + bupropion SR	3	2.5 (1.9–3.4)	28.9 (23.5–35.1)
Patch + nortriptyline	2	2.3 (1.3–4.2)	27.3 (17.2–40.4)
Patch + inhaler	2	2.2 (1.3– 3.6)	25.8 (17.4–36.5)
Patch + second generation antidepressants (paroxetine, venlafaxine)	3	2.0 (1.2–3.4)	24.3 (16.1–35.0)
Medications not shown to be effective			
Selective serotonin re-uptake inhibitors	3	1.0 (0.7–1.4)	13.7 (10.2–18.0)
Naltrexone	2	0.5 (0.2–1.2)	7.3 (3.1–16.2)

Note. *N* = 86 studies. Visit <https://www.ahrq.gov/prevention/guidelines/tobacco/clinicians/references/meta/meta03.html#t626> for the studies used in this meta-analysis. NRT = nicotine replacement therapy. *Source:* Adapted from Fiore et al. 2008 (Table 6.26).

Table 3.4 Odds of Smoking Cessation Using Behavioral Interventions

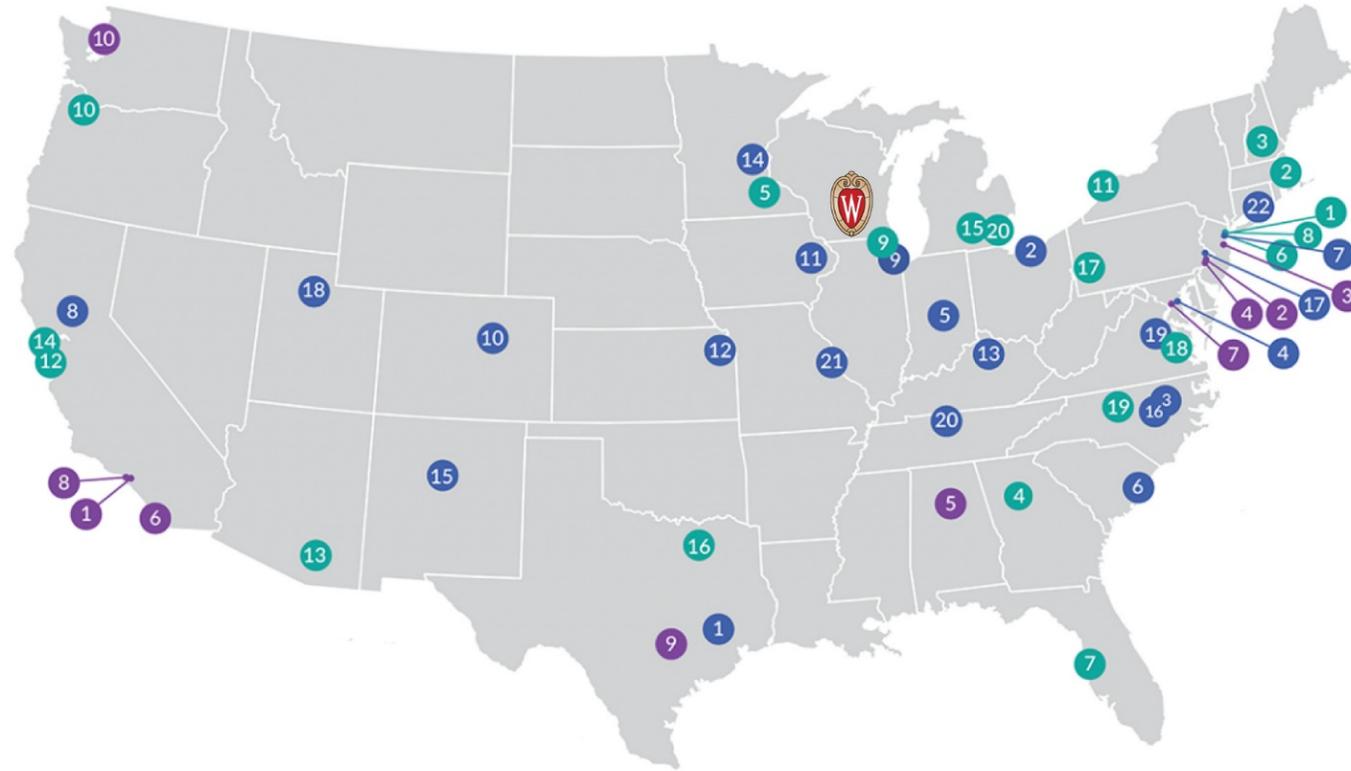
Comparison	Odds ratio, risk ratio, or g (95% CI)	Number of studies included in the respective review
Counseling treatments		
Cognitive behavioral therapy vs. control (Fiore et al. 2008)	1.5 (1.3–1.8) ^a	64
Mindfulness vs. control (Maglione et al. 2017)	2.52 (0.76–8.29)	6
Acceptance and commitment therapy vs. control (Lee et al. 2015)	0.42 (0.19–0.64) ^b	5
Behavioral activation	N/A	N/A
Motivational interviewing vs. control (Lindson et al. 2019)	0.84 (0.63–1.12)	4
Contingency management vs. control (Notley et al. 2019)	1.49 (1.28–1.73) ^a	30
Digital treatments		
Website interventions vs. control (McCrabb et al. 2019)	1.19 (1.06–1.35) ^{a,c}	31
Text message intervention vs. control (Whittaker et al. 2019)	1.54 (1.19–2.0) ^a	13

Note. N/A = not applicable. Smoking cessation measure varied by study.

^aIndicates benefit for active treatment vs. control. ^b*g* statistic indicating benefit of Acceptance and Commitment Therapy vs. control. ^c*N* and effect estimate for the study by McCrabb and colleagues are for all long-term (6-month) outcomes (prolonged abstinence, 7-day point-prevalence abstinence, and 30-day point-prevalence abstinence). Variation was found by outcome measure, with significant effects for prolonged abstinence, but no significant effects for 7- and 30-day point-prevalence abstinence determined at 6-month follow-up.

Source: Adapted from systematic reviews and meta-analyses from Fiore et al. 2008, Maglione et al. 2017, Lee et al. 2015, Notley et al. 2019, Lindson et al. 2019, McCrabb et al. 2019, and Whittaker et al. 2019.

Figure 4.4 National Cancer Institute (NCI) Cancer Center Cessation Initiative (C3I) Sites



Cohort 1 (2017-2019)

1. Baylor College of Medicine
2. Case Western Reserve University
3. Duke University
4. Georgetown University
5. Indiana University
6. Medical University of South Carolina
7. New York University
8. University of California Davis
9. University of Chicago
10. University of Colorado
11. University of Iowa
12. University of Kansas
13. University of Kentucky
14. University of Minnesota
15. University of New Mexico
16. University of North Carolina at Chapel Hill
17. University of Pennsylvania
18. University of Utah
19. University of Virginia
20. Vanderbilt University
21. Washington University
22. Yale University

Cohort 2 (2018-2020)

1. Columbia University
2. Dana-Farber/Harvard Cancer Center
3. Dartmouth College
4. Emory University
5. Mayo Clinic
6. Memorial Sloan Kettering
7. Moffitt
8. Mount Sinai
9. Northwestern University
10. Oregon Health and Science University
11. Roswell Park
12. Sanford University
13. University of Arizona
14. University of California San Francisco
15. University of Michigan
16. University of Texas Southwestern
17. UPMC Hillman
18. Virginia Commonwealth University
19. Wake Forest University
20. Wayne State University

Cohort 3 (2020-2021)

1. City of Hope Comprehensive Center
2. Fox Chase Cancer Center
3. Rutgers Cancer Institute of New Jersey
4. Thomas Jefferson University
5. University of Alabama at Birmingham
6. University of California, San Diego
7. University of Maryland
8. University of Southern California
9. University of Texas
10. University of Washington

 = C3I Coordinating Center, University of Wisconsin Carbone Cancer Center

Figure 4.5 Elements of Exemplar Tobacco Cessation Treatment Programs: Three Models Used Successfully in Cancer Care Settings

Common Elements for All Tobacco Treatment Programs (TTPs)

- Screen all patients for tobacco use and document status in EHR.
- Offer all tobacco users both counseling and medication for smoking cessation via one or more of the three treatment models below.
- Leverage the EHR to facilitate delivery of program elements and to monitor program utilization and outcomes.

Oncology clinics and their health systems can adapt one of the three treatment models below or combine elements of these models.

Model 1 Point-of-Care Delivery of Tobacco Treatment

- Oncology clinicians:
 - Advise tobacco cessation.
 - Prescribe cessation medication.
 - May provide counseling.
 - Emphasize the impact of continued tobacco use on both cancer and non-cancer outcomes.
- Nurse or health educator in oncology clinic:
 - Typically delivers bulk of counseling care.
 - Sometimes including referral to internal/external TTPs (see models 2 and 3).
- Point-of-care treatment occurs as part of oncology care visits.

Model 2 Refer Patients to an Internal TTP

- Oncology clinicians and/or clinic staff:
 - Advise tobacco cessation.
 - Refer patients to dedicated TTP within the cancer center health care system.
- Internal TTPs are staffed by trained tobacco treatment specialists or other trained clinicians. Such staff typically:
 - Provide feedback, usually via the EHR, to the oncology care clinicians.
 - Oversee cessation follow-up care (e.g., continuing counseling, troubleshooting medication problems, renewals, changes).
- Internal TTPs also typically include (either via opt-in or opt-out system):
 - EHR-based outreach to all patients within the cancer care setting identified as patients who smoke (e.g., via the EHR Tobacco User Registry function).
- Internal TTPs cessation services are typically delivered apart from oncology care visits.

Model 3 Refer Patients to an External TTP

- Oncology clinicians and/or clinic staff:
 - Refer patients to TTPs outside of the cancer center/health care system, such as state quitline or SmokefreeTXT.
- Outcomes of external TTP referral and care are shared with oncology care team:
 - Ideally, via closed-loop e-Referral capacities that now exist for state quitline and SmokefreeTXT to inform treating clinicians of referral outcomes.
- Prescribing of cessation medications may be delivered by the oncology care clinical team or by the external TTP referral.
- Referral to external TTPs can be offered via EHR-based outreach to all patients who smoke within the cancer care setting, typically via the EHR Tobacco User Registry function.
- External TTP cessation services are typically delivered apart from oncology care.

Table 5.1 Prevalence of Current Cigarette Smoking Among U.S. Adults Age 18 and Older, by Sex, Race and Ethnicity, Poverty Status, Income, Educational Attainment, and Sexual Orientation, 1994–2020

Category	1994	1998	2002	2006	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	25.5	24.1	22.5	20.8	19.3	19.0	18.1	17.8	16.8	15.1	15.5	14.0	13.7	14.0	12.5
Sex															
Male	28.2	26.4	25.2	23.9	21.5	21.6	20.5	20.5	18.8	16.7	17.5	15.8	15.6	15.3	14.1
Female	23.1	22.0	20.0	18.0	17.3	16.5	15.8	15.3	14.8	13.6	13.5	12.2	12.0	12.7	11.0
Race/ethnicity^a															
White	26.3	25.0	23.6	21.9	21.0	20.6	19.7	19.4	18.2	16.6	16.6	15.2	15.0	15.5	13.3
Black	27.2	24.7	22.4	23.0	20.6	19.4	18.1	18.3	17.5	16.7	16.5	14.9	14.6	14.9	14.4
Latino or Hispanic	19.5	19.1	16.7	15.2	12.5	12.9	12.5	12.1	11.2	10.1	10.7	9.9	9.8	8.8	8.0
American Indian or Alaska Native	42.2	40.0	40.8	32.4	31.4	31.5	21.8	26.1	29.2	21.9	31.8	24.0	22.6	20.9	27.1
Asian or Pacific Islander	13.9	13.7	—	—	—	—	—	—	—	—	—	—	—	—	—
Asian	—	—	13.3	10.4	9.2	9.9	10.7	9.6	9.5	7.0	9.0	7.1	7.1	7.2	8.0
Multiple races	—	—	—	—	25.9	27.4	26.1	26.8	27.9	20.2	25.2	20.6	19.1	—	—
Poverty status															
At or above	24.1	23.5	22.2	20.4	18.3	17.9	17.0	16.2	15.2	13.9	14.3	—	—	—	—
Below	34.7	32.3	32.9	30.6	28.9	29.0	27.9	29.2	26.3	26.1	25.3	—	—	—	—
Unknown	28.8	22.5	19.7	18.3	16.0	15.0	13.6	16.0	16.4	10.5	12.0	—	—	—	—

Note: Numbers are percentages. Em dash (—) = data not collected in a category for a particular year. Current smoking includes individuals who smoked at least 100 cigarettes in their lifetime and who smoked every day or some days. The National Health Interview Survey (NHIS) was redesigned in 1997 and 2019, and trend analysis and comparison with prior years should be conducted with caution.

^aAll racial and ethnic groups are non-Hispanic except those categorized as Hispanic. In 1997, the Office of Management and Budget changed its data collection guidelines to require Native Hawaiian and Other Pacific Islander data be collected separately from Asian populations. Limited data were collected on American Indian or Alaska Native people, and data for a single year could be unstable or unreliable due to a small sample size. Data on current smoking among Native Hawaiian or other Pacific Islander people are not reported. ^bAdditional categories were added to education in 1999. Educational attainment data are provided for individuals age 25 years or older. GED = general educational development certificate. ^cResponse options provided on the NHIS were “straight, that is, not gay” for men, and “straight, that is, not gay or lesbian” for women.

Source: National Health Interview Survey, 1994–2019: Agaku et al. 2014; Centers for Disease Control and Prevention (CDC) 1996, 2000, 2004, 2007, 2012; Cornelius et al. 2020, 2022; Creamer et al. 2019; Jamal et al. 2014, 2015, 2016, 2018; Wang et al. 2018.

Table 5.1 Prevalence of Current Cigarette Smoking Among U.S. Adults Age 18 and Older, by Sex, Race and Ethnicity, Poverty Status, Income, Educational Attainment, and Sexual Orientation, 1994–2020 (cont.)

Category	1994	1998	2002	2006	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Income (USD)															
<35,000	—	—	—	—	—	—	—	—	—	—	—	21.4	21.3	21.4	20.2
35,000–74,999	—	—	—	—	—	—	—	—	—	—	—	15.3	14.9	15.7	14.1
75,000–99,999	—	—	—	—	—	—	—	—	—	—	—	11.8	13.3	11.4	10.5
≥100,000	—	—	—	—	—	—	—	—	—	—	—	7.6	7.3	7.1	6.2
Educational attainment^b															
0–12 years (no diploma)	—	—	27.6	26.7	25.1	25.5	24.7	24.2	22.9	24.2	24.1	23.1	21.8	21.6	21.5
≤8th grade	23.7	21.9	19.3	17.4	16.2	15.0	15.2	15.4	13.7	14.4	16.2	—	—	—	—
9th–11th grade	38.2	36.8	34.1	35.4	33.8	34.6	32.1	33.2	29.5	31.6	30.7	—	—	—	—
12th grade (no diploma)	—	—	31.0	25.6	21.7	25.1	24.7	19.7	25.7	26.3	24.8	—	—	—	—
GED certificate	—	—	42.3	46.0	45.2	45.3	41.9	41.4	43.0	34.1	40.6	36.8	36.0	35.3	32.0
High school graduate	29.8	27.4	25.6	23.8	23.8	23.8	23.1	22.0	21.7	19.8	19.7	18.7	19.7	19.6	17.6
Some college (no degree)	—	—	23.1	22.7	23.2	22.3	20.9	20.9	19.7	18.5	18.9	17.4	18.3	17.7	14.4
Associate degree	—	—	21.5	21.2	18.8	19.3	17.9	17.8	17.1	16.6	16.8	15.5	14.8	14.0	12.7
Undergraduate degree	—	—	12.1	9.6	9.9	9.3	9.1	9.1	7.9	7.4	7.7	7.1	7.1	6.9	5.6

Note: Numbers are percentages. Em dash (—) = data not collected in a category for a particular year. Current smoking includes individuals who smoked at least 100 cigarettes in their lifetime and who smoked every day or some days. The National Health Interview Survey (NHIS) was redesigned in 1997 and 2019, and trend analysis and comparison with prior years should be conducted with caution.

^aAll racial and ethnic groups are non-Hispanic except those categorized as Hispanic. In 1997, the Office of Management and Budget changed its data collection guidelines to require Native Hawaiian and Other Pacific Islander data be collected separately from Asian populations. Limited data were collected on American Indian or Alaska Native people, and data for a single year could be unstable or unreliable due to a small sample size. Data on current smoking among Native Hawaiian or other Pacific Islander people are not reported. ^bAdditional categories were added to education in 1999. Educational attainment data are provided for individuals age 25 years or older. GED = general educational development certificate. ^cResponse options provided on the NHIS were “straight, that is, not gay” for men, and “straight, that is, not gay or lesbian” for women.

Source: National Health Interview Survey, 1994–2019: Agaku et al. 2014; Centers for Disease Control and Prevention (CDC) 1996, 2000, 2004, 2007, 2012; Cornelius et al. 2020, 2022; Creamer et al. 2019; Jamal et al. 2014, 2015, 2016, 2018; Wang et al. 2018.

Table 5.1 Prevalence of Current Cigarette Smoking Among U.S. Adults Age 18 and Older, by Sex, Race and Ethnicity, Poverty Status, Income, Educational Attainment, and Sexual Orientation, 1994–2020 (cont.)

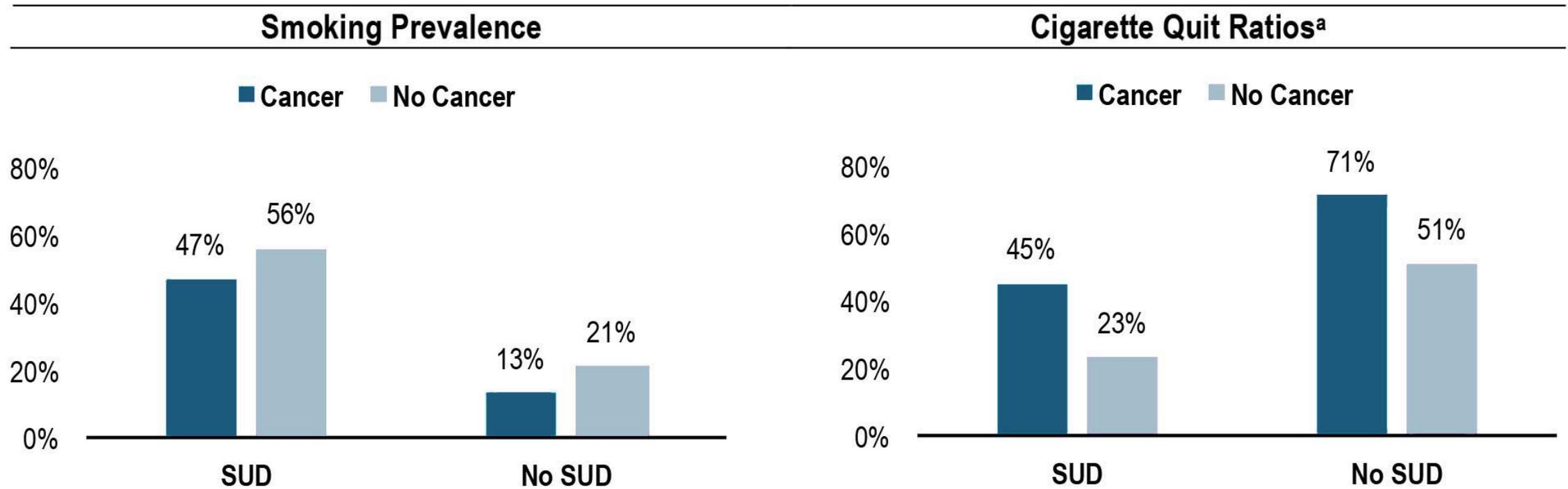
Category	1994	1998	2002	2006	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Graduate degree	—	—	7.2	6.6	6.3	5.0	5.9	5.6	5.4	3.6	4.5	4.1	3.7	4.0	3.5
13-15 years	25.7	24.6	—	—	—	—	—	—	—	—	—	—	—	—	—
≥16 years	12.3	11.3	—	—	—	—	—	—	—	—	—	—	—	—	—
Sexual orientation^c															
Straight	—	—	—	—	—	—	—	17.6	16.6	14.9	15.3	13.7	13.5	13.8	12.3
Gay/lesbian/bisexual	—	—	—	—	—	—	—	26.6	23.9	20.6	20.5	20.3	20.6	19.2	16.1

Note: Numbers are percentages. Em dash (—) = data not collected in a category for a particular year. Current smoking includes individuals who smoked at least 100 cigarettes in their lifetime and who smoked every day or some days. The National Health Interview Survey (NHIS) was redesigned in 1997 and 2019, and trend analysis and comparison with prior years should be conducted with caution.

^aAll racial and ethnic groups are non-Hispanic except those categorized as Hispanic. In 1997, the Office of Management and Budget changed its data collection guidelines to require Native Hawaiian and Other Pacific Islander data be collected separately from Asian populations. Limited data were collected on American Indian or Alaska Native people, and data for a single year could be unstable or unreliable due to a small sample size. Data on current smoking among Native Hawaiian or other Pacific Islander people are not reported. ^bAdditional categories were added to education in 1999. Educational attainment data are provided for individuals age 25 years or older. GED = general educational development certificate. ^cResponse options provided on the NHIS were “straight, that is, not gay” for men, and “straight, that is, not gay or lesbian” for women.

Source: National Health Interview Survey, 1994–2019: Agaku et al. 2014; Centers for Disease Control and Prevention (CDC) 1996, 2000, 2004, 2007, 2012; Cornelius et al. 2020, 2022; Creamer et al. 2019; Jamal et al. 2014, 2015, 2016, 2018; Wang et al. 2018.

Figure 5.1 Current Cigarette Smoking Prevalence and Quitting by Past-Year Substance Use Disorder Status and Past-Year Cancer Diagnosis Among U.S. Adults Age 18 and Older, 2015–2018



^aCigarette quit ratios were defined as the ratio of those with former smoking to those with ever smoking at each survey year.

Source: Adapted from Streck et al. 2020, based on data from the National Survey on Drug Use and Health, 2015–2018.

Table 5.2 Substance Use Disorders Among U.S. Adults Age 18 and Older With and Without a Past-Year Cancer Diagnosis, 2015–2018

Substance use disorder (SUD)^a	Cancer (unweighted N = 1,571)	No cancer (unweighted N = 168,540)	p value^b
Any past-year SUD	4.6%	7.9%	<.001
1 SUD	4.0%	6.6%	
2+ SUDs	0.4%	1.2%	
Alcohol use disorder	3.4%	6.0%	.001
Cannabis use disorder	0.2%	1.4%	<.001
Opioid use disorder	0.8%	0.8%	.87
Stimulant use disorder ^c	0.2%	0.5%	.01
Other use disorder ^d	0.4%	0.7%	.11
Past-month cigarette smoking	15.0%	24.0%	<.001

Note: Percentages are weighted and unadjusted for demographic characteristics. Percentages may not sum to 100% due to rounding.

^aNontobacco substance use disorders were defined as diagnosis of abuse and/or dependence within the past year. ^bp-values compare characteristic values for respondents with a past-year cancer diagnosis with those without a past-year cancer diagnosis. ^cIncludes prescription stimulant and cocaine use disorder. ^dIncludes hallucinogen, inhalant, methamphetamine, tranquilizer, or sedative use disorder.

Source: Adapted from Streck et al. 2020, based on data from the National Survey on Drug Use and Health, 2015–2018.

Treating Smoking in Cancer Patients: Resources

To read the full report and access related materials, visit:

cancercontrol.cancer.gov/monographs

To learn more about the NCI Cancer MoonshotSM-supported Cancer Center Cessation Initiative, visit:

cancercontrol.cancer.gov/c3i

To learn more about quitting smoking, visit:

smokefree.gov

To learn more about NCI's tobacco control research activities, visit:

cancercontrol.cancer.gov/tcrb