Tobacco Use and Dependence

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Introduction

Tobacco use in the United States (US) has fallen over the last half-century but remains the leading preventable causes of death and disability [1]. From a peak of over 40% in 1965, cigarette smoking has declined to 12.5% among adults in 2020 [2]. When other tobacco products such as chewing tobacco, cigars, and e-cigarettes are included, 19% of adults in the US (47 million people) currently use a tobacco product [2]. Globally, smoking caused nearly 8 million deaths and 200 million disability-adjusted life years in 2019 [3].

Up to one out of three cardiovascular deaths and four out of ten cancer deaths are due to tobacco use [4, 5]. Sites of tobacco-related cancers include the lung, bladder, cervix, gastrointestinal tract, liver, pancreas, stomach, esophagus, larynx, oropharynx, and blood (myeloid leukemia) [1]. In addition, for every person who dies from tobacco-related disease, 30 more people suffer debilitating chronic illnesses, including diabetes, decreased immune function, rheumatoid arthritis, hip fractures, vascular disease, chronic obstructive pulmonary disease (COPD), blindness, cataracts, strokes, and pneumonia. [6] Exposure to secondhand smoke (SHS) increases risk of premature death and disease for people who have never smoked, and negatively impacts fetal development as well as the health of infants and children [7, 8]. In the US, tobacco use costs $600 billion (in 2018 dollars), including $240 billion in direct medical care, lost productivity from smoking-related illnesses and health conditions, lost productivity from early death related to smoking, and $7 billion in lost productivity due to death from secondhand tobacco exposure [6, 9–11].

Large disparities in tobacco use exist by region, state, age, race and ethnicity, social economic status, occupation, mental health, gender, and sexual orientation. In medical practice, smoking by people with one or more chronic diseases, including mental health and substance use, remains significantly higher than those with no comorbidities [12]. One of the largest factors in tobacco use is educational attainment, with tobacco use ranging from 40% among people with a high-school degree or equivalent to 8.6% among those with a graduate degree [2]. Income follows a similar trend, with smoking rates ranging from 25% among people with an annual household income of under $35,000 to 14% among people with an income of over $100,000 [2]. Mental health is also an important predictor, with tobacco use more common among people with generalized anxiety (30% use), major depression (36% use), and bipolar or psychotic disorders. People who identify as lesbian, gay, or bisexual also have a higher prevalence of tobacco use (25%) [2]. Cigarillo use, one of the most popular of all cigar types, is disproportionately higher among young adults and African American adults [13].

Since the 1964 US Surgeon General's report on smoking and health, a comprehensive tobacco control strategy has sought to decrease the initiation and prevalence of smoking through public health policy initiatives such as clean air statutes, media campaigns, taxes on cigarettes, and comprehensive state programs, including quitlines, websites, and apps. Despite

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advocacy for health care system change that supports treatment, evidence-based interventions remain under-prescribed by providers and under-utilized by patients [1, 14, 15].

Tobacco Use and Chronic Disease

Tobacco Use as a Chronic Disease

The US Public Health Service's Guidelines on Treating Tobacco Use and Dependence includes 10 key recommendations (Table 4.1). The first recommendation emphasizes that tobacco use and addiction are *chronic diseases* that often require repeated intervention and multiple attempts to quit and that effective treatments exist that can significantly increase rates of long-term abstinence [16]. Only a minority of people who use tobacco are able to achieve long-term abstinence in an initial attempt; rather, the experience of most patients involves multiple quit attempts, with periods of abstinence followed by periods of relapse, hence the ongoing, chronic nature of tobacco addiction. Like managing hypertension or diabetes, clinicians who acknowledge tobacco use as a chronic disease should include brief interventions in every patient encounter, give patients realistic expectations about achieving success, use behavioral therapy, encourage use of various approved pharmacotherapy agents and monitor compliance, refer patients to treatment specialists, and view relapse without judgment.

Table 4.1 US Public Health Service's ten guidelines on treating tobacco use and dependence [16]

Tobacco dependence is a chronic disease that often requires repeated intervention and multiple attempts to quit.
It is essential that clinicians and health care delivery systems consistently identify and document tobacco use status and treat every tobacco user seen in a health care setting.
Tobacco dependence treatments are effective across a broad range of populations. Clinicians should encourage every patient willing to make a quit attempt to use recommended counseling treatments and medications.
Brief tobacco dependence treatment is effective. Clinicians should offer every patient who uses tobacco at least brief treatments.
Individual, group, and telephone counseling are effective, and their effectiveness increases with treatment intensity. Practical counseling (problem-solving/skills training) and social support are especially effective.
Nicotine replacement (provided in gum, inhaler, lozenge, nasal spray, or patch) and two non-nicotine medications (bupropion SR and varenicline) are effective for tobacco dependence and their use should be encouraged, except when medically contraindicated or with specific populations for which there is insufficient evidence of effectiveness.
Counseling and medication are effective when used by themselves, and more so when used in combination.
Telephone quitline counseling is effective with diverse populations and has broad reach.
If a tobacco user is currently unwilling to make a quit attempt, clinicians should use motivational treatments to increase future quit attempts
Tobacco dependence treatments are both clinically effective and highly cost-effective. Providing coverage for these treatments increases quit rates. Insurers and purchasers should cover these services.

While over two-thirds of smokers want to quit smoking, and over one half try to quit each year, less than 10% who try on their own are successful in any given year, which is lower than successful abstention from heroin or alcohol [17, 18]. Tobacco cessation doubles with strong advice from the clinician to quit and achieves successful quit rates of 20–30% of patients when behavioral counseling is combined with pharmacotherapy [19].

Tobacco dependence is a chronic illness that involves changes in brain chemistry from the effects of nicotine and other compounds involved in the upregulation of nicotine receptors. When people stop using tobacco, physiologic changes in the brain cause urges and withdrawal symptoms. Like other chronic illnesses, tobacco dependence merits effective treatment and should be covered by health insurance [20].

Patients who smoke often feel isolated and tend to underreport or deny their tobacco use if they anticipate judgment from their doctor. Patients are more likely to successfully quit if their clinicians offer empathy and an acknowledgment of the difficulty of stopping tobacco use while providing resources for cessation [21].

Impact on Other Chronic Diseases

Tobacco use, especially smoking, damages nearly every organ in the body and has a significant impact on chronic diseases [6] (Fig. 4.1). From 2005 to 2013, adults with asthma, diabetes, heart disease, hypertension, and substance abuse did not reduce their rate of smoking as much as that of adults without chronic conditions, and those with substance use disorder or mental health problems continue to smoke at higher rates than the general population [12]. Almost half of cigarettes are consumed by those with serious mental illness, and smoking rates for individuals with schizophrenia and bipolar disorder are increasing. The stress of trying to stop a highly addictive behavior like smoking while living with a chronic disease can feel overwhelming to patients, who may struggle to give up the one thing that comforts them. Patients may also dislike the weight gain associated with stopping smoking. Still, most people are willing to contemplate stopping and understand that doing so will decrease the adverse outcomes of their chronic disease [22, 23].

Types of Tobacco Products

Tobacco use disorder involves tobacco use on a regular basis for which abstinence produces withdrawal symptoms, meeting criteria for addiction (Table 4.2). Tobacco products,

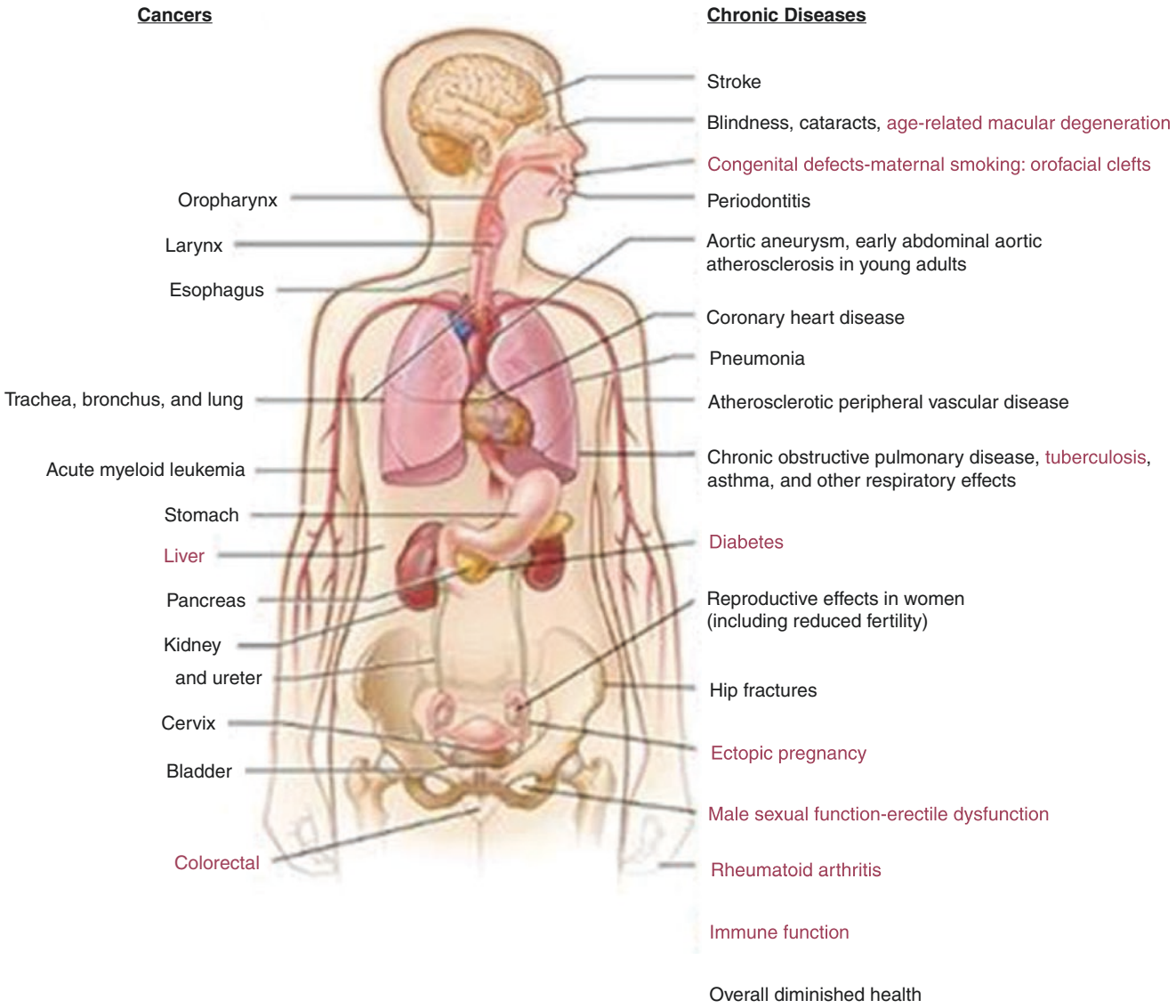

Fig. 4.1 The health consequences causally linked to smoking. Notations in red were newly added to the 2014 Surgeon General's Report. Reprinted from public domain: http://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/

defined and regulated by the US Food and Drug Authority (FDA), include smoked, smokeless, and heated/vaporized. About one in five tobacco users use more than one product, which is referred to as poly-tobacco use and is especially prevalent in young adults (ages 18–24 years). Most poly-tobacco users use two products ("dual-use"), the most common of which are cigarette and e-cigarette use, followed by cigarettes and another combustible product (e.g., cigars), followed by cigarettes and smokeless tobacco [2]. It is important to ask about all tobacco product use.

Smoked (Combustibles)

All combustible tobacco products are carcinogenic and promote multiple respiratory and cardiac diseases. ***Cigarettes*** contain tobacco wrapped in a paper, usually with a filter to reduce the harshness (but not the toxicity) of the inhaled smoke. Cigarettes are a highly effective and efficient drug delivery system, delivering a bolus of nicotine to the brain within 10 seconds of inhalation [25]. A pack includes 20 cigarettes and can be sold as single packs or in cartons of 10 packs. Sale of single cigarettes ("loosies") is illegal, but common in some places. Previous attempts by tobacco companies to brand cigarettes as safer included "light" and "low tar" designations. These misleading labels are now prohibited, but still identifiable by color labels, for example, light products are often in gold packaging. Terms such as "natural" and "organic" have also been used to convey a less harmful product [26]. Congress banned all characterizing flavors in US cigarettes in 2009, with the notable exception of menthol, even though it may be the most harmful flavor.

Table 4.2 Tobacco use disorder definitions [24]

DSM-5 condition	ICD 10 codes	Description
Tobacco use disorder and dependence	305.1 (Z72.0)—Mild: 2–3 symptoms 305.1 (F17.200)—Moderate: 4–5 symptoms 305.1 (F17.200)—Severe: 6 or more symptoms	A problematic pattern of tobacco use leading to clinically significant impairment or distress, characterized by at least two of the following: loss of control (inability to stop using); persistent desire/unsuccessful efforts to stop using; craving (a strong desire to use the substance); failure to fulfill major role obligations due to use; a great deal of time is spent obtaining, using, and recovering from the use of substances; continued use of substances despite having social or interpersonal problems caused or made worse by the use; important activities are reduced or given up because of the use; substance use in situations where it is physically hazardous; continued use of substances despite having physical or psychological caused or made worse by the use; tolerance; or withdrawal.
Nicotine dependence	Z72.0 (F17.200)	Chronic, relapsing disease defined as a compulsive craving to use tobacco, despite social consequences, loss of control over tobacco intake, and emergence of withdrawal symptoms when quitting.
Nicotine dependence with withdrawal	292.0 (F17.213)	Daily use for at least several weeks, with abrupt cessation or reduction in tobacco use, followed by significant distress or impairment within 24 h characterized by four or more of the following: irritability, frustration, or anger; anxiety; difficulty concentrating; increased appetite; restlessness; depressed mood; or insomnia.

Abbreviations: DSM-5 Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, *ICD-10* International Classification of Disease

Menthol masks the harsh taste and feel of inhaled smoke and allows for deeper inhalation, with the ability to deliver higher levels of nicotine in fewer cigarettes. In 2020, 37% of all cigarettes sold in the US were mentholated [27]. Use of menthol makes it easier to start smoking and more difficult to stop [28]. Young people smoke menthol cigarettes at higher rates than adults and almost 75% of African Americans who smoke use menthol cigarettes [29]. The FDA announced in 2022 plans to ban menthol in cigarettes, a move that could dramatically decrease cigarette consumption if combined with increased support for cessation [30].

Cigars and cigarillos use tobacco leaf as the wrapper and range in size from cigarette-size (little cigars) to an intermediary size (cigarillos), to large cigars. Someone who smokes 20 cigarettes a day (one pack) and who switches to cigarillos will typically use about three cigarillos per day, stubbing them out and relighting them frequently to maintain nicotine levels. Because there are no minimum pack sizes, cigarillos can be sold individually or in small packages at inexpensive prices (e.g., 3 for $0.99). Currently no federal flavor limitations exist for cigar products, allowing a wide array of flavors, such as apple, grape, and cherry, which are popular with youth and young adults. The FDA may ban flavors in cigar products [30].

Pipe smoking involves use of different blends of tobacco stuffed into the pipe bowl, lit, and inhaled through the pipe stem. While it has the lowest prevalence among combustible tobacco products, it still delivers nicotine and carcinogens throughout the lungs and most organ systems.

Hookah or water pipe, originally from the Middle East, has become more popular in the US, particularly among youth and young adults, often in group settings [31]. Hookah use among college students is high, with over 20% of college students using hookah in any given year [32]. In a hookah, burned tobacco passes through a water pipe which filters out some chemicals, but the inhaled smoke still contains high levels of toxins that come from the burning of the charcoal, tobacco, and flavoring; hence, it is not a safe alternative to smoking cigarettes [31].

Smokeless (Non-combustibles)

Smokeless tobacco is placed in the mouth, where nicotine and other chemicals are absorbed through the oral mucosa. Smokeless tobacco includes chew, dip, snuff, and snus, and newer products like nicotine pouches. Smokeless tobacco (especially Swedish snus), while harmful, is substantially less harmful than cigarette use [33]. Chew and dip (also sometimes called moist snuff) [34] usually require expectoration of the liquid that pools in the lower jaw, hence the name spit tobacco. Nasal snuff may be sniffed up the nose. Snus, based on a Scandinavian product, contains tobacco in a small teabag-like pouch that does not require spitting. Nicotine pouch products also use a small pouch, but rather than containing ground tobacco leaves use a white powder that is a mix of nicotine, flavoring, sweeteners, and binding agents. Smokeless tobaccos contain a number of carcinogens and cause oral cancer, esophageal cancer, and pancreatic cancer [34]. Smokeless tobacco use can also lead to leukoplakia, gum disease, tooth decay, and tooth loss. Use of smokeless tobacco increases the risk of death from heart disease and stroke and use during pregnancy increases the risk of pre-term delivery and stillbirth and affects fetal brain development [35].

E-Cigarettes (Vapes) and Heated Tobacco Products

E-cigarettes (also called vape pens) deliver nicotine by using a battery to heat a solution of nicotine, flavoring, and carrier chemicals (propylene glycol and/or glycerin) to create an

aerosol that is inhaled or "vaped." The small, discrete size of e-cigarettes, the variety of flavors available, and social media marketing make e-cigarettes popular among youth.

Heated tobacco products (also called "heat-not-burn" tobacco products, for example, Philip Morris's IQOS brand) use a battery-powered device to heat a heavily modified type of tobacco cigarette. These products are increasingly popular internationally and are recently available in the US.

While people who use e-cigarettes and heated tobacco products are not exposed to the carbon monoxide, tars, or carcinogens of smoked tobacco, these products are not harmless and research is underway to determine their carcinogenicity and toxicity. The FDA has started the process of regulating e-cigarettes.

Second- and Thirdhand Smoke Exposure

While those who use combustible tobacco products receive the most concentrated exposure to toxic chemicals, the effects can be experienced by others. Secondhand smoke (SHS) is a combination of smoke that comes directly from burning cigarettes, cigars, or pipes, called "side-stream smoke," and smoke that is exhaled by the person smoking, or "main-stream" smoke. Side-stream smoke comprises 85% of SHS. SHS can remain in the air for hours which increases the time others are vulnerable [7]. Nonsmokers who are exposed to SHS increase their risk of developing heart disease by 25–30%, yet providers rarely ask nonsmokers about SHS exposure [6].

Thirdhand smoke (THS) refers to the residual nicotine and carcinogens found in tobacco smoke adhering to surfaces long after a cigarette has been finished. [36] These lingering toxins are found in hair, skin, clothes, carpets, furniture, walls, insulation, and vehicles. The molecules react with oxidants in the air and other compounds in the environment to generate secondary contaminants that can be more toxic to humans than the original contaminants [37]. These toxic effects have been shown in cells, animal models, and children, including in neonates. While more research is needed to understand long-term effects of these exposures, it is prudent to decrease such exposure [38].

Individuals exposed to SHS and THS can suffer the same adverse health effects as those who smoke voluntarily [7]. Adults exposed to tobacco smoke in the environment have increased adverse effects on their cardiovascular system and can develop lung cancer. In the US, SHS annually causes about 3,400 lung cancer deaths and 42,000 heart disease deaths in people who do not smoke. Children who are exposed to smoke have elevated risk for sudden infant death syndrome (SIDS), acute respiratory infections, ear infections, and asthma [7]. In the US, this translates to hundreds of thousands of lower respiratory tract infections in children younger than 18 months. Approximately 14% of US children live in a household with at least one person who smokes, which increases their vulnerability to tobacco smoke and the resulting consequences [39].

African Americans, children, people with incomes below the poverty level, and those who rent their homes are more likely to be exposed to SHS than other populations. Especially vulnerable are people living in multi-unit housing like apartments and condominiums. Even if they adopt smoke-free policies for their own living units, they can be exposed to smoke from nearby units and shared areas. Tobacco-free policies in workplaces and public places, including public housing, have contributed to reducing exposure to SHS and THS for many people in the US, but such policies vary widely by state and locality [40].

Children are at the greatest risk of exposure to THS, as they more frequently touch surfaces on which the toxic particles reside. They also can be exposed over long periods of time, from in utero until leaving home as young adults. Exposure to nicotine and tobacco-specific nitrosamines is of particular concern [41]. Thirdhand smoke is not easily removed and can take months to years to dissipate [42]. Although the risks of exposure are not fully known, human and in vitro animal studies link THS to DNA damage, altered fibroblast migration involved in wound healing, and impaired respiratory development [43–45].

Public health experts advocate that all clinicians ask adults and children if they are or have been exposed to smoke from tobacco products in their usual environment [46]. Secondhand smoke exposure is an ICD 10 code (Z77.22) that can be used to indicate a diagnosis for reimbursement purposes [47].

Benefits of Cessation in Patient Populations

Asymptomatic Patients and Disease Prevention

People who stop using tobacco decrease the risk for cancer, lung disease, and cardiovascular disease and add years to life expectancy [48] (Fig. 4.2). They report increased sense of taste and smell, overall well-being and sense of accomplishment, a new-found freedom, and increased self-efficacy for making other behavior changes. The 2020 report of the US Surgeon General summarizes the health benefits of smoking cessation on multiple health systems and diseases (Table 4.3) [1]. The benefits of stopping tobacco use on individual chronic conditions are discussed below [22, 23].

Cardiovascular Disease

For patients at risk for or with current cardiovascular disease (CVD), stopping smoking can be the single best intervention for improving cardiovascular health and has greater cost-effectiveness than treatment for hypertension and hyperlipidemia [49]. Benefits begin immediately, including decrease in

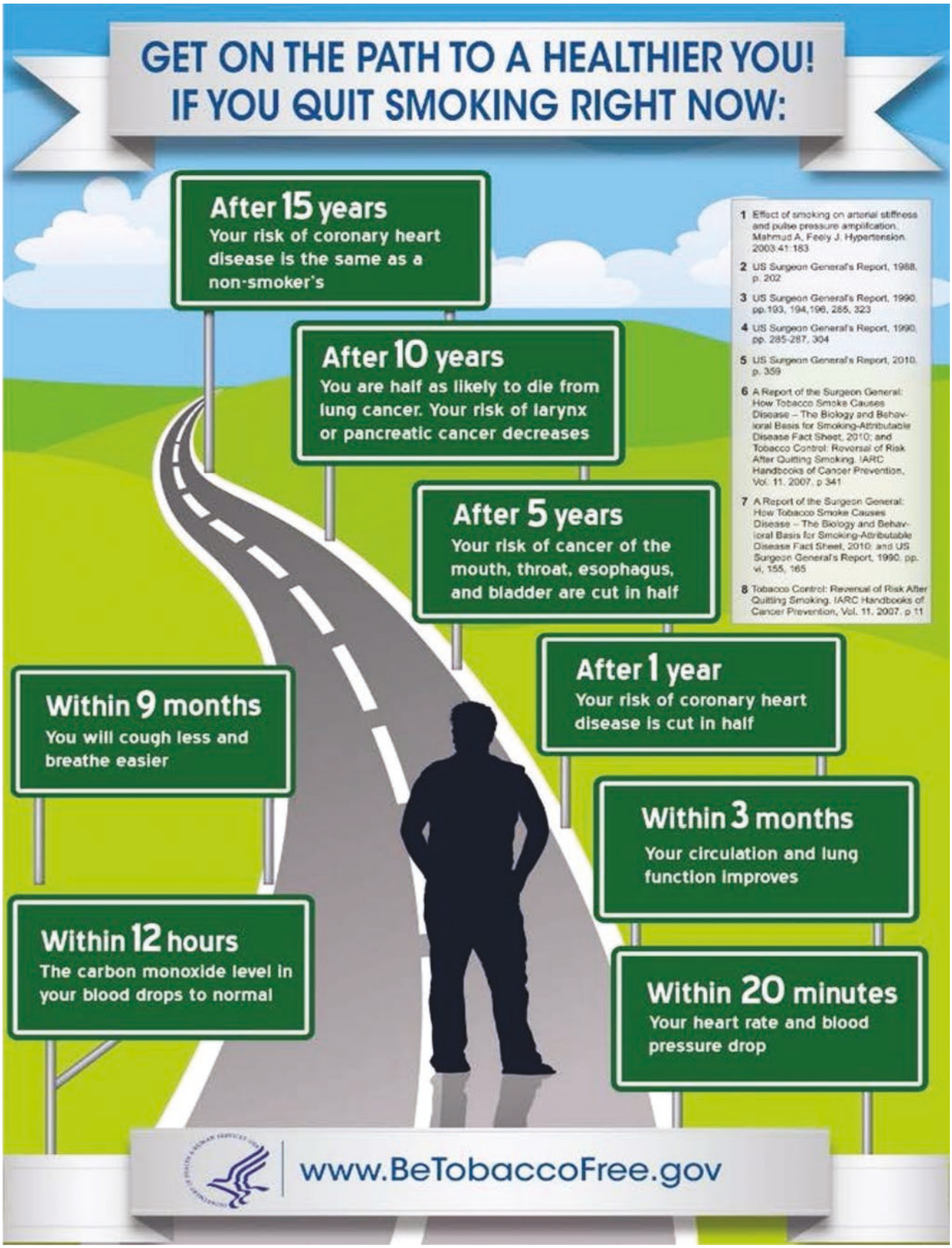

Fig. 4.2 Positive outcomes from stopping tobacco use. Reprinted from public domain: www.BeTobaccoFree.gov

Table 4.3 Smoking cessation: a report of the surgeon general—2020, key findings [1]

Smoking cessation is beneficial at any age, improves health status, and enhances quality of life.
Smoking cessation reduces the risk of premature death and can add as much as a decade to life expectancy.
Smoking places a substantial financial burden on people who smoke, health care systems, and society. Smoking cessation reduces this burden, including smoking-attributable health care expenditures.
Smoking cessation reduces risk for many adverse health effects, including reproductive health outcomes, cardiovascular diseases, chronic obstructive pulmonary disease (COPD), and cancer. Quitting smoking is beneficial to those with heart disease and COPD.
More than three out of five US adults who have ever smoked cigarettes have quit. Although most people who smoke cigarettes make a quit attempt each year, less than one-third use cessation medications approved by the FDA or behavioral counseling to support quit attempts.
Disparities exist in the prevalence of smoking across the US population, with higher prevalence in some subgroups. Smoking cessation attempts, support, and treatment also vary across the population, with lower prevalence in some subgroups. These disparities are defined by educational attainment, poverty, age, health insurance status, race/ethnicity, and geography.
Smoking cessation medications approved by the FDA and behavioral counseling are cost-effective strategies and increase the likelihood of successfully quitting smoking, particularly when used in combination. Using combinations of nicotine replacement therapies can further increase the likelihood of quitting.
Insurance coverage for smoking cessation treatment that is comprehensive, barrier free, and widely promoted increases the use of these treatment services, leads to higher rates of successful quitting, and is cost-effective.
E-cigarettes, a continually changing and heterogeneous group of products, are used in a variety of ways. There is presently inadequate evidence to conclude that e-cigarettes increase smoking cessation.
Smoking cessation can be increased by raising the price of cigarettes, adopting comprehensive smokefree policies, implementing mass media campaigns, requiring pictorial health warnings, and maintaining comprehensive statewide tobacco control programs.

Abbreviations: US United States, *FDA* US Food & Drug Administration

sudden cardiac death, and within a few years the risk for acute myocardial infarction is decreased (Fig. 4.2) [50]. Cessation also decreases the risk of stroke [51]. All FDA-approved tobacco use treatment medications can be effectively used with patients who have CVD. While misconceptions about use of nicotine replacement therapy (NRT) persist, no clinical evidence links NRT and CVD, even if patients smoke while using NRT [52]. Intensive behavioral therapy can significantly increase quit rates in patients with CVD [53].

Diabetes

Long-term effects of stopping smoking for people with diabetes include improved blood lipid levels and rates of inhaled insulin absorption that approach those of people who do not smoke [54, 55]. Varenicline is well tolerated in people with diabetes and can help achieve continuous abstinence rates of 18%, which is double that of placebo, with an average weight gain in those who stopped smoking similar to study participants who did not have diabetes (around 2 kg) [56].

Chronic Obstructive Pulmonary Disease

In early chronic obstructive pulmonary disease (COPD), people who stop smoking can reduce disease progression [57]. Even in advanced COPD, decreasing lung function can be slowed, and risk of death decreases compared to continued smoking [58, 59]. Interventions that include pharmacotherapy, educational materials, and behavioral strategies demonstrate significant abstinence rates and effectiveness in patients, regardless of perceived readiness or motivation [60].

Asthma

Smoking cessation improves asthma control, with significant reductions in chest tightness and nighttime symptoms, improved lung function, decreased sputum neutrophil count, and reduced inhaled steroid use [61]. People with asthma can quit, but they may experience slower declines in nicotine withdrawal symptoms and cravings compared to people without asthma [62]. Promising treatment approaches include peer interventions with adolescents, mobile applications, and tailoring for specific needs of asthma patients [63].

Cancer

With increasing survival following cancer diagnosis, the need for addressing continued tobacco use in cancer care is critical. Surgery, radiation, and chemotherapy treatments are more effective when patients stop using tobacco, and patients who are tobacco free have lower rates of cancer recurrence and higher quality-of-life measures [6, 64]. Effective interventions include pharmacotherapy and intensive behavioral strategies [65–68].

HIV/AIDS

While effective treatments for people living with human immunodeficiency virus (HIV) have extended life expectancy, those who smoke have twice the decreased life expectancy as HIV itself [69]. People with HIV smoke at higher rates (42%) and are less likely to quit than the general population [70]. Those who stop smoking in the course of HIV treatment can gain up to 5.7 years of life by decreasing risks of pneumonia, thrush, and hairy leukoplakia, as well as cancer, cardiovascular disease, and respiratory disease [69]. Pilot studies on treatment that include adherence-focused interventions, such as peer counseling, prepaid cell phones, or texting, have demonstrated effectiveness [71–73].

Mental Health and Substance Use

Having a mental health or substance use problem is associated with significantly higher rates of tobacco use compared to the general population [74]. Such conditions often occur in environments that normalize smoking, with concomitant less access to tobacco use treatment [75]. People with mental health disorders who stop smoking experience decreased depression, anxiety, and stress, with improved mood and quality of life compared to those who continue to smoke [76]. Studies also show increased abstinence from illicit drug and alcohol use in those who stop smoking [75, 77]. Effective treatment includes intensive pharmacotherapy and behavioral interventions, often over a long period of time. Peer counseling and integrated treatment models are also effective.

Inpatients

The inpatient setting, which is invariably smoke-free, is an ideal environment for patients to receive tobacco cessation counseling [78]. The Joint Commission has implemented inpatient tobacco treatment measures (TTMs) which involve identifying patients who have used tobacco within 30 days, offering nicotine replacement therapy and counseling while inpatient, and providing nicotine replacement therapy and referral for outpatient tobacco cessation counseling at discharge. Standardized pathways in an electronic medical record can improve inpatient ordering of nicotine replacement therapy, tobacco cessation counseling, and care coordination of tobacco cessation treatments [79]. Evidence-based inpatient tobacco treatment programs are successful, easy to access, offer appropriate smoking cessation medications, and save the inpatient team time [80]. Patients who receive bedside cessation counseling as an inpatient followed by 6 months of outpatient counseling after hospital discharge have abstinence rates of 78% at 4 weeks and 59% at 6 months [81]. In contrast, patients who only receive counseling while in the hospital have low (less than 20%) success rates of smoking cessation at 3 or 6 months [82]. Patients on inpatient psychiatry services randomized to receive group counseling, free nicotine patches at time of hospital discharge, free post-discharge counseling (quitline, text- or web-based), and post-discharge automatic interactive calls and/or texts are more likely to use smoking cessation treatments than a control group (74.6 vs 40.5%) and to achieve abstinence from tobacco use (8.9 vs 3.5%) [83]. Patients with admission for cardiovascular diagnoses have higher smoking cessation rates than patients admitted with respiratory or neurologic diagnoses after enrollment in an inpatient smoking cessation program, suggesting that some diagnoses provide better teachable moments than others [84]. One pharmacist-led smoking cessation program during hospital stays did not improve smoking cessation rates, which may be due to the "Hawthorne effect," in which participants in the control group of a study modify their behaviors due to an awareness of being observed [85]. Still, hospitalizations may serve as an entry point to tobacco cessation education and counseling, and further studies may determine what strategies have the most impact.

The Chronic Care Model and Tobacco Dependence

Effective chronic care management requires understanding of the chronic nature of tobacco dependence and utilization of effective evidence-based treatments. The Chronic Care Model (CCM) improves health outcomes through system changes that include patient-centered and evidence-based care, team care, planned interventions, self-management, community resources, decision support, patient registries, and information technology [86].

A Comprehensive Approach

Effective approaches such as the 5As model for tobacco use (described below) should be utilized at every health care visit [87]. Effective use of information technology to support this model includes integrating the 5As into electronic health records (EHRs). Most EHRs include ***Ask*** in vital signs. If ***Assess*** and ***Advise*** are also in the vital signs, counseling rates for smoking cessation increase [88]. The American Academy of Family Physicians recommends an abbreviated version known as ***Ask and Act*** [89].

Physicians and other health care providers must view tobacco use as a long-term condition and routinely assess motivation and interest in medications and referral to specialized or community resources, utilizing shared decision making. Clinicians should address patient concerns such as failure, boredom, addiction, weight gain, and loss of a social circle, and understand the barriers to the use of medications, such as cost, availability, or misinformation.

Team Approach

While providers are in the best position to relate tobacco use to health outcomes, the involvement of clinic staff and other health care professionals increases delivery and success rates of treatment [89–91]. Team-based care demonstrates the importance of addressing tobacco use and increases efficiency by introducing the topic before the physician sees the patient. Supportive, non-judgmental comments such as "We are happy that you are trying to quit, and our team looks forward to seeing you again soon."

Family and Social Support

Social networks and families can support a person's cessation efforts and increase the intention and success rate of smoking cessation [92–94]. Having family or friends who are quitting tobacco increases the probability that patients will also quit [95]. Interactions with former smokers or peer-support groups increase successful quit attempts in patients with less social support, such as those experiencing homelessness or historically marginalized populations [96, 97]. Since smoking behavior is often similar in family and friends, it is important to determine who in the patient's social network is willing and able to support the patient [98, 99]. Partners often undertake behavior changes together, including smoking cessation [100]. Optimizing support for the patient's quit attempt often means working with family members on cessation including discussing how a tobacco-free environment improves everyone's health and saves money [101]. Children who live in tobacco-free homes are less likely to initiate use.

Social connections can also negatively influence a person's attempt to quit. Family or friends may not believe that tobacco use is a chronic disease and may not be empathetic or supportive of patients who struggle with continued use despite health complications [102]. If others in the family smoke, the patient may change the status quo in the home which may result in conflict or family stress regarding continued smoking in a family member [103, 104]. Clinicians can try to motivate family members to consider cessation or supportive behaviors such as not smoking in the home [105].

Public Health Interventions

Tobacco's massive cost to society for health care and lost productivity is a public health concern. Public health initiatives can counter efforts that promote smoking. The tobacco industry spends billions of dollars in advertising and promotion or nearly $22 million per day in the US [106]. In addition to direct advertising and coupons, marketing dollars are paid directly to retailers or wholesalers to reduce the price of cigarettes and fund promotions such as two for one pricing. Much of the advertising is historically targeted to younger populations, women, racial and ethnic communities. Community-based coalitions across the US can advocate for federal, state, and local policy initiatives, including youth empowerment efforts, taxes, or minimum prices to raise the cost of tobacco products, strong clean air regulations, preventing youth access to tobacco products, smoke-free homes and cars, banning flavored tobacco products, promoting strong warnings on tobacco products, and supporting comprehensive state funding for tobacco-free initiatives.

Emotional Support

When individuals understand that tobacco use is a chronic disease, they may feel less of a sense of failure if they struggle to quit. Understanding the relapsing nature of the addiction, while knowing that support and effective treatment exist, can increase self-efficacy. Misperceptions can be barriers to successful management of this chronic condition. One misperception is that the responsibility for change rests entirely on the individual who uses tobacco, viewing tobacco use as "just a bad habit" or "just a mind thing." This view reinforces judgment and shame. In fact, the highly addictive nature of tobacco products, which deliver nicotine to the brain in less than 10 seconds, makes tobacco use an automatic, ingrained repetitive behavior. Effective abstinence requires continued practice to relearn new behaviors while dealing with the difficult symptoms of withdrawal. Willpower alone rarely succeeds, especially with patients who deal with multiple chronic diseases, financial insecurity, or other life stress.

Another misperception is the association of smoking with stress relief. Nicotine triggers the release of dopamine, leading to a temporary feeling of well-being and enhanced cognitive performance. However, this is a "cruel illusion." [107] While the immediate hit of nicotine causes feelings of well-being, it also puts stress on the heart by increasing heart rate and blood pressure and, after a few hours, adds the stress of withdrawal that can only be relieved by smoking again. It is important that both patient and provider understand this phenomenon as they work to find effective strategies to improve health.

The 5As Model for Tobacco Cessation

Effective systems addressing tobacco dependence follow a strong theoretical intervention, such as the 5As model for tobacco use: Ask, Advise, Assess, Assist, and Arrange, which should be addressed at every health care visit (Fig. 4.3). [21, 87, 108, 109]

Ask

Team-based care starts with ***Ask***, meaning a nurse or medical assistant inquiries about tobacco use while taking vital signs. Asking about smoking behaviors in a non-judgmental manner acknowledges the chronic nature of tobacco dependence and that tobacco cessation is not a linear accomplishment for most patients [110]. A straight forward "Have you ever used tobacco products?" with a positive response followed by "Do you currently smoke or use any other tobacco products, including e-cigarettes?" has a very different feel than the

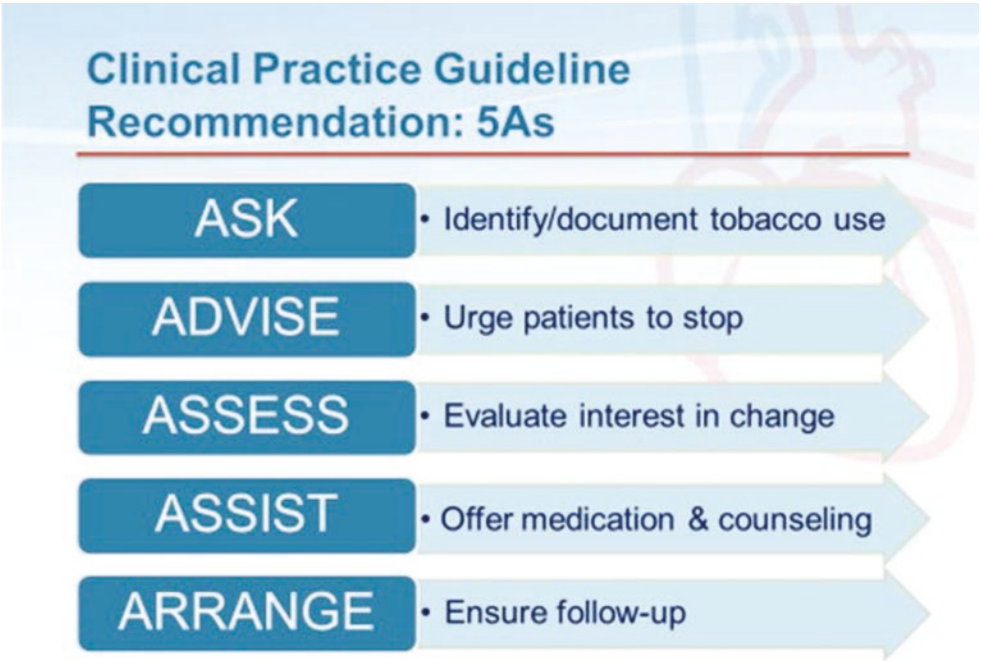

Fig. 4.3 The Five A's for treating tobacco use (Reprinted from public domain)

accusatory tone of "Are you (still) a smoker?" or "You don't smoke, do you?" Asking the patient if they are exposed to secondhand smoke allows for conversations on ways to reduce that exposure. Patients may be embarrassed or reluctant to be truthful regarding tobacco use. The term "smoker" reinforces judgment and stigmatization, labeling a person by the disease or addiction. Alternative language such as "a person who smokes" labels the behavior instead of the person, allowing clinicians to see patients who use tobacco as people who are caught in a cycle of addiction that has both individual and societal determinants. This reframing can increase empathy toward the patient who is being asked to change daily routines that revolve around smoking, while fighting off cravings and irritability.

Advise

Many patients report that their doctor told them to quit smoking but did not offer any help or information about how to quit. Patients do not like being preached to or having fingers wagged or hearing about all the bad things that will happen if they continue to smoke. Instead, they benefit from specific information related to individual circumstances, for example, "Stopping all tobacco use is one of the best things you can do for your health. You will notice significant reductions in your asthma symptoms, without having to rely on higher doses of medications. I understand how difficult this change can be. We have effective medications and resources for supporting you in becoming tobacco-free." In this brief message, the clinician voices belief in positive outcomes of stopping tobacco use, demonstrates empathy, and offers resources to the patient. Positive messaging or "gain-framed" statements, such as the benefits that will accrue after stopping tobacco use for 1 day, 1 month, or 1 year, may be positive moderators of treatment [111].

Assess

Assessment has typically been framed as a yes/no question such as "Are you ready to quit?" with an affirmative answer required for further assistance. This is insufficient. Seventy percent of people who smoke say they want to stop, but may not say they are ready to quit because of perceived stress, lack of success in previous efforts, or not knowing how. An open-ended prompt, such as "I'd like to hear your thoughts about cutting down or stopping smoking" or "Tell me about your smoking and your interest in making any changes," is better and allows patients to state their concerns and give clinicians clues about how to best approach efforts to become tobacco free. The clinician can listen for patient fears and perceived difficulties, then address those with empathy, education, and resources.

If the patient is not interested in quitting, **motivational interviewing** using empathetic open-ended questions is an evidenced-based strategy to help patients consider treatment [112, 113]. Effective motivational interviewing creates teachable moments when a patient may be more receptive to considering a behavior change due to a health scare (e.g., chronic disease diagnosis, hospitalization, or cancer diagnosis related to complications from smoking) or due to renewed

interest in health optimization (e.g., annual physical exam) [114–118]. Teachable moments occur in the inpatient, outpatient, and emergency department setting but are often lost opportunities to increase patient motivation and commitment to change [119, 120].

The OARS framework can guide motivational interviewing:

- **O**pen-ended questions to invite further dialogue with the patient, such as "What has worked when you have tried to stop smoking in the past?"
- **A**ffirming to identify positive attributes in the patient, such as "That is great that you were able to cut down by 5 cigarettes."
- **R**eflective or active listening to communicate back to patient that their message was heard and they have your attention, such as "I hear that it has been difficult for you to quit tobacco and that you have tried many different approaches to quitting."
- **S**ummarizing the conversation to gather important points within the current session and/or link salient information from prior sessions, transition to a new topic, or signal the end of a session, such as "It sounds like you're saying that despite many previous attempts to quit on your own that were not fully successful, you are ready to try medications and counseling."

Asking the patient open-ended questions such as "Help me understand why you are not ready to quit given what you know about the health effects of tobacco use" or "What would it take to get you interested in quitting?" often elicits information that motivates change. Follow-up questions might help overcome resistance, such as "If we could relieve your cravings, would you consider quitting?" or "Knowing that it is not easy, how can I best help you do so?" Physician-delivered motivational interviewing is associated with a 3.5-fold increased rate of quitting tobacco compared to usual care or limited brief advice [121].

Motivational interviewing can elicit both strengths and challenges to quitting. Strengths can be found even in statements such as "I've tried a hundred times and failed," which can be countered with the statement "You've had a lot of practice and it sounds like you can be quite persistent." The patient may reference a past situation that prevented abstinence such as "I quit for a few months but then my husband lost his job" and the clinician can reply "You were able to quit, and a very stressful situation set you back." Finding strengths can be useful in suggesting strategies to deal with the challenge of changing tobacco habits. Some patients end up stopping smoking even when they do not indicate a readiness to quit. When provided treatment, patients who said they were not ready to quit had higher rates of six-month abstinence than those stating they were planning to quit [122, 123].

Assist

Evidence-based treatment includes a combination of pharmacotherapy and behavioral counseling. The strength of the addiction to nicotine and other substances means that changing behavior immediately and without intervention ("cold turkey") will be extremely difficult for most people [19].

Cutting-Down-to-Quit (Nicotine Fading)

The traditional advice is that a person using tobacco should set a quit date and abruptly quit on that date [124]. An alternative approach is to gradually reduce the amount of tobacco used (e.g., cutting down from 10 cigarettes per day to 1 cigarette per day over the course of a few weeks) as both abrupt and gradual cessation approaches are similarly effective [125]. Clinicians should support the approach that the patient believes will work best for them.

Behavioral Counseling

Even brief behavioral interventions for tobacco dependence treatment can promote abstinence [126]. Given the chronic nature of tobacco dependence, repeated, longitudinal interventions and multiple quit attempts may be necessary for long-term cessation. Comprehensive treatment strategies benefit most people who use tobacco, and intensive counseling increases patient satisfaction even in those patients who are not ready to quit smoking [127–129]. Individual, group, and telephone counseling can all be effective strategies. There is a dose-response between counseling and effectiveness suggesting that increasing the duration or frequency of counseling will improve outcomes. While even 3 minutes of counseling can have impact, 10 or more minutes is ideal, with increasing effectiveness with four or more sessions. Counseling via different strategies (i.e., problem-solving skills vs social support), by different personnel (both clinicians and non-clinicians) and inclusion of nicotine replacement therapies and/or non-nicotine pharmacologic management compliment tobacco cessation counseling and increase abstinence rates.

Pharmacotherapy

Physical and psychological tobacco use dependence is most effectively managed with medications that alleviate nicotine withdrawal symptoms and reduce the strength and frequency of urges to use tobacco. Medications can double initial quit rates but sustained abstinence requires behavioral interventions that address the routines, stressors, and psychological factors that reinforce tobacco use.

The Food and Drug Administration (FDA) has approved varenicline, bupropion, and various types of nicotine replacement therapy (NRT) for tobacco cessation treatment (Table 4.4). The two most effective pharmacotherapy approaches are single-use varenicline or combination NRT,

Table 4.4 FDA-approved tobacco cessation medications; table adapted from Duke-UNC Tobacco Treatment Specialist Training Program Manual

Medication (and doses)	Contraindications	Potential Side Effects (Mitigation)	Mechanism of Action	Dosing
Nicotine patch (7 mg, 14 mg, 21 mg)	Systemic allergic reaction (hives) to adhesive Latex allergy Pregnant women may consider use if behavioral treatments fail	Local skin irritation (helps to rotate patch site); vivid dreams/sleep disturbance (helps to remove patch at night and have short-acting nicotine medication available upon awakening if withdrawal symptoms)	Sustained nicotine receptor agonist	7 mg if 14 mg not tolerated or while decreasing dose[a] 14 mg for ≤10 cigarettes/day for 12 weeks[b] 21 mg for 11–20 cigarettes/day for 12 weeks[b]
Nicotine gum (2 mg, 4 mg)	Dental work/problems preventing gum use	Headache, hiccups, jaw pain (chew until tingling sensation felt then park in cheek and stop chewing); mouth, esophageal, and gastric irritation; nausea/vomiting; palpitations	Immediate release nicotine receptor agonist	If first cigarette is: >30 min after waking, use 2 mg ≤30 min after waking, use 4 mg
Nicotine lozenge or mini lozenge (2 mg, 4 mg)	Pregnant women may consider use if behavioral treatments fail	Headache, hiccups, jaw pain (chew until tingling sensation felt then park in cheek and stop chewing); mouth, esophageal, and gastric irritation; nausea/vomiting; palpitations	Immediate release nicotine receptor agonist. Mini lozenge has faster absorption than original lozenge.	If first cigarette is: >30 min after waking, use 2 mg ≤30 min after waking, use 4 mg
Nicotine nasal spray 10 mg/mL	Pregnant women may consider use if behavioral treatments fail	Cough, headache, nasal irritation, rhinitis, throat irritation	Immediate release nicotine receptor agonist	1 spray in each nostril 1–2 times/hour up to 10 sprays per hour
Nicotine inhaler 10 mg/cartridge	Pregnant women may consider use if behavioral treatments fail	Cough, mouth irritation, throat irritation	Immediate release nicotine receptor agonist	Puff into mouth 6–16 cartridges/day as needed
Varenicline; Chantix (0.5 mg, 1 mg)	Not recommended for women who are pregnant or breast feeding	Abnormal dreams, headache, insomnia, nasopharyngitis, nausea/vomiting, xerostomia	Sustained nicotine receptor agonist and antagonist (so prevents immediate, larger nicotine stimulation nicotine inhaled from cigarettes)	Day 1–3: 0.5 mg once daily; Day 4–7: 0.5 mg twice daily; Day 8 and onward: 1 mg twice daily
Bupropion SR; Zyban (150 mg)	Not recommended for those with risk of seizure (seizure history, alcohol dependence, stroke, head injury, MAO inhibitors, anorexia or bulimia) or for women who are pregnant or breast feeding	Constipation, diaphoresis, dizziness, headache, insomnia, nausea/vomiting, weight loss, xerostomia	Blocks re-uptake of dopamine and norepinephrine	150 mg SR once daily for 3 days then increase to 150 mg twice daily

[a] Some patients prefer step-down dosing of patch
[b] Minimum recommended dosing for nicotine replacement is 12 weeks. Some patients may require longer dosing indefinitely

such as a long-acting patch plus short-acting gum or lozenge. Varenicline is a nicotine agonist and is proven safe, even in people with mental health diagnoses [130]. Patients do not need to quit smoking before starting varenicline. Combination NRT allows for self-dosing of nicotine to reduce withdrawal symptoms, which is the most common cause for relapse or inability to stop use. Step-down dosing of the patch strength over weeks to months is a common approach, with use of NRT gum or lozenge dosing as needed for cravings. Informing patients of medication cost and potential side effects improves compliance with therapy.

The amount of nicotine delivered per cigarette has increased in the past decades, which makes quitting more difficult and NRT less effective. E-cigarette use practices make this clear, as patients liberally self-dose. Nicotine withdrawal symptoms include agitation, anhedonia, anxiety, depression, foggy thoughts, irritability, cravings for tobacco, and restlessness. Over medicating with nicotine can also cause symptoms such as nausea, dizziness, light-headedness, and insomnia. Effective management of withdrawal symptoms allows the energy and focus necessary to develop the behavioral changes that will support long-term abstinence, such as strategies to manage triggers and cues, cognitive therapy to reframe feelings of weakness or lack of willpower, and nutritional and physical activity to reduce resultant weight gain.

Arrange

As with any chronic illness, long-term follow-up improves outcomes. Immediate follow-up to new quit attempts helps patients adhere to medications and manage side effects and improves cessation outcomes [131]. Patients may be referred to a quitline or a tobacco treatment specialist or other behavioral health provider. Quitlines are free, live, evidence-based, and are available in every US state by calling 1-800-QUIT NOW (1-800-784-8669). Automated text-messaging interventions are effective, but smartphone apps remain unproven.

Referrals to quitlines can be integrated into EHRs or faxed. Hospitals, clinics, and other organizations may employ certified tobacco treatment specialists who undergo evidence-based training, including didactic sessions on the biomedical and psychosocial aspects of tobacco dependence, counseling techniques, and 240 hours of documented tobacco cessation counseling with patients, prior to becoming certified [132]. They skillfully provide short- and long-term follow-up with patients including counseling, coaching, and medication management.

Long-term follow-up focuses on relapse prevention, reinforces the positives of a tobacco-free life, and anticipates challenges or cause for return to tobacco use. Inquiring as to progress in cessation takes only a few moments at follow-up visits. This individual care along with community resources increases the success rate of tobacco cessation.

Telehealth

The COVID-19 pandemic increased virtual care delivery including tobacco cessation treatment. Telehealth for smoking cessation is efficient and effective [133–137]. It has potential as an effective tool for tobacco cessation but disparities in access to telehealth tools (i.e., computers, cell phones, tablets, and/or broadband) exacerbate inequities in care delivery [138–140]. In the US, the Federal Communication Commission is investing billions of dollars to improve broadband connectivity to rural and lower-income regions [139, 141, 142]. Greater access will help overcome barriers to virtual tobacco treatment [143]. Ongoing research and implementation evaluations regarding best practices have the potential to improve effective access to tobacco use treatment, ensuring equitable access for all populations [143, 144].

Population Health and the Health Care System

Tobacco use is so detrimental to the health of individuals that efforts to promote cessation should be prominent in the health care system. Addressing tobacco use may be a consideration in recognition as a Patient-Centered Medical Home (PCMH). Tobacco use treatment should be streamlined into patient visits, including integration of protocols into EHRs which can assist with patient and cohort identification, care documentation, patient follow-up, guideline adherence, and benchmarking. EHR registries can identify patients with a disease of interest and facilitate population health tracking and interventions for these patients [145]. Dashboards use demographic data from registries and associated interventions to track process, financial, quality, and clinical outcome measures. Dashboards that present data in an accessible and comprehensible way to clinicians improve care processes and outcomes [146]. Visualization dashboards present data to clinicians in graphic formats that are easy to read and time efficient, thereby reducing clinician errors and cognitive load and improving evidence-based guideline adherence [147].

The Centers for Disease Control and Prevention (CDC) recommends use of tobacco registries and treatment tracking in all patients who smoke though it is not yet clear which types of digital support are used and which are most effective [148]. Tobacco registries standardize tobacco use treatment leading to increased referrals to quitlines, tobacco use counseling, and medication prescriptions [149]. EHRs can send Best Practice Advisories to clinicians during an encounter, reminding them to ***Ask, Advise, Assess, Assist,*** and ***Arrange,*** while providing decision support, pharmacotherapy guidance, and behavioral treatment referrals which can include access to community resources [145]. These digital supports provide population-level interventions to standardize outreach and tracking of patients who use tobacco, send targeted messages to patients (via patient portals or mailings), and provide billing prompts for rendered services [149].

Federal population-based tobacco use treatment efforts include the National Cancer Institute's smokefree.gov initiative, which offers free evidence-based support to the public [150]. These digital supports augment traditional quitlines and individual counseling sessions with websites, text-messaging programs, and mobile applications that can target the general population or specific populations such as military veterans, women, adolescents, Spanish-speakers, and older adults. With over 7 million users a year, the benefits of multiple intervention modalities are apparent [150].

Quality Improvement

Quality improvement (QI) efforts can dramatically increase tobacco use treatment [101, 151]. QI processes such as Lean continuous improvement to systematically evaluate workflows and processes can improve care delivery [152, 153]. QI studies may use Plan-Do-Study-Act (PDSA) cycles to iteratively evaluate, implement, and test patient care improvement efforts. Systematic methods to improve workflows and patient care processes in tobacco use can improve site-specific tobacco treatment and inform similar work at other institutions resulting in shared knowledge and continuous process improvements across institutions [154–156].

Insurance Changes

The 2010 Affordable Care Act requires insurance companies to cover evidence-based services that have a rating of "A" or "B" from the US Preventive Services Task Force (USPSTF), an independent panel of clinicians and scientists commissioned by the Agency for Healthcare Research and Quality, including tobacco use counseling and medication. Treatment is covered up to four sessions twice a year with 12 weeks of pharmacotherapy coverage. While these provisions are a start, they do not acknowledge the long-term nature of behavioral change, especially in people who are trying to address mental health or other substance use at same time, or for whom smoking is a coping strategy for grief, stress, discomfort, and loneliness.

Future Directions

Social Media, mHealth, and eHealth

Mobile health interventions, such texting, may increase quitting success. There are numerous smartphone cessation apps but their quality varies and evidence is still lacking on their efficacy or effectiveness [157]. Online and text-based interventions are common with peer recruiting through social media showing some promise with one online social network (Share2Quit) quadrupling peer recruitment [158]. Given the ubiquity of social media and digital devices, more options for tobacco cessation support are likely to develop.

New Pharmacotherapies

There are several novel pharmacotherapies in clinical trials [159]. Nicotine vaccines and galenic formulations of varenicline may be effective in producing antibody levels that reduce side effects. Efforts should also continue to address misperceptions about the currently available medications, including the low risk of these agents compared to the enormous health risks of continued smoking.

E-Cigarettes for Quitting Cigarettes

Electronic cigarettes have grown in popularity, and some people who smoke use them to try to quit cigarette smoking even those that are not an approved cessation product. While likely less harmful than cigarettes, e-cigarettes are not harmless and the long-term health effects remain unknown [160]. E-cigarettes may be more effective than nicotine replacement therapy in randomized clinical trials, but evidence is conflicting, especially in the long term (more than 1 year) [161, 162]. Observational studies of consumer e-cigarette use have not found them to be associated with smoking cessation [163]. Rather than using e-cigarettes to completely quit smoking, many smokers use e-cigarettes as a supplement, for example, vaping in places where they can't smoke [164]. About half of e-cigarette users still smoke cigarettes with the associated ongoing health risks [165]. E-cigarette users should be encouraged to fully quit cigarettes and only use e-cigarettes or, better yet, use an approved cessation product.

Behavioral Therapies

Mindfulness, as both primary and adjunct therapy for becoming tobacco free, can reduce craving and manage stress, which may improve smoking abstinence and relapse prevention [166–168]. This approach may be especially helpful when combined with other established treatments.

Genetics

Research on the human genome has opened a new dimension for understanding tobacco use and dependence. An association between the nicotinic receptor alpha 5 (CHRNA5) and increased risk of addiction-associated phenotypes may explain why some people smoke more heavily than others. The potential for using genetic data includes individualized treatment as well as the ability to target prevention efforts [169–171].

Adolescents and Young Adults

Tobacco use and habituation usually start in adolescence or young adulthood [172, 173]. In 2020, 24% of high-school students and 7% of middle-school students reported use of a tobacco product in the previous 30 days. Primary treatment for tobacco use in adolescents focuses on behavioral interventions with little research showing efficacy of pharmacotherapy in youth [174]. Characteristics of effective behavioral cessation programs include voluntary and fun sessions, motivational interviewing focused on intrinsic and extrinsic motivations to quit, frequent counseling sessions (10 sessions have been efficacious), using social and community support for cessation, extrinsic rewards for quitting, and education on handling stress, social situations, and peer pressure [175]. The National Cancer Institute's Smokefree Teen website provides online resources for teens including text messaging, apps, and access to counselors with age-appropriate cessation support [176]. Several resources are also available for parents and caregivers to support adolescents in cessation efforts [177, 178]. The Truth Initiative has a texting program for youth and young adult vaping called "This is Quitting" that has been shown effective. [179]

Prenatal Treatment

Behavioral treatment is also emphasized during pregnancy, given the concerns of medication use. A 2021 USPSTF guideline recommends (grade A recommendation) that clinicians ask and advise cessation for pregnant people who smoke and provide behavioral counseling to assist in cessation [131]. This guideline also states there is insufficient evidence (grade I recommendation) to adequately determine the risks and benefits of cessation medication use in pregnancy.

Education to Health Care Team Members

Team-based care is a growing concept in our health care system. All health care providers in practice or training, including physicians, nurses, dentists, physical and occupational therapists, and advanced practice practitioners, should be well-versed in the harms of tobacco use and taught the skills to address this leading cause of preventable disease and death.

References

1. U.S. Department of Health and Human Services. Smoking cessation: a report of the surgeon general; 2020. https://www.hhs.gov/surgeongeneral/reports-and-publications/tobacco/2020-cessation-sgr-factsheet-key-findings/index.html. Accessed 01 Jul 2020
2. Cornelius ME, Loretan CG, Wang TW, Jamal A, Homa DM. Tobacco product use among adults—United States, 2020. MMWR Morb Mortal Wkly Rep. 2022;71:397–405. https://doi.org/10.15585/mmwr.mm7111a1external.
3. Reitsma MB, Kendrick PJ, Ababneh E, et al. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990–2019: a systematic analysis from the global burden of disease study 2019. Lancet. 2021;397(10292):2337–60. https://doi.org/10.1016/s0140-6736(21)01169-7.
4. Jacobs EJ, Newton CC, Carter BD, et al. What proportion of cancer deaths in the contemporary United States is attributable to cigarette smoking? Ann Epidemiol. 2015;25(3):179–82. e1. https://doi.org/10.1016/j.annepidem.2014.11.008.
5. Islami F, Goding Sauer A, Miller KD, et al. Proportion and number of cancer cases and deaths attributable to potentially modifiable risk factors in the United States. CA Cancer J Clin. 2018;68(1):31–54. https://doi.org/10.3322/caac.21440.
6. The health consequences of smoking—50 years of progress: a report of the surgeon general; 2014.
7. The health consequences of involuntary exposure to tobacco smoke: a report of the surgeon general; 2006.
8. Meernik C, Goldstein AO. A critical review of smoking, cessation, relapse and emerging research in pregnancy and post-partum. Br Med Bull Jun 2015;114(1):135–146. doi:https://doi.org/10.1093/bmb/ldv016.
9. Xu X, Shrestha SS, Trivers KF, Neff L, Armour BS, King BA. U.S. healthcare spending attributable to cigarette smoking in 2014. Prev Med. 2021:106529. https://doi.org/10.1016/j.ypmed.2021.106529.
10. Shrestha SS, Ghimire R, Wang X, Trivers KF, Homa DM, Armour BS. Cost of cigarette smoking attributable productivity losses, U.S., 2018. Am J Prev Med. 2022; https://doi.org/10.1016/j.amepre.2022.04.032.
11. Max W, Sung HY, Shi Y. Deaths from secondhand smoke exposure in the United States: economic implications. Am J Public Health. 2012;102(11):2173–80. https://doi.org/10.2105/AJPH.2012.300805.
12. Stanton CA, Keith DR, Gaalema DE, et al. Trends in tobacco use among US adults with chronic health conditions: National Survey on drug use and health 2005-2013. Prev Med. 2016;92:160–8. https://doi.org/10.1016/j.ypmed.2016.04.008.
13. Kong AY, Queen TL, Golden SD, Ribisl KM. Neighborhood disparities in the availability, advertising, promotion, and youth appeal of little cigars and cigarillos, United States, 2015. Nicotine Tob Res. 2020;22(12):2170–7. https://doi.org/10.1093/ntr/ntaa005.
14. Edwards SA, Bondy SJ, Callaghan RC, Mann RE. Prevalence of unassisted quit attempts in population-based studies: a systematic review of the literature. Addict Behav. 2014;39(3):512–9. https://doi.org/10.1016/j.addbeh.2013.10.036.
15. Danesh D, Paskett ED, Ferketich AK. Disparities in receipt of advice to quit smoking from health care providers: 2010 National Health Interview Survey. Prev Chronic Dis. 2014;11:E131. https://doi.org/10.5888/pcd11.140053.
16. Fiore M, Jaen CR, Baker T, et al. Treating tobacco use and dependence: 2008 update. Rockville, MD: US Department of Health and Human Services; 2008.
17. Creamer MR, Wang TW, Babb S, et al. Tobacco product use and cessation indicators among adults-United States, 2018. MMWR. 2019;68(45):1013–9.
18. Heyman GM. Do addicts have free will? An empirical approach to a vexing question. Addict Behav Rep Jun 2017;5:85–93. doi:https://doi.org/10.1016/j.abrep.2017.02.001.
19. Lemmens VOA, Knut IK, Brug J. Effectiveness of smoking cessation interventions among adults: a systematic review of reviews. Eur J Cancer Prevention. 2008;17(6):535–44. https://doi.org/10.1097/CEJ.0b013e3282f75e48.
20. Steinberg MB, Schmelzer AC, Richardson DL, Foulds J. The case for treating tobacco dependence as a chronic disease. Ann Intern Med. 2008;148(7):554–6.
21. Halladay JR, Vu M, Ripley-Moffitt C, Gupta SK, O'Meara C, Goldstein AO. Patient perspectives on tobacco use treatment in primary care. Prev Chronic Dis. 2015;12:E14. https://doi.org/10.5888/pcd12.140408.
22. Gritz ER, Vidrine DJ, Fingeret MC. Smoking cessation: a critical component of medical management in chronic disease populations. Am J Prev Med. 2007;33(6):S414–22.
23. Rojewski AM, Baldassarri S, Cooperman NA, et al. Exploring issues of comorbid conditions in people who smoke. Nicotine Tob Res. 2016;18(8):1684–96. https://doi.org/10.1093/ntr/ntw016.
24. Reis RK, Miller SC. The ASAM principles of addiction medicine. Wolters Kluwer Health; 2014.
25. Berridge MS, Apana SM, Nagano KK, Berridge CE, Leisure GP, Boswell MV. Smoking produces rapid rise of [11C]nicotine in human brain. Psychopharmacology. 2010;209(4):383–94. https://doi.org/10.1007/s00213-010-1809-8.
26. Byron MJ, Baig SA, Moracco KE, Brewer NT. Adolescents' and adults' perceptions of 'natural', 'organic' and 'additive-free' cigarettes, and the required disclaimers. Tob Control. 2016;25(5):517. https://doi.org/10.1136/tobaccocontrol-2015-052560.
27. Commission USFT. U.S. Federal Trade Commission (FTC), Cigarette Report for 2020, 2021. 2021.
28. Levy DT, Blackman K, Tauras J, et al. Quit attempts and quit rates among menthol and nonmenthol smokers in the United States. Am J Public Health. 2011;101(7):1241–7. https://doi.org/10.2105/ajph.2011.300178.

29. Keeler C, Max W, Yerger V, Yao T, Ong MK, Sung HY. The association of menthol cigarette use with quit attempts, successful cessation, and intention to quit across racial/ethnic groups in the United States. Nicotine Tob Res. 2016; https://doi.org/10.1093/ntr/ntw215.
30. FDA proposes rules prohibiting menthol cigarettes and Flavored cigars to prevent youth initiation, significantly reduce tobacco-related disease and death. FDA; 04/28/2022. https://www.fda.gov/news-events/press-announcements/fda-proposes-rules-prohibiting-menthol-cigarettes-and-flavored-cigars-prevent-youth-initiation
31. Office on Smoking and Health NCfCDPaHP. Hookahs. U.S. Department of Health & Human Services; 2022. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/tobacco_industry/hookahs/index.htm. Accessed 29 Aug 2022.
32. General USPHSOotS, Prevention NCfCD, Smoking HPOo. Preventing tobacco use among youth and young adults: a report of the surgeon general. US Government Printing Office; 2012.
33. Biener L, Nyman AL, Stepanov I, Hatsukami D. Public education about the relative harm of tobacco products: an intervention for tobacco control professionals. Tob Control. 2014;23(5):385. https://doi.org/10.1136/tobaccocontrol-2012-050814.
34. Organization WH. IARC Monographs on the evaluation of carcinogenic risks to humans. Volume 89: smokeless tobacco and some tobacco-specific N-nitrosamines; 2007.
35. Prevention UCfDCa. Smokeless tobacco: health effects. Office on Smoking and Health, US Center for Disease Control and Prevention. Updated August 13, 2020. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/smokeless/health_effects/index.htm. Accessed 9 Sep 2022.
36. Burton A. Does the smoke ever really clear? Thirdhand smoke exposure raises new concerns. Environ Health Perspect. 2011;119(2):A70–4.
37. Protano C, Vitali M. The new danger of thirdhand smoke: why passive smoking does not stop at secondhand smoke. Environ Health Perspect. 2011;119(10):A422. https://doi.org/10.1289/ehp.1103956.
38. Diez-Izquierdo A, Cassanello-Penarroya P, Lidon-Moyano C, Matilla-Santander N, Balaguer A, Martinez-Sanchez JM. Update on thirdhand smoke: a comprehensive systematic review. Environ Res. 2018;167:341–71. https://doi.org/10.1016/j.envres.2018.07.020.
39. U.S. Department of Health and Human Services. America's health rankings analysis of National Survey of Children's Health. (MCHB) MaCHB; 2021. https://www.americashealthrankings.org. Accessed 15 Sep 2022
40. CDC. Vital signs: nonsmokers' exposure to secondhand smoke—United States, 1999–2008. MMWR Morb Mortal Wkly Rep. 2010;59(35):1141–6.
41. Northrup TF, Matt GE, Hovell MF, Khan AM, Stotts AL. Thirdhand smoke in the homes of medically fragile children: assessing the impact of indoor Smoking levels and Smoking bans. Nicotine Tob Res. 2016;18(5):1290–8. https://doi.org/10.1093/ntr/ntv174.
42. Bahl V, Jacob P 3rd, Havel C, Schick SF, Talbot P. Thirdhand cigarette smoke: factors affecting exposure and remediation. PLoS One. 2014;9(10):e108258. https://doi.org/10.1371/journal.pone.0108258.
43. Hang B, Sarker AH, Havel C, et al. Thirdhand smoke causes DNA damage in human cells. Mutagenesis. 2013;28(4):381–91. https://doi.org/10.1093/mutage/get013.
44. Rehan VK, Sakurai R, Torday JS. Thirdhand smoke: a new dimension to the effects of cigarette smoke on the developing lung. Am J Physiol Lung Cell Mol Physiol. 2011;301(1):L1–8. https://doi.org/10.1152/ajplung.00393.2010.
45. Díez-Izquierdo A, Cassanello-Peñarroya P, Lidón-Moyano C, Matilla-Santander N, Balaguer A, Martínez-Sánchez JM. Update on thirdhand smoke: a comprehensive systematic review. Environ Res. 2018;167:341–71. https://doi.org/10.1016/j.envres.2018.07.020.
46. Klein JD, Chamberlin ME, Kress EA, et al. Asking the right questions about secondhand smoke. Nicotine Tob Res. 2021;23(1):57–62. https://doi.org/10.1093/ntr/ntz125.
47. ICD10.Data.com. ICD10-CM Codes. https://www.icd10data.com/ICD10CM/Codes/Z00-Z99/Z77-Z99/Z77-/Z77.22. Accessed 29 Aug 2022.
48. Jha P, Ramasundarahettige C, Landsman V, et al. 21st-century hazards of smoking and benefits of cessation in the United States. N Engl J Med. 2013;368(4):341–50. https://doi.org/10.1056/NEJMsa1211128.
49. Bullen C. Impact of tobacco smoking and smoking cessation on cardiovascular risk and disease. Expert Rev Cardiovasc Ther. 2008;6(6):883–95. https://doi.org/10.1586/14779072.6.6.883.
50. Burns DM. Epidemiology of smoking-induced cardiovascular disease. Prog Cardiovasc Dis. 2003;46(1):11–29.
51. Robbins AS, Manson JE, Lee IM, Satterfield S, Hennekens CH. Cigarette smoking and stroke in a cohort of U.S. male physicians. Ann Intern Med. 1994;120(6):458–62.
52. McRobbie H, Hajek P. Nicotine replacement therapy in patients with cardiovascular disease: guidelines for health professionals. Addiction. 2001;96(11):1547–51. https://doi.org/10.1080/09652140120080688.
53. Barth J, Critchley J, Bengel J. Efficacy of psychosocial interventions for smoking cessation in patients with coronary heart disease: a systematic review and meta-analysis. Ann Behav Med. 2006;32(1):10–20. https://doi.org/10.1207/s15324796abm3201_2.
54. Mikhailidis DP, Papadakis JA, Ganotakis ES. Smoking, diabetes and hyperlipidaemia. J R Soc Health. 1998;118(2):91–3.
55. Becker RH, Sha S, Frick AD, Fountaine RJ. The effect of smoking cessation and subsequent resumption on absorption of inhaled insulin. Diabetes Care. 2006;29(2):277–82.
56. Tonstad S, Lawrence D. Varenicline in smokers with diabetes: a pooled analysis of 15 randomized, placebo-controlled studies of varenicline. J Diabetes Investig. 2016; https://doi.org/10.1111/jdi.12543.
57. Anthonisen NR. Lessons from the lung health study. Proc Am Thorac Soc. 2004;1(2):143–5. https://doi.org/10.1513/pats.2306033.
58. Burnes D. Chronic obstructive pulmonary disease In: Tobacco: science, policy and public health. Oxford University Press; 2004.
59. Godtfredsen NS, Lam TH, Hansel TT, et al. COPD-related morbidity and mortality after smoking cessation: status of the evidence. Eur Respir J. 2008;32(4):844–53. https://doi.org/10.1183/09031936.00160007.
60. Hilberink SR, Jacobs JE, Bottema BJ, de Vries H, Grol RP. Smoking cessation in patients with COPD in daily general practice (SMOCC): six months' results. Prev Med. 2005;41(5–6):822–7. https://doi.org/10.1016/j.ypmed.2005.08.003.
61. Lazarus SC, Chinchilli VM, Rollings NJ, et al. Smoking affects response to inhaled corticosteroids or leukotriene receptor antagonists in asthma. Am J Respir Crit Care Med. 2007;175(8):783–90. https://doi.org/10.1164/rccm.200511-1746OC.
62. McLeish AC, Farris SG, Johnson AL, Bernstein JA, Zvolensky MJ. Evaluation of smokers with and without asthma in terms of smoking cessation outcome, nicotine withdrawal symptoms, and craving: findings from a self-guided quit attempt. Addict Behav. 2016;63:149–54. https://doi.org/10.1016/j.addbeh.2016.07.021.
63. Perret JL, Bonevski B, McDonald CF, Abramson MJ. Smoking cessation strategies for patients with asthma: improving patient outcomes. J Asthma Allergy. 2016;9:117–28. https://doi.org/10.2147/jaa.s85615.
64. Balduyck B, Sardari Nia P, Cogen A, et al. The effect of smoking cessation on quality of life after lung cancer surgery. Eur J Cardio-

Thorac Surg. 2011;40(6):1432–7.; discussion 1437-8. https://doi.org/10.1016/j.ejcts.2011.03.004.
65. Nayan S, Gupta MK, Strychowsky JE, Sommer DD. Smoking cessation interventions and cessation rates in the oncology population: an updated systematic review and meta-analysis. Otolaryngol Head Neck Surg. 2013;149(2):200–11. https://doi.org/10.1177/0194599813490886.
66. Sheeran P, Jones K, Avishai A, et al. What works in smoking cessation interventions for cancer survivors? A meta-analysis. Health Psychol. 2019;38(10):855–65. https://doi.org/10.1037/hea0000757.
67. Goldstein AO, Shoenbill KA, Jolly TA. Intensive smoking cessation counseling for patients with cancer. JAMA. 2020;324(14):1401–3. https://doi.org/10.1001/jama.2020.13102.
68. Park ER, Perez GK, Regan S, et al. Effect of sustained smoking cessation counseling and provision of medication vs shorter-term counseling and medication advice on smoking abstinence in patients recently diagnosed with cancer: a randomized clinical trial. JAMA. 2020;324(14):1406–18. https://doi.org/10.1001/jama.2020.14581.
69. Reddy KP, Parker RA, Losina E, et al. Impact of cigarette smoking and smoking cessation on life expectancy among people with HIV: a US-based modeling study. J Infect Dis. 2016;2016 https://doi.org/10.1093/infdis/jiw430.
70. Mdodo R, Frazier EL, Dube SR, et al. Cigarette smoking prevalence among adults with HIV compared with the general adult population in the United States: cross-sectional surveys. Ann Intern Med. 2015;162(5):335–44. https://doi.org/10.7326/m14-0954.
71. Tseng TY, Krebs P, Schoenthaler A, et al. Combining text messaging and telephone counseling to increase varenicline adherence and smoking abstinence among cigarette smokers living with HIV: a randomized controlled study. AIDS Behav. 2016; https://doi.org/10.1007/s10461-016-1538-z.
72. Wewers ME, Neidig JL, Kihm KE. The feasibility of a nurse-managed, peer-led tobacco cessation intervention among HIV-positive smokers. J Assoc Nurses AIDS Care. 2000;11(6):37–44. https://doi.org/10.1016/s1055-3290(06)60353-1.
73. Vidrine DJ, Arduino RC, Lazev AB, Gritz ER. A randomized trial of a proactive cellular telephone intervention for smokers living with HIV/AIDS. AIDS (London, England). 2006;20(2):253–60. https://doi.org/10.1097/01.aids.0000198094.23691.58.
74. Gfroerer JDS, King BA, Garrett BE, Babb S, McAfee T. Vital signs: currrent cigarette smoking among adults aged ≥18 years with mental illness, United States 2009–2011. MMWR Morb Mortal Wkly Rep. 2013;62:81–7.
75. Schroeder SA, Morris CD. Confronting a neglected epidemic: tobacco cessation for persons with mental illnesses and substance abuse problems. Annu Rev Public Health. 2010;31:297–314. 1p following 314. https://doi.org/10.1146/annurev.publhealth.012809.103701.
76. Taylor G, McNeill A, Girling A, Farley A, Lindson-Hawley N, Aveyard P. Change in mental health after smoking cessation: systematic review and meta-analysis. BMJ. 2014;348:g1151. https://doi.org/10.1136/bmj.g1151.
77. Tsoh JY, Chi FW, Mertens JR, Weisner CM. Stopping smoking during first year of substance use treatment predicted 9-year alcohol and drug treatment outcomes. Drug Alcohol Depend. 2011;114(2–3):110–8. https://doi.org/10.1016/j.drugalcdep.2010.09.008.
78. Kopsaftis Z, van Agteren J, Carson K, O'Loughlin T, Smith B. Smoking cessation in the hospital setting: a systematic review and meta-analysis. Eur Respir J. 2017;50(suppl 61):PA1271. https://doi.org/10.1183/1393003.congress-2017.PA1271.
79. Iannello J, Levitt MP, Poetter D, et al. Improving inpatient tobacco treatment measures: outcomes through standardized treatment, care coordination, and electronic health record optimization. J Healthc Qual. 2021;43(1):48–58. https://doi.org/10.1097/JHQ.0000000000000251.
80. Trout S, Ripley-Moffitt C, Meernik C, Greyber J, Goldstein AO. Provider satisfaction with an inpatient tobacco treatment program: results from an inpatient provider survey. Int J General Med. 2017;10:363–9. https://doi.org/10.2147/IJGM.S136965.
81. Park HY, Choe YR, Oh IJ, et al. Efficacy of an inpatient smoking cessation program at a single regional cancer center: a prospective observational study. Medicine (Baltimore). 2021;100(6):e24745. https://doi.org/10.1097/MD.0000000000024745.
82. Matuszewski PE, Joseph K, O'Hara NN, DiClemente C, O'Toole RV. Prospective randomized trial on smoking cessation in orthopaedic trauma patients: results from the let's STOP (smoking in trauma orthopaedic patients) now trial. J Orthop Trauma. 2021;35(7):345–51. https://doi.org/10.1097/BOT.0000000000002028.
83. Brown RA, Minami H, Hecht J, et al. Sustained care Smoking cessation intervention for individuals hospitalized for psychiatric disorders: the helping HAND 3 randomized clinical trial. JAMA Psychiatry. 2021;78(8):839–47. https://doi.org/10.1001/jamapsychiatry.2021.0707.
84. See JJH, See KC. Impact of admission diagnosis on the Smoking cessation rate: a brief report from a multi-Centre inpatient smoking cessation programme in Singapore. J Prev Med Public Health. 2020;53(5):381–6. https://doi.org/10.3961/jpmph.20.134.
85. Thomas D, Abramson MJ, Bonevski B, et al. Integrating smoking cessation into routine care in hospitals—a randomized controlled trial. Addiction. 2016;111(4):714–23. https://doi.org/10.1111/add.13239.
86. Coleman K, Austin BT, Brach C, Wagner EH. Evidence on the chronic care model in the new millennium. Health Aff (Millwood). 2009;28(1):75–85. https://doi.org/10.1377/hlthaff.28.1.75.
87. Wagner EH, Bennett SM, Austin BT, Greene SM, Schaefer JK, Vonkorff M. Finding common ground: patient-centeredness and evidence-based chronic illness care. J Altern Complement Med. 2005;11(supplement 1):s-7–s-15.
88. McCullough A, Fisher M, Goldstein AO, Kramer KD, Ripley-Moffitt C. Smoking as a vital sign: prompts to ask and assess increase cessation counseling. J Am Board Fam Med. 2009;22(6):625–32. https://doi.org/10.3122/jabfm.2009.06.080211.
89. Theobald M, Botelho RJ, Saccocio SC, Houston TP, McAfee T, Mullins S, Weida TJ. Treating tobacco dependence practice manual, a systems-change approach. Am Acad Fam Phys; 2017.
90. Whittet MN, Capesius TR, Zook HG, Keller PA. The role of health systems in reducing tobacco dependence. Am J Accountable Care. 2019;7(2):4–11.
91. Lindson N, Pritchard G, Hong B, Fanshawe TR, Pipe A, Papadakis S. Strategies to improve smoking cessation rates in primary care. Cochrane Database Syst Rev. 2021;9(9):Cd011556. https://doi.org/10.1002/14651858.CD011556.pub2.
92. Soulakova JN, Tang CY, Leonardo SA, Taliaferro LA. Motivational benefits of social support and behavioural interventions for smoking cessation. J Smok Cessat. 2018;13(4):216–26. https://doi.org/10.1017/jsc.2017.26.
93. Cohen S, Lichtenstein E. Partner behaviors that support quitting smoking. J Consult Clin Psychol. 1990;58(3):304–9. https://doi.org/10.1037//0022-006x.58.3.304.
94. Derrick JL, Leonard KE, Homish GG. Perceived partner responsiveness predicts decreases in smoking during the first nine years of marriage. Nicotine Tob Res. 2013;15(9):1528–36. https://doi.org/10.1093/ntr/ntt011.
95. Christakis NFJ. The collective dynamics of smoking in a large social network. New Engl J Med. 2008;358(21):2248–58.
96. Ford P, Clifford A, Gussy K, Gartner C. A systematic review of peer-support programs for smoking cessation in disadvantaged groups. Int J Environ Res Public Health. 2013;10(11):5507–22. https://doi.org/10.3390/ijerph10115507.

97. Goldade K, Des Jarlais D, Everson-Rose SA, et al. Knowing quitters predicts smoking cessation in a homeless population. Am J Health Behav. 2013;37(4):517–24. https://doi.org/10.5993/ajhb.37.4.9.
98. Ruge J, Ulbricht S, Schumann A, Rumpf HJ, John U, Meyer C. Intention to quit smoking: is the partner's smoking status associated with the smoker's intention to quit? Int J Behav Med. 2008;15(4):328–35. https://doi.org/10.1080/10705500802365607.
99. vanDellen MR, Boyd SM, Ranby KW, MacKillop J, Lipkus IM. Willingness to provide support for a quit attempt: a study of partners of smokers. J Health Psychol. 2016;21(9):1840–9. https://doi.org/10.1177/1359105314567209.
100. Falba TA, Sindelar JL. Spousal concordance in health behavior change. Health Serv Res. 2008;43(1 Pt 1):96–116. https://doi.org/10.1111/j.1475-6773.2007.00754.x.
101. Ruebush E, Mitra S, Meyer C, Sisler L, Goldstein AO. Using a family systems approach to treat tobacco use among Cancer patients. Int J Environ Res Public Health. 2020;17(6) https://doi.org/10.3390/ijerph17062050.
102. Lobchuk MM, McClement SE, McPherson CJ, Cheang M. Impact of patient smoking behavior on empathic helping by family caregivers in lung cancer. Oncol Nurs Forum. 2012;39(2):E112–21.
103. Bottorff JL, Robinson CA, Sullivan KM, Smith ML. Continued family smoking after lung cancer diagnosis: the patient's perspective. Oncol Nurs Forum. 2009;36(3):E126–32. https://doi.org/10.1188/09.ONF.E126-E132.
104. Robinson CA, Bottorff JL, Smith ML, Sullivan KM. "Just because you've got lung cancer doesn't mean I will": lung cancer, smoking, and family dynamics. J Fam Nurs. 2010;16(3):282–301. https://doi.org/10.1177/1074840710370747.
105. Bottorff JL, Robinson CA, Sarbit G, Graham R, Kelly MT, Torchalla I. A motivational, gender-sensitive smoking cessation resource for family members of patients with lung cancer. Oncol Nurs Forum. 2015;42(4):363–70. https://doi.org/10.1188/15.Onf.42-04ap.
106. Federal Trade Commission Cigarette Report for 2019 (Federal Trade Commission); 2021, pp. 1–35.
107. Cleveland Clinic. Stress, stress Management, and Smoking. Cleveland Clinic. http://my.clevelandclinic.org/health/healthy_living/hic_Stress_Management_and_Emotional_Health/hic_Stress_Stress_Management_and_Smoking. Accessed 6 Jan 2017.
108. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. Milbank Q. 1996:511–44.
109. Gould GS. Patient-centred tobacco management. Drug Alcohol Rev. 2014;33(1):93–8. https://doi.org/10.1111/dar.12082.
110. Bernstein SL, Toll BA. Ask about smoking, not quitting: a chronic disease approach to assessing and treating tobacco use. Addict Sci Clin Pract. 2019;14(1):29. https://doi.org/10.1186/s13722-019-0159-z.
111. Toll BA, Rojewski AM, Duncan LR, et al. "Quitting smoking will benefit your health": the evolution of clinician messaging to encourage tobacco cessation. Clin Cancer Res. 2014;20(2):301–9. https://doi.org/10.1158/1078-0432.ccr-13-2261.
112. Apodaca TR, Longabaugh R. Mechanisms of change in motivational interviewing: a review and preliminary evaluation of the evidence. Addiction. 2009;104(5):705–15. https://doi.org/10.1111/j.1360-0443.2009.02527.x.
113. Heckman CJ, Egleston BL, Hofmann MT. Efficacy of motivational interviewing for smoking cessation: a systematic review and meta-analysis. Tob Control. 2010;19(5):410–6. https://doi.org/10.1136/tc.2009.033175.
114. Cohen DJ, Clark EC, Lawson PJ, Casucci BA, Flocke SA. Identifying teachable moments for health behavior counseling in primary care. Patient Educ Couns. 2011;85(2):e8–15. https://doi.org/10.1016/j.pec.2010.11.009.
115. Dresler C, Warren GW, Arenberg D, et al. "Teachable moment" interventions in lung cancer: why action matters. J Thorac Oncol. 2018;13(5):603–5. https://doi.org/10.1016/j.jtho.2018.02.020.
116. Lawson PJ, Flocke SA. Teachable moments for health behavior change: a concept analysis. Patient Educ Couns. 2009;76(1):25–30. https://doi.org/10.1016/j.pec.2008.11.002.
117. Puleo GE, Borger T, Bowling WR, Burris JL. The state of the science on cancer diagnosis as a "Teachable Moment" for smoking cessation: a scoping review. Nicotine Tob Res. 2021; https://doi.org/10.1093/ntr/ntab139.
118. Xiang X. Chronic disease diagnosis as a teachable moment for health behavior changes among middle-aged and older adults. J Aging Health. 2016;28(6):995–1015. https://doi.org/10.1177/0898264315614573.
119. Buchbinder M, Wilbur R, Zuskov D, McLean S, Sleath B. Teachable moments and missed opportunities for smoking cessation counseling in a hospital emergency department: a mixed-methods study of patient-provider communication. BMC Health Serv Res. 2014;14:651. https://doi.org/10.1186/s12913-014-0651-9.
120. Gritz ER, Fingeret MC, Vidrine DJ, Lazev AB, Mehta NV, Reece GP. Successes and failures of the teachable moment: smoking cessation in cancer patients. Cancer. 2006;106(1):17–27. https://doi.org/10.1002/cncr.21598.
121. Lindson-Hawley N, Thompson TP, Begh R. Motivational interviewing for smoking cessation. Cochrane Database Syst Rev. 2015;(3):CD006936. https://doi.org/10.1002/14651858.CD006936.pub3.
122. Ellerbeck EF, Mahnken JD, Cupertino AP, et al. Effect of varying levels of disease management on smoking cessation: a randomized trial. Ann Intern Med. 2009;150(7):437–46.
123. Pisinger C, Vestbo J, Borch-Johnsen K, Jorgensen T. It is possible to help smokers in early motivational stages to quit. The Inter99 study. Prev Med. 2005;40(3):278–84. https://doi.org/10.1016/j.ypmed.2004.06.011.
124. Tan J, Zhao L, Chen H. A meta-analysis of the effectiveness of gradual versus abrupt smoking cessation. Tob Induc Dis. 2019;17:09. https://doi.org/10.18332/tid/100557.
125. Lindson N, Klemperer E, Hong B, Ordóñez-Mena JM, Aveyard P. Smoking reduction interventions for smoking cessation. Cochrane Database Syst Rev. 2019;(9) https://doi.org/10.1002/14651858.CD013183.pub2.
126. Lancaster T, Stead L. Physician advice for smoking cessation. Cochrane Database Syst Rev. 2004;(4):CD000165. https://doi.org/10.1002/14651858.CD000165.pub2.
127. Alterman AI, Gariti P, Mulvaney F. Short- and long-term smoking cessation for three levels of intensity of behavioral treatment. Psychol Addict Behav. 2001;15(3):261–4.
128. Hilleman DE, Mohiuddin SM, Packard KA. Comparison of conservative and aggressive smoking cessation treatment strategies following coronary artery bypass graft surgery. Chest. 2004;125(2):435–8. https://doi.org/10.1378/chest.125.2.435.
129. Barzilai DA, Goodwin MA, Zyzanski SJ, Stange KC. Does health habit counseling affect patient satisfaction? Prev Med. 2001;33(6):595–9. https://doi.org/10.1006/pmed.2001.0931.
130. Anthenelli RM, Benowitz NL, West R, et al. Neuropsychiatric safety and efficacy of varenicline, bupropion, and nicotine patch in smokers with and without psychiatric disorders (EAGLES): a double-blind, randomised, placebo-controlled clinical trial. Lancet. 2016;387(10037):2507–20. https://doi.org/10.1016/s0140-6736(16)30272-0.
131. USPSTF, Krist AH, Davidson KW, et al. Interventions for tobacco smoking cessation in adults, including pregnant persons: US preventive services task force recommendation statement. JAMA. 2021;325(3):265–79. https://doi.org/10.1001/jama.2020.25019.

132. National Association for Alcoholism and Drug Abuse Counselors (NAADAC). National certificate in tobacco treatment practice. https://www.naadac.org/NCTTP. Accessed 10 Dec 2021.
133. American Academy of Family Physicians (AAFP). Tobacco cessation telehealth guide; 2020. https://www.aafp.org/dam/AAFP/documents/patient_care/tobacco/tobacco-cessation-telehealth-guide.pdf. Accessed 02 May 2021.
134. American Lung Association. Tobacco cessation, telehealth and a pandemic: a changing landscape; 2020. https://www.lung.org/getmedia/83628722-434c-432b-84f4-754b25ea0cce/tobacco-cessation-and-telehealth_final.pdf. Accessed 05 Feb 2021.
135. Kotsen C, Dilip D, Carter-Harris L, et al. Rapid scaling up of telehealth treatment for tobacco-dependent cancer patients during the COVID-19 outbreak in New York City. Telemed J E Health. 2020;27(1):20–9. https://doi.org/10.1089/tmj.2020.0194.
136. Mujcic A, Blankers M, Bommele J, et al. The effectiveness of distance-based interventions for smoking cessation and alcohol moderation among cancer survivors: a meta-analysis. Psychooncology. 2020;29(1):49–60. https://doi.org/10.1002/pon.5261.
137. Shoenbill KA, Newcomer E, Valcourt-Hall C, Baca-Atlas M, Smith CA, Goldstein AO. An analysis of inpatient tobacco use treatment transition to telehealth. Nicotine Tob Res. 2021; https://doi.org/10.1093/ntr/ntab233.
138. Cantor JH, McBain RK, Pera MF, Bravata DM, Whaley CM. Who is (and is not) receiving telemedicine care during the COVID-19 pandemic. Am J Prev Med. 2021;61(3):434–8. https://doi.org/10.1016/j.amepre.2021.01.030.
139. Hirko KA, Kerver JM, Ford S, et al. Telehealth in response to the COVID-19 pandemic: implications for rural health disparities. J Am Med Inform Assoc. 2020;27(11):1816–8. https://doi.org/10.1093/jamia/ocaa156.
140. Arlington Research. Telehealth take-up: the risks and opportunities; Healthcare Report 2021. November 30, 2021. https://media.kasperskycontenthub.com/wp-content/uploads/sites/43/2021/11/22125239/Kaspersky_Healthcare-report-2021_eng.pdf.
141. Federal Communications Commission. COVID-19 Telehealth Program. Federal Communications Commission. https://www.fcc.gov/covid-19-telehealth-program. Accessed 05 Apr 2021.
142. HHS invests $8 million to address gaps in rural telehealth through the telehealth broadband pilot program. 01/11/2021, 2021. Accessed 15 Jan 2021. https://www.hhs.gov/about/news/2021/01/11/hhs-invests-8-million-to-address-gaps-in-rural-telehealth-through-telehealth-broadband-pilot.html
143. Slater JS, Nelson CL, Parks MJ, Ebbert JO. Connecting low-income smokers to tobacco treatment services. Addict Behav. 2016;52:108–14. https://doi.org/10.1016/j.addbeh.2015.10.013.
144. Darrat I, Tam S, Boulis M, Williams AM. Socioeconomic disparities in patient use of telehealth during the coronavirus disease 2019 surge. JAMA Otolaryngol Head Neck Surg. 2021;147(3):287–95. https://doi.org/10.1001/jamaoto.2020.5161.
145. Neutze D, Ripley-Moffitt C, Gwynne M, Goldstein AO. The implementation of a tobacco use registry in an academic family practice. J Am Board Fam Med. 2015;28(2):214–21. https://doi.org/10.3122/jabfm.2015.02.140117.
146. Dowding D, Randell R, Gardner P, et al. Dashboards for improving patient care: review of the literature. Int J Med Inform Feb 2015;84(2):87–100. doi:https://doi.org/10.1016/j.ijmedinf.2014.10.001.
147. Khairat SS, Dukkipati A, Lauria HA, Bice T, Travers D, Carson SS. The impact of visualization dashboards on quality of care and clinician satisfaction: integrative literature review. JMIR Hum Factors. 2018;5(2):e22. https://doi.org/10.2196/humanfactors.9328.
148. Centers for Disease Control and Prevention. Best practices for comprehensive tobacco control programs—2014; 2014.
149. Ripley-Moffitt C, Neutze D, Gwynne M, Goldstein AO. Patient care outcomes of a tobacco use registry in an academic family practice. J Am Board Fam Med. 2015;28(2):205–13. https://doi.org/10.3122/jabfm.2015.02.140121.
150. Prutzman YM, Wiseman KP, Grady MA, et al. Using digital technologies to reach tobacco users who want to quit: evidence from the National Cancer Institute's Smokefree.gov initiative. Am J Prev Med. 2021;60(3 Suppl 2):S172–84. https://doi.org/10.1016/j.amepre.2020.08.008.
151. Kowitt SD, Goldstein AO, Cykert S. A heart healthy intervention improved tobacco screening rates and cessation support in primary care practices. J Prev Dent. 2022;43(3):375–86. https://doi.org/10.1007/s10935-022-00672-5.
152. Meyer C, Mitra S, Ruebush E, Sisler L, Wang K, Goldstein AO. A lean quality improvement initiative to enhance tobacco use treatment in a cancer hospital. Int J Environ Res Public Health. 2020;17(6) https://doi.org/10.3390/ijerph17062165.
153. Sisler L, Omofoye O, Paci K, Hadar E, Goldstein AO, Ripley-Moffitt C. Using lean quality improvement tools to increase delivery of evidence-based tobacco use treatment in hospitalized neurosurgical patients. Jt Comm J Qual Patient Saf. 2017;43(12):633–41. https://doi.org/10.1016/j.jcjq.2017.06.012.
154. Croyle RT, Morgan GD, Fiore MC. Addressing a core gap in cancer care—the NCI moonshot program to help oncology patients stop smoking. N Engl J Med. 2019;380(6):512–5. https://doi.org/10.1056/NEJMp1813913.
155. Ugalde A, White V, Rankin NM, et al. How can hospitals change practice to better implement smoking cessation interventions? A systematic review. CA Cancer J Clin. 2021; https://doi.org/10.3322/caac.21709.
156. Wiseman KP, Hauser L, Clark C, et al. An evaluation of the process and quality improvement measures of the University of Virginia Cancer Center Tobacco Treatment Program. Int J Environ Res Public Health. 2020;17(13) https://doi.org/10.3390/ijerph17134707.
157. Whittaker R, McRobbie H, Bullen C, Rodgers A, Gu Y, Dobson R. Mobile phone text messaging and app-based interventions for smoking cessation. Cochrane Database Syst Rev. 2019;10:CD006611. https://doi.org/10.1002/14651858.CD006611.pub5.
158. Sadasivam RS, Cutrona SL, Luger TM, et al. Share2Quit: online social Network peer marketing of tobacco cessation systems. Nicotine Tob Res. 2016; https://doi.org/10.1093/ntr/ntw187.
159. Beard E, Shahab L, Cummings DM, Michie S, West R. New pharmacological agents to aid Smoking cessation and tobacco harm reduction: what has been investigated, and what is in the pipeline? CNS Drugs. 2016;30(10):951–83. https://doi.org/10.1007/s40263-016-0362-3.
160. National Academies of Sciences E, Medicine. Public health consequences of E-cigarettes. The National Academies Press; 2018. p. 774.
161. Hartmann-Boyce J, McRobbie H, Butler AR, et al. Electronic cigarettes for smoking cessation. Cochrane Database Syst Rev. 2021;(9) https://doi.org/10.1002/14651858.CD010216.pub6.
162. Ibrahim S, Habiballah M, Sayed IE. Efficacy of electronic cigarettes for smoking cessation: a systematic review and meta-analysis. Am J Health Promot. 2021;35(3):442–55. https://doi.org/10.1177/0890117120980289.
163. Wang RJ, Bhadriraju S, Glantz SA. E-cigarette use and adult cigarette smoking cessation: a meta-analysis. Am J Public Health. 2021;111(2):230–46. https://doi.org/10.2105/ajph.2020.305999.
164. Harlow AF, Cho J, Tackett AP, et al. Motivations for E-cigarette use and associations with vaping frequency and smoking abstinence among adults who smoke cigarettes in the United States. Drug Alcohol Depend. 2022;238:109583. https://doi.org/10.1016/j.drugalcdep.2022.109583.

165. Mirbolouk M, Charkhchi P, Kianoush S, et al. Prevalence and distribution of E-cigarette use among U.S. adults: behavioral risk factor surveillance system, 2016. Ann Intern Med. 2018;169(7):429–38. https://doi.org/10.7326/m17-3440.
166. de Souza IC, de Barros VV, Gomide HP, et al. Mindfulness-based interventions for the treatment of smoking: a systematic literature review. J Altern Complement Med. 2015;21(3):129–40. https://doi.org/10.1089/acm.2013.0471.
167. Davis JM, Manley AR, Goldberg SB, Smith SS, Jorenby DE. Randomized trial comparing mindfulness training for smokers to a matched control. J Subst Abus Treat. 2014;47(3):213–21. https://doi.org/10.1016/j.jsat.2014.04.005.
168. Elwafi HM, Witkiewitz K, Mallik S, Thornhill TA, Brewer JA. Mindfulness training for smoking cessation: moderation of the relationship between craving and cigarette use. Drug Alcohol Depend. 2013;130(1–3):222–9. https://doi.org/10.1016/j.drugalcdep.2012.11.015.
169. Wen L, Jiang K, Yuan W, Cui W, Li MD. Contribution of variants in CHRNA5/A3/B4 gene cluster on chromosome 15 to tobacco smoking: from genetic association to mechanism. Mol Neurobiol. 2016;53(1):472–84. https://doi.org/10.1007/s12035-014-8997-x.
170. Bierut LJ, Johnson EO, Saccone NL. A glimpse into the future—personalized medicine for smoking cessation. Neuropharmacology Jan 2014;76(Pt B):592-599. doi:https://doi.org/10.1016/j.neuropharm.2013.09.009.
171. O'Loughlin J, Sylvestre MP, Labbe A, et al. Genetic variants and early cigarette smoking and nicotine dependence phenotypes in adolescents. PLoS One. 2014;9(12):e115716. https://doi.org/10.1371/journal.pone.0115716.
172. Office on Smoking and Health NCfCDPaHP. Youth and Tobacco Use. 09/09/2022.
173. Barrington-Trimis JL, Braymiller JL, Unger JB, et al. Trends in the age of cigarette smoking initiation among young adults in the US from 2002 to 2018. JAMA Netw Open. 2020;3(10):e2019022. https://doi.org/10.1001/jamanetworkopen.2020.19022.
174. Stanton A, Grimshaw G. Tobacco cessation interventions for young people. Cochrane Database Syst Rev. 2013;(8):CD003289. https://doi.org/10.1002/14651858.CD003289.pub5.
175. American Lung Association. N-O-T: Not On Tobacco—proven teen smoking and vaping cessation program. https://www.lung.org/quit-smoking/helping-teens-quit/not-on-tobacco. Accessed 11 Sep 2022.
176. U.S. Department Health and Human Services. Smokefree Teen. Accessed 09 Sep 2022. https://teen.smokefree.gov.
177. Mayo Foundation for Medical Education and Research. Mayo Clinic: teen smoking: how to help your teen quit. https://www.mayoclinic.org/healthy-lifestyle/tween-and-teen-health/in-depth/teen-smoking/art-20046474. Accessed 09 Sep 2022.
178. MD Anderson Cancer Network. How to help your teen quit vaping. https://www.mdanderson.org/publications/focused-on-health/how-to-help-your-teen-quit-vaping.h13-1593780.html. Accessed 09 Sep 2022.
179. Graham AL, Amato MS, Cha S, Jacobs MA, Bottcher MM, Papandonatos GD. Effectiveness of a vaping cessation text message program among young adult e-cigarette users: a randomized clinical trial. JAMA Intern Med. 2021;181(7):923–30. https://doi.org/10.1001/jamainternmed.2021.1793.