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REVIEW ARTICLE

A Review on Global Tobacco Burden and Health Sequelae

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Abstract: Tobacco use, primarily through cigarette smoking, is one of the preventable morbidity and premature mortality factors worldwide. This review provides the extensive evidence on the health consequences of tobacco consumption and exposure to environmental tobacco smoke (ETS). The combustion of tobacco releases an aerosol containing thousands of chemical compounds, including numerous carcinogens and toxins, which initiate and promote systemic pathophysiological processes. These processes include oxidative stress, chronic inflammation, endothelial dysfunction, and profound genotoxicity. The clinical manifestations of these effects are extensive, including a high burden of cardiovascular diseases such as coronary artery disease and stroke, a spectrum of respiratory conditions including Chronic Obstructive Pulmonary Disease (COPD), and a causal association with at least 17 different types of cancer, with lung cancer being the most prominent. Nicotine, the primary psychoactive component, causes a potent neurobiological dependence making it impossible to avoid smoking habit. Exposure to ETS extends these health risks to non-smokers, particularly impacting pediatric populations. Effective cessation, achieved through a combination of behavioral counseling and pharmacotherapy, can substantially mitigate these risks, with the magnitude of benefit directly related to the duration of abstinence. Public health programs focused on prevention, cessation support, and policy-level interventions are important to diminish the global health burden caused by tobacco consumption.

Keywords: Tobacco Smoking; Nicotine Dependence; Smoking Cessation; Cardiovascular Diseases; COPD; Carcinogenesis

1. Introduction

Tobacco consumption constitutes one of the most significant and preventable public health crises of the modern era. Its global reach and the addictive nature of nicotine have created a deeply entrenched epidemic, responsible for a staggering burden of disease, disability, and economic loss. Currently, tobacco use is directly responsible for an estimated six million deaths annually worldwide [1]. This figure surpasses the combined mortality from HIV/AIDS, tuberculosis, and malaria, showing the profound impact of tobacco on global health. The lethality of long-term, persistent smoking is unmatched by any other consumer product.

Projections based on current consumption patterns and population growth estimate that tobacco use could claim approximately one billion lives during the 21st century [2]. This catastrophic forecast represents a tenfold escalation from the 100 million deaths attributed to tobacco in the 20th century, a period that saw the industrialization and global marketing of the cigarette. A disproportionate and increasing share of this burden is borne by low- and middle-income countries (LMICs), which are often targeted by the tobacco industry and may possess less-resourced public health infrastructure to counteract industry influence and manage the health sequelae [3].

The persistence of this epidemic is largely driven by the fact that tobacco use is a pediatric-onset condition. Smoking initiation occurs predominantly during adolescence, a critical neurodevelopmental window where the brain is uniquely vulnerable to the addictive properties of nicotine. This early onset establishes a potent, lifelong dependence that is notoriously difficult to reverse [3]. Consequently, the global public health response must be anchored in a dual-pronged strategy: first, the comprehensive prevention of tobacco uptake among youth and young adults, and second, the widespread promotion and support of cessation among the more than one billion established adult smokers [3].

Effectively addressing this challenge requires a clear, evidence-based understanding of the full scope of tobacco-related harm. This includes a grasp of the evolving epidemiological trends, the specific pathophysiological mechanisms, the spectrum of diseases caused by both active smoking and passive exposure, and the substantial, well-documented health benefits of cessation. The aim of this review is to discuss about the epidemiological and biomedical evidence, primarily from high-income countries where the tobacco epidemic first matured and its long-term consequences that have been most extensively studied [3].

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2. The Nature of Tobacco Use

2.1. Modes of Consumption

The inhalation of smoke from combusted tobacco, typically in the form of cigarettes, is the most common and hazardous method of consumption [4]. However, other forms include cigars, pipes, and water pipes (hookah). Additionally, smokeless tobacco products are prevalent in many regions, which involve chewing, sniffing, or placing tobacco preparations in the mouth. These "smokeless" forms are not benign and carry significant health risks, including oral cancers, cardiovascular disease, and nicotine dependence [5].

Table 1. Toxic and Carcinogenic Components in Tobacco Smoke

Phase	Component	Category	Associated Health Risks
Gaseous Phase	Carbon Monoxide (CO)	Toxin	Reduces oxygen-carrying capacity of blood; contributes to cardiovascular disease.
	Benzene	Carcinogen	Linked to leukemia.
	Formaldehyde	Carcinogen	Respiratory irritant; known carcinogen.
	Hydrogen Cyanide	Toxin	Ciliatoxic (damages lung clearance mechanisms); systemic poison.
	Nitrogen Oxides	Toxin	Lung irritant; contributes to airway inflammation and emphysema.
Particulate Phase	Nicotine	Alkaloid (Addictive)	The primary driver of dependence; contributes to cardiovascular effects (e.g., increased heart rate, blood pressure).
	Tar (Complex Mixture)	Toxin / Carcinogen	A sticky, black residue containing multiple carcinogens.
	Benzo(a)pyrene	Carcinogen (PAH)	Potent mutagen; directly damages DNA to initiate cancer.
	Tobacco-Specific Nitrosamines (TSNAs)	Carcinogen	Includes N'-nitrosonornicotine (NNN); strongly linked to lung, esophageal, and pancreatic cancers.
	Polonium-210	Carcinogen (Radioactive)	Radioactive heavy metal; deposits in airways and delivers alpha radiation.
	Cadmium / Lead	Heavy Metals (Toxin)	Systemic toxins; contribute to cardiovascular and kidney damage.

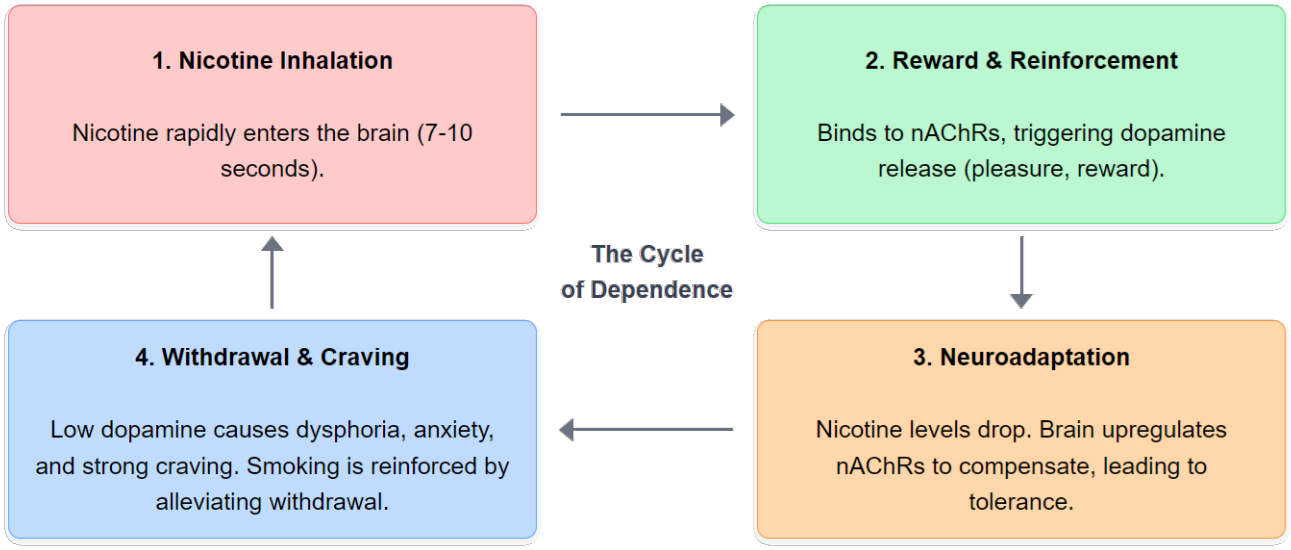

Figure 1. The Cycle of Nicotine Dependence

2.2. Nicotine Dependence

The act of smoking is maintained by a potent physical dependence on nicotine, a psychoactive alkaloid naturally present in the tobacco leaf [6]. Nicotine is a highly addictive substance that, when inhaled, reaches the brain within seconds, binding to nicotinic acetylcholine receptors (nAChRs). This binding triggers the release of various neurotransmitters, most notably dopamine, which produces effects of pleasure, arousal, and mood modulation [7].

This neurochemical reward system rapidly leads to neuroadaptation, characterized by an upregulation of nAChRs and the development of tolerance. When nicotine levels fall, individuals experience withdrawal symptoms, including irritability, anxiety, difficulty concentrating, and intense craving. Smoking behavior is thus powerfully reinforced, not only by the positive effects of dopamine release but also by the alleviation of these negative withdrawal symptoms [7]. This cycle makes cessation a significant challenge, often requiring multiple attempts and collaborative support [6].

3. Epidemiology of Tobacco Use

3.1. Global Prevalence and Burden

In 2019, an estimated 1.14 billion individuals smoked tobacco globally [8]. While age-standardized prevalence has declined in many regions since 1990, population growth has resulted in an increase in the total number of smokers. This consumption translates to a staggering disease burden; in 2019 alone, smoking was responsible for approximately 7.7 million deaths and 200 million disability-adjusted life-years (DALYs) [8].

Smoking prevalence is not distributed equally. It is consistently higher among populations with lower socioeconomic status, lower educational attainment, and individuals with co-occurring mental health conditions or substance use disorders [9, 10, 11]. Rates are also significantly higher for men than for women globally, though this gap is narrowing in some regions [8].

3.2. Age of Onset

The vast majority of tobacco use begins during adolescence and young adulthood. Globally, nearly 90% of individuals who start smoking do so before the age of 25 [12]. This early initiation is critical because it establishes nicotine dependence at a time of active brain development, leading to more entrenched dependence and a higher cumulative risk of disease over the lifespan [13]. In recent years, the emergence of Electronic Nicotine Delivery Systems (ENDS), or e-cigarettes, has introduced new concerns regarding youth initiation, with some longitudinal studies suggesting that adolescent ENDS use may increase the risk of subsequent transition to combustible tobacco smoking [14].

3.3. Mortality

The health impact of smoking is profound. Long-term smokers have a mortality rate approximately three times higher than that of individuals who have never smoked [13]. On average, persistent smokers lose at least 10 years of life expectancy [15]. This mortality is not a distant risk; at least half of all smoking-related deaths occur during middle age (35–69 years), representing decades of lost life [13, 16].

4. Systemic Pathophysiology of Tobacco-Related Disease

Tobacco smoke is not a single substance but a dynamic and complex aerosol containing over 7,000 chemical compounds. At least 69 of these are known human carcinogens [17]. The particulate phase, or "tar," contains polycyclic aromatic hydrocarbons (PAHs) and tobacco-specific nitrosamines (TSNAs), while the gaseous phase contains carbon monoxide, hydrogen cyanide, and various oxidants and aldehydes [18]. These toxins cause disease through systemic absorption from the lungs, leading to three primary pathogenic pathways.

4.1. Oxidative Stress and Inflammation

Inhaling tobacco smoke introduces a massive load of free radicals and oxidants into the lungs, overwhelming the body's antioxidant defenses. This creates a state of systemic oxidative stress, which damages cellular lipids, proteins, and DNA. This damage, in turn, promotes a chronic inflammatory state, characterized by elevated levels of circulating inflammatory mediators (e.g., C-reactive protein) and activated leukocytes. This systemic inflammation is a key unifying mechanism contributing to diseases in multiple organ systems [19].

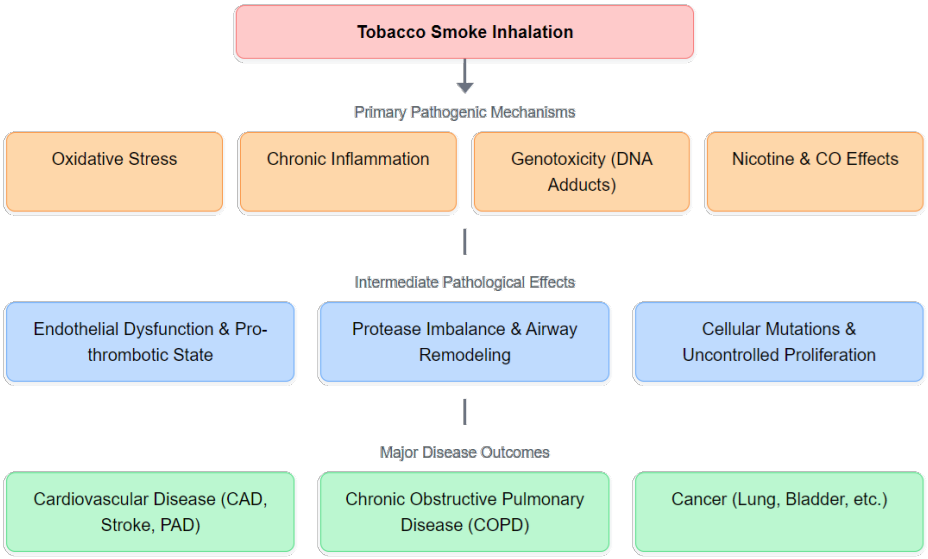

Figure 2. Pathophysiological Pathways of Tobacco-Induced Disease

4.2. Cardiovascular Effects

Tobacco smoking is a primary and independent risk factor for cardiovascular disease [20]. The mechanisms are multifaceted. Oxidative stress and inflammation directly cause endothelial dysfunction, reducing the availability of nitric oxide and impairing the blood vessels' ability to dilate [19]. Smoking also creates a pro-thrombotic state by increasing platelet activation and fibrinogen levels. Furthermore, it adversely alters lipid profiles, increasing low-density lipoprotein (LDL) cholesterol and decreasing high-density lipoprotein (HDL) cholesterol. Concurrently, carbon monoxide binds to hemoglobin, reducing the oxygen-carrying capacity of the blood and forcing the heart to work harder [20].

4.3. Carcinogenesis

The link between smoking and cancer is definitive. Carcinogens from tobacco smoke, such as benzo[a]pyrene (a PAH), are metabolically activated in the body and form covalent bonds with DNA, creating "DNA adducts" [21]. If these adducts are not repaired by cellular mechanisms, they can cause permanent mutations in critical genes, particularly tumor suppressor genes (like *TP53*) and oncogenes (like *KRAS*). This genetic damage, combined with the chronic inflammation and cellular proliferation induced by smoke, drives the multi-step process of carcinogenesis [22].

Table 2. Health Consequences of Tobacco Use by System

Organ System	Associated Diseases and Conditions
Cardiovascular	Coronary Artery Disease (CAD), Myocardial Infarction, Stroke, Aortic Aneurysm, Peripheral Arterial Disease (PAD)
Respiratory	Chronic Obstructive Pulmonary Disease (COPD) (Emphysema & Chronic Bronchitis), Exacerbation of Asthma, Increased risk of Tuberculosis
Oncological	Lung Cancer, Cancers of the Head & Neck (Oral, Larynx), Esophagus, Bladder, Kidney, Pancreas, Stomach, Colon/Rectum, Cervix
Reproductive (Female)	Decreased Fertility, Ectopic Pregnancy, Premature Menopause
Reproductive (Male)	Erectile Dysfunction, Reduced Sperm Count and Motility
Perinatal	Low Birth Weight, Premature Birth, Sudden Infant Death Syndrome (SIDS), Orofacial Clefts
Musculoskeletal	Osteoporosis, Increased Hip Fracture Risk (especially postmenopausal women)
Metabolic	Increased risk of Type 2 Diabetes Mellitus, Worsening of diabetic complications (nephropathy, neuropathy)
Immune	Impaired Immune Function, Increased risk of Pulmonary Infections, Rheumatoid Arthritis
Gastrointestinal	Peptic Ulcer Disease

5. Clinical Manifestations of Tobacco-Related Disease

The systemic damage caused by tobacco smoke manifests in nearly every organ of the body.

5.1. Respiratory Diseases

The lungs are the primary site of exposure. Smoking is the cause of approximately 85-90% of Chronic Obstructive Pulmonary Disease (COPD) cases [23]. Smoke-induced inflammation and oxidative stress lead to a protease-antiprotease imbalance, resulting in the progressive destruction of alveolar walls (emphysema). Simultaneously, it causes chronic bronchitis through mucous gland hyperplasia and ciliary dysfunction, leading to airflow obstruction and impaired mucus clearance. Smoking also exacerbates asthma and significantly increases the risk for respiratory infections like pneumonia [17].

5.2. Cardiovascular Diseases

Smoking is a leading cause of cardiovascular events. It is directly responsible for a substantial portion of coronary artery disease (CAD) and myocardial infarctions [20]. It also significantly increases the risk of stroke, aortic aneurysm, and peripheral arterial disease (PAD), which can lead to limb ischemia and amputation [17].

5.3. Cancers

Tobacco smoking is the single largest preventable cause of cancer, responsible for roughly 30% of all cancer deaths in high-income countries [17]. The strongest association is with lung cancer, but smoking is also a causal agent in at least 17 other types, including cancers of the oropharynx, larynx, esophagus, bladder, kidney, pancreas, stomach, and cervix, as well as acute myeloid leukemia [17, 22].

5.4. Effects on Other Physiological Systems

Maternal smoking during pregnancy introduces a range of risks to the fetus, primarily through fetal hypoxia from carbon monoxide and the vasoconstrictive effects of nicotine. This leads to an increased risk of low birth weight, preterm delivery, sudden infant death syndrome (SIDS), and congenital abnormalities such as orofacial clefts [17, 24]. In men, smoking is a recognized cause of erectile dysfunction due to its vascular effects [17]. Smoking also impairs immune function, increases the risk for type 2 diabetes mellitus, peptic ulcer disease, and osteoporosis, and delays wound healing [17, 25].

6. Exposure to Environmental Tobacco Smoke (ETS)

The health risks of tobacco are not limited to the active user. Environmental Tobacco Smoke (ETS), or "secondhand smoke," is a combination of sidestream smoke (from the burning tip of the cigarette) and mainstream smoke (exhaled by the smoker). Non-smokers exposed to ETS inhale the same toxic and carcinogenic compounds [26]. Exposure occurs in any microenvironment where smoking takes place, such as homes, workplaces, and vehicles [27]. In non-smoking adults, ETS exposure is a proven cause of lung cancer and coronary heart disease [17, 26]. The impact on children is particularly severe, as their developing respiratory systems are more vulnerable. ETS exposure in children is causally linked to SIDS, lower respiratory tract infections, middle ear disease, and the exacerbation of asthma [17, 26]. Assessment of exposure can be conducted through questionnaires, air monitoring for specific markers (like airborne nicotine), or the use of biomarkers, with cotinine (a nicotine metabolite) in blood, saliva, or urine being the most reliable indicator [28, 29].

7. Clinical Strategies for Tobacco Cessation

Quitting smoking is the single most effective intervention to reduce the risk of tobacco-related disease. The benefits begin almost immediately and are substantial, though the risk for some diseases may never return to that of a never-smoker [15]. Quitting before the age of 40 reduces the risk of smoking-related death by approximately 90% [13].

7.1. The Role of Healthcare Professionals

Healthcare professionals are critical in promoting cessation. A systematic approach, often encapsulated by the "5 A's" model (Ask, Advise, Assess, Assist, Arrange), is recommended [30].

- Ask: Systematically identify all tobacco users at every visit.
- Advise: Strongly urge all users to quit.
- Assess: Determine the patient's willingness to make a quit attempt.
- Assist: Aid the patient in quitting. This includes developing a quit plan, providing counseling, and offering pharmacotherapy.
- Arrange: Schedule follow-up contact.

Even brief advice from a clinician significantly increases quit rates [30].

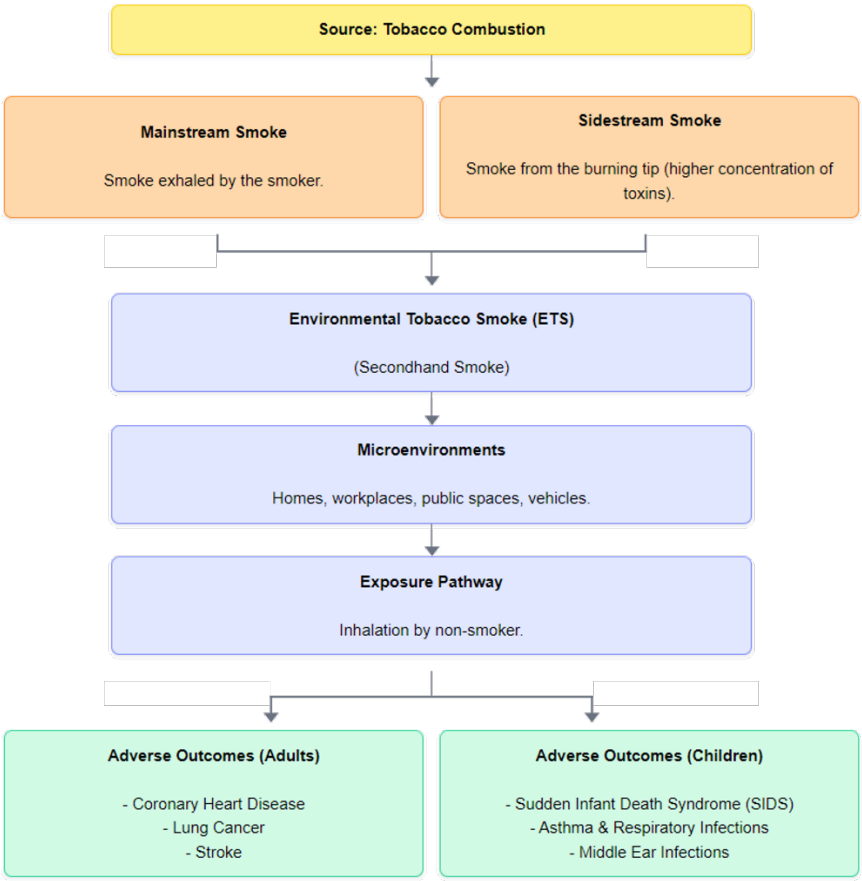

Figure 3. Environmental Tobacco Smoke (ETS) Exposure

Table 3. Timeline of Health Benefits Following Smoking Cessation

Time* Since Quitting	Health Benefit
Within 20 minutes	Heart rate and blood pressure begin to drop.
Within 12 hours	Carbon monoxide levels in the blood drop to normal.
Within 2-12 weeks	Circulation improves and lung function begins to increase.
Within 1-9 months	Coughing and shortness of breath decrease; cilia regain normal function, improving mucus clearance and reducing infection risk.
Within 1 year	The excess risk of coronary heart disease is reduced by about half compared to a continuing smoker.
Within 5-10 years	Stroke risk is reduced to that of a non-smoker.
Within 10 years	The risk of dying from lung cancer is about half that of a person who is still smoking. Risk of cancers of the mouth, throat, esophagus, and bladder also decreases.
Within 15 years	The risk of coronary heart disease is reduced to that of a non-smoker.

**Timeline can vary based on individual smoking history and health status*

7.2. Behavioral and Pharmacological Interventions

Due to the powerful nature of nicotine dependence, cessation is most successful when behavioral support is combined with pharmacotherapy [31].

7.2.1. Behavioral Support

This ranges from brief advice to intensive individual counseling, group therapy, and telephone quitlines. These interventions provide problem-solving skills and social support to help individuals navigate withdrawal and high-risk relapse situations [32].

7.2.2. Pharmacotherapy

First-line medications approved by the FDA have been proven to increase long-term quit rates. These include:

Table 4. First-Line Pharmacologic Interventions for Tobacco Cessation

Medication Class	Agents	Mechanism of Action	Clinical Considerations
Nicotine Replacement Therapy (NRT)	Transdermal Patch (long-acting)	Provides steady, low-level nicotine to prevent withdrawal.	Apply to new, clean skin site daily. Remove before MRI.
	Gum, Lozenge (short-acting)	Provides rapid-delivery nicotine to manage acute cravings.	Requires "chew and park" or slow-dissolve technique to avoid GI upset. Acidic drinks can impair absorption.
	Nasal Spray (short-acting)	Provides very rapid nicotine delivery, mimicking a cigarette.	Highest dependence potential among NRTs. Can cause nasal irritation.
	Inhaler (short-acting)	Provides nicotine via oral inhalation, mimicking hand-to-mouth behavior.	Can cause throat irritation. Dose is in "puffs."
Non-Nicotine	Varenicline	Partial agonist at the nicotinic acetylcholine receptor. Eases withdrawal and blocks rewards from smoking.	Often started 1 week before quit date. May cause nausea or vivid dreams.
	Bupropion SR (Sustained-Release)	Atypical antidepressant; enhances noradrenergic and dopaminergic signaling.	Start 1-2 weeks before quit date. Lowers seizure threshold; contraindicated in patients with seizure or eating disorders.

Table 5. Non-Pharmacologic Cessation Techniques

Strategy	Description	Features	Relative Efficacy
Brief Clinical Intervention	Advice from a healthcare professional (e.g., "Ask, Advise, Refer" model).	< 3 minutes; opportunistic; leverages provider trust.	Minimal but highly scalable. More effective than no advice.
Individual Counseling	One-on-one sessions with a trained cessation specialist (in-person or telehealth).	Provides personalized problem-solving and support.	High efficacy. More effective than brief intervention or self-help.
Group Counseling	Sessions led by a specialist with a group of peers who are also quitting.	Provides mutual support and shared learning.	More effective than self-help. Efficacy similar to individual counseling.
Telephone Quitlines	Proactive telephone-based counseling and support.	Accessible, free, and can be anonymous. Proactive calls are more effective than reactive.	Highly effective and cost-effective on a population level.
Self-Help Materials	Printed or digital materials (e.g., pamphlets, websites, apps).	Low cost and high reach. Can be used as a standalone or adjunct.	As a standalone, efficacy is low but better than no intervention.

- Nicotine Replacement Therapy (NRT): Available as patches, gum, lozenges, inhalers, and nasal sprays. NRT provides a clean source of nicotine to alleviate withdrawal symptoms, allowing the individual to focus on behavioral change.

- Varenicline: A partial agonist at the nAChR. It reduces withdrawal symptoms by stimulating dopamine release (agonist effect) while simultaneously blocking nicotine from binding to its receptor, thereby reducing the reward from smoking (antagonist effect).
- Bupropion SR: An atypical antidepressant that is believed to enhance dopaminergic and noradrenergic signaling, reducing cravings and withdrawal symptoms [31, 33].

Combining a long-acting NRT (patch) with a short-acting form (e.g., gum or lozenge) is often more effective than using a single agent [31].

8. Conclusion

Tobacco consumption is a persistent and multifaceted global health crisis. The inhalation of tobacco smoke initiates a cascade of systemic pathophysiological events, including oxidative stress, inflammation, and genotoxicity, which manifest as a wide array of devastating and often fatal diseases. The addictive properties of nicotine create a chronic, relapsing condition that is difficult to overcome. Moreover, the health burden extends to non-smokers through exposure to environmental tobacco smoke, which is a significant cause of morbidity and mortality in its own right. Reducing this burden requires a double approach: preventing the initiation of tobacco use among young people and providing robust, evidence-based support for cessation to all current users. The combination of behavioral counseling and pharmacotherapy provides the most effective pathway to quitting. Continued effort in research, clinical practice, and public policy is essential to combat the harms of tobacco and promote global health.

References

[1] World Health Organization. WHO report on the global tobacco epidemic, 2013: enforcing bans on tobacco advertising, promotion and sponsorship. Geneva: WHO; 2013.

[2] Peto R, Lopez AD, Boreham J, Thun M, Heath CJ. Mortality from smoking in developed countries 1950-2000. Indirect estimates from national vital statistics. Oxford, UK: Oxford University Press; 1994.

[3] Jha P. The hazards of smoking and the benefits of cessation: a critical summation of the epidemiological evidence in high-income countries. Elife. 2020;9:e49979.

[4] West R. Tobacco smoking: Health impact, prevalence, correlates and interventions. Psychol Health. 2017 Aug;32(8):1018-1036.

[5] Critchley J, Unal B. Health effects associated with smokeless tobacco: A systematic review. Thorax. 2003;58(5):435–443.

[6] West R, Shiffman S. Smoking cessation. 3rd ed. Abingdon: Health Press; 2016.

[7] Le Foll B, Piper ME, Fowler CD, et al. Tobacco and nicotine use. Nat Rev Dis Primers. 2022 Mar 24;8(1):19.

[8] GBD 2019 Tobacco Collaborators. 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):2337–2360.

[9] Palipudi KM, Mbulo L, Morton J, et al. Social determinants of health and tobacco use in 13 low and middle income countries: evidence from the Global Adult Tobacco Survey. PLoS One. 2016;11(3):e0152433.

[10] Goodwin RD, Pagura J, Spiwak R, Lemeshow AR, Sareen J. Predictors of persistent nicotine dependence among adults in the United States. Drug Alcohol Depend. 2011;118(2-3):127–133.

[11] Weinberger AH, Gbedemah M, Martinez AM, et al. Cigarette use is increasing among people with illicit substance use disorders in the United States, 2002–14: emerging disparities in vulnerable populations. Addiction. 2018;113(4):719–728.

[12] GBD 2019 Under-25 Tobacco Collaborators. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and initiation among young people in 204 countries and territories, 1990-2019. Lancet Public Health. 2021;6(7):e472-e481.

[13] 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):341–350.

[14] Soneji S, Barrington-Trimis JL, Wills TA, et al. Association between initial use of e-cigarettes and subsequent cigarette smoking among adolescents and young adults: a systematic review and meta-analysis. JAMA Pediatr. 2017;171(8):788–797.

[15] Doll R, Peto R, Boreham J, Sutherland I. Mortality in relation to smoking: 50 years' observations on male British doctors. BMJ. 2004;328(7455):1519.

[16] Pirie K, Peto R, Reeves GK, Green J, Beral V; Million Women Study Collaborators. The 21st century hazards of smoking and benefits of stopping: a prospective study of one million women in the UK. Lancet. 2013;381(9861):133–141.

[17] US Department of Health and Human Services. The health consequences of smoking—50 years of progress: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2014.

[18] Benowitz NL, Brunetta PG. Smoking hazards and cessation. In: Murray & Nadel's Textbook of Respiratory Medicine. 6th ed. Elsevier; 2016: 46.

[19] Ambrose JA, Barua RS. The pathophysiology of cigarette smoking and cardiovascular disease: an update. J Am Coll Cardiol. 2004;43(10):1731-1737.

[20] Onor IO, Stirling DL, Williams SR, et al. Clinical effects of cigarette smoking: epidemiologic impact and review of pharmacotherapy options. Int J Environ Res Public Health. 2017;14(10):1147.

[21] Balbo S, Turesky RJ, Villalta PW. DNA adductomics. Chem Res Toxicol. 2014;27(3):356-366.

[22] Hecht SS. Lung carcinogenesis by tobacco smoke. Int J Cancer. 2012;131(12):2724-2732.

[23] Laniado-Laborín R. Smoking and chronic obstructive pulmonary disease (COPD). Parallel epidemics of the 21st century. Int J Environ Res Public Health. 2009;6(1):209-224.

[24] Adams TN, Morris J. Smoking. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-.

[25] Alberg AJ, Shopland DR, Cummings KM. The 2014 Surgeon General's report: commemorating the 50th Anniversary of the 1964 Report of the Advisory Committee to the US Surgeon General and updating the evidence on the health consequences of cigarette smoking. Am J Epidemiol. 2014;179(4):403-412.

[26] US Department of Health and Human Services. The health consequences of involuntary exposure to tobacco smoke: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2006.

[27] Jaakkola MS, Jaakkola JJ. Assessment of exposure to environmental tobacco smoke. Eur Respir J. 1997;10(10):2384–2397.

[28] Benowitz NL. Cotinine as a biomarker of environmental tobacco smoke exposure. Epidemiol Rev. 1996;18(2):188–204.

[29] Vainiotalo S, Vaaranrinta R, Tornaeus J, Aremo N, Hase T, Peltonen K. Passive monitoring method for 3-ethenylpyridine: A marker for environmental tobacco smoke. Environ Sci Technol. 2001;35(9):1818–1822.

[30] Fiore MC, Jaén CR, Baker TB, et al. Treating tobacco use and dependence: 2008 update. Clinical practice guideline. Rockville, MD: US Department of Health and Human Services, Public Health Service; 2008.

[31] Cahill K, Stevens S, Perera R, Lancaster T. Pharmacological interventions for smoking cessation: an overview and network meta-analysis. Cochrane Database Syst Rev. 2013;(5):CD009329.

[32] Lancaster T, Stead LF. Individual behavioural counselling for smoking cessation. Cochrane Database Syst Rev. 2017;3(3):CD001292.

[33] 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):2507-2520.