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REVIEW

Are emergency departments useful for quitting smoking? A narrative review

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Abstract

Smoking is among the most commonly cited preventable causes of cardiopulmonary death. Interventions aimed at helping patients quit smoking in healthcare institutions yielded limited success. Various factors, including legal regulations, economic constraints, lack of time, motivation, and incentives can hamper these efforts. Emergency departments (EDs) are the most critical referral settings for individuals with acute health problems resulting from the direct and indirect effects of smoking. Smoking cessation (SC) interventions conducted in acute disease settings may be effective for individuals with low dependency and a strong intention to quit. A structured SC intervention delivered when individuals seek care for an acute and serious health issue may have a greater impact than other approaches. Therefore, structured SC interventions may effectively increase SC rates in adult patients with acute respiratory infections in the EDs. ED visits due to a health crisis, such as acute respiratory problems, may represent a good opportunity to tackle in most patients as an excuse to launch a fresh beginning, including SC. However, more comprehensive research and support programs are needed for individuals with high addiction levels.

Keywords

Smoking cessation; Emergency department; Fagerström test; Intervention programs; Nicotine dependence; Acute respiratory infections

1. Introduction and definitions

Consumption of cigarettes and other tobacco products is prevalent and among the most common causes of mortality globally. It is an outstanding risk factor in the progression of many chronic diseases, especially respiratory diseases, malignancies, ischemic heart diseases, cerebrovascular diseases, *etc.*, leading to death at some point [1]. Nonetheless, recent years have witnessed a shift of smoking individuals to vaping or using e-cigarettes, and a large portion of vapers/e-cigarette users are young, daily users with high nicotine use and dependence [2].

Tobacco-related deaths involve around eight million people every year due to cardiopulmonary causes, as reported by the World Health Organization (WHO), while around one-sixth of these are secondary to exposure to passive or secondhand smoke [3]. WHO predicts increases in these numbers by 80% each year unless robust preventive measures are implemented [4]. Recently, smokers were reported to have lower antibody titers after vaccination with a coronavirus disease 2019 (COVID-19) mRNA vaccine when compared to those of nonsmokers [5]. Globally, the highest prevalence of smoking has been observed in the 45–54 age group among men, while the highest prevalence is recorded in the 55–64 age group in women [6].

After 1991, the Centers for Disease Control and Prevention (CDC) quantified the quit attempt and defined smoking cessation (SC) as not using for one day or more [7]. Recently, authors classified individuals who had completely quit smoking as those who had not smoked for at least 12 months [1]. SC is reported to be among the most effective prevention strategies against pneumonia worldwide [8].

The severity of nicotine dependence (ND) affects smoking and the success of SC attempts. Fagerström Test of Nicotine Dependence (FTND) developed by Fagerström *et al.* [9] is a widely used instrument to assess the ND level of the involved patients [10]. In a study from China, mean FTND score was 3.9 (95% Confidence interval (CI): 3.8–4.0), with the prevalence of medium-high ND being 41.0% (95% CI: 39.0–42.9%) and that of high and very high ND being 27.6% (95% CI: 26.0–29.3%), both of which were significantly higher in men than in women (both $p < 0.001$) [11]. ND or addiction severity can also be measured using the Heaviness of Smoking Index (HSI) [12]. Im *et al.* [13] revealed that mean (standard error of mean (SEM)) HSI was significantly different between current smokers and quitters (2.42 + −0.04 *vs.* 2.16 + −0.11, respectively, $p = 0.022$). Validity of the FTND and of the HSI was studied by Etter *et al.* [14] in a population of relatively light smokers. They reported that even though FTND and HSI correlated about as expected with criterion variables, the number of cigarettes smoked per day performed

better than either composite scale on most validation criteria. Most studies accept FTND score <5 as a marker of mild or relieved condition, or a significant reduction in FTND scores from baseline [15, 16].

Uysal *et al.* [17] conducted the Turkish validity and reliability study of the test in 2000s. The level of ND is crucial in determining personalized intervention strategies concerning SC attempts. At high levels of addiction, physical and psychological dependence is so severe that nicotine replacement therapy (NRT) or pharmacological treatments are recommended. In these cases, motivational counseling and regular follow-up are necessary during the SC process. At moderate levels of addiction, NRT or behavioral techniques are generally recommended, while drug therapy can be necessary to a lesser extent. Intervention with strategies appropriate to the level of ND is a crucial factor in increasing the success of SC. Studies have shown that the rate of tobacco use and ND is higher in individuals who have a circle of friends who are addicted to tobacco products and who have an active smoking family [18, 19]. Continued research into understanding and promoting smoking cessation remains one of the most important public health priorities for the United States [20]. This study aims to address the role of healthcare interventions that can be carried out in the ED setting following acute care of patients in need of a step towards SC.

2. Methods

This systematic narrative review aims to answer the question, "Can healthcare interventions that can be carried out in the ED setting be effective to quit smoking following acute care of the patients?". A systematic search of the literature was used to extract relevant articles. All English-language studies published from 2005 to 2025 investigating the efficacy of healthcare interventions for SC were included. We used the Google Scholar, PubMed, Scopus, Web of Science, and MEDLINE databases to extract articles. The articles reporting evidence-based data on the impact of healthcare interventions on SC were abstracted and included in the reporting processes.

Articles with a high level of evidence, such as randomized controlled trials and meta-analyses, were prioritized, while case reports, experimental, and non-human studies were excluded from the analysis. The findings of these articles were analyzed narratively to underline mechanisms of action, indications, safety, and specific features regarding ND and SC interventions, and were listed accordingly. Systematic review and meta-analysis procedures, such as the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, were not followed.

3. Smoking cessation (SC) and its associations with triggers of smoking

There are various ways to assist in SC, such as psychological interventions, self-regulation, various drug therapies, and food substitution [21]. Socio-demographic characteristics, age, gender, cost, psychological properties, and legal regulations, including bans, are all effective factors for SC. A study from Turkiye indicated that the rate of anxiety was higher among non-quitters compared to quitters (9.4% *vs.* 1.2%) (p = 0.024) [22]. Non-quitters were 19 times more likely to have ED admissions (Adjusted odds ratio (AOR) = 19.64; 95% CI: 8.08–47.68) than quitters.

Cost is a major factor in SC globally, and warning labels have been shown to increase knowledge and quit attempts at no cost [23, 24]. Younger smokers are more likely to consider socializing as a motive to smoke, while older smokers are more likely to consider personal enjoyment as a main motive [23]. In a study to identify individual and interpersonal triggers and compare their relative importance for SC in a Chinese sample of smokers and quitters, Im *et al.* [13] reported that "personal health concerns" was among the most cited triggers for SC.

4. Interventions for cessation

According the WHO Clinical Treatment Guideline for Tobacco Cessation in Adults published in 2024, recommends combining pharmacotherapy and behavioural interventions to support tobacco users interested in quitting (Strong recommendation; high certainty) [4]. Importantly, these approaches should be delivered in both clinical and community settings. Behavioral support includes certain predefined interventions such as brief advice and counselling, written materials containing advice on quitting, multisession group therapy programs, or individual counselling sessions in person or by telephone [15]. Providing standard self-help materials alone seems to have a small effect on success, but there is evidence of a benefit of individually tailored self-help materials or more intensive advice or counselling [25]. Treatment models for SC nowadays are divided into two parts: 1—Non-stage-based approach 2—Stage-specific approach. In non-stage-based approach, researchers developed "three-step model" (Ask, Advise & Offer). As a stage-specific approach. WHO recommends five major steps (5A) in SC treatment to determine the assistance method in individuals who wish to quit smoking. In practice, the "Ask, Advise, Assess, Assist, Arrange" approach is an evidence-based SC model that has been developed to provide effective interventions in a short time, especially in busy working environments [26]. In comparison, non-stage-based approach offers three steps (Ask, Advise & Offer) to all patients regardless of their readiness to quit, so it can be offered to patients faster than 5A strategies. Also, it seems this approach may improve quit rates compared with approaches that only offer SC interventions to patients who are ready to quit.

Recent technological advances introduced new opportunities, including mobile phones or computerized solutions whose low cost and widespread availability render them beneficial to deliver these interventions to patients [27, 28]. Furthermore, I-Change model of behavioral change better tailors the motivational messages to remain smoke-free [29]. Research employed a recommender system for 6 months, which sent smokers motivational messages to support SC every 3 days and used machine learning to incorporate user feedback [30]. The authors reported that high user-system engagement was positively associated with both high retention rate and smoking cessation, suggesting that investigation of methods to increase engagement may be crucial to increase the impact of the rec-

ommender system for SC.

NRT, drug treatment regimens including nicotinic receptor agonists (varenicline), dopamine and norepinephrine reuptake inhibitors (bupropion), behavioral therapy, and combination therapy (NRT + medication) can be employed on a case-by-case basis [31]. Recent studies highlight that nicotine replacement therapy (NRT) remains a widely used approach due to its availability in multiple formulations and reduced withdrawal symptoms [15]. However, its drawback lies in the potential for prolonged ND and localized irritation [32]. Varenicline demonstrates superior efficacy compared to NRT [33] but has neuropsychiatric risks and requires caution in patients with psychiatric conditions, although these concerns have been refuted in recent research [34]. Bupropion inhibits the reuptake of dopamine and norepinephrine, disrupting the reward pathways linked to nicotine addiction, and may be acting on nicotinic cholinergic receptors, improving its effectiveness in SC [35]. The compound provides an effective non-nicotine alternative with notable benefits in smokers with depressive symptoms, though it has increased adverse effects and seizure risk [36]. The meta-analysis demonstrated that high-certainty evidence showed that bupropion can aid long-term SC. Behavioral therapy, while pharmacologically risk-free, demands long-term commitment and professional guidance for optimal efficacy [37]. Combination therapy, integrating pharmacological and behavioral interventions, has demonstrated higher quit rates for heavy smokers or those with prior SC failures [38]. In addition, web-based algorithms have also been proposed and proved beneficial in cancer care, and providers are reported to have significantly improved their self-efficacy and practices toward SC in a South American study [39].

New approaches to SC include some models developed by authors to encompass multidisciplinary strategies. The Ottawa Model for Smoking Cessation (OMSC) has been launched to use an "organizational change" approach and has since become the basis of multiple successful SC programs [40]. Authors analyzed the OMSC in 14 Ontario (Canada) hospitals and reported an important reduction in 30-day, 1-year and 2-year healthcare usage as reflected in diminished readmission rates and ED visits following implementation [41]. The adoption and efficacy of these models can be enhanced when healthcare funders introduce performance expectations regarding SC in funding agreements with hospitals and other clinical providers [42]. OMSC protocols emphasize training clinic staff in order to overcome cultural and institutional barriers against SC interventions in the acute healthcare setting [43]. Multicomponent intervention components encompassed participation of frontline physicians and nurse practitioners in 3-hour training sessions to convey information and skills training in addressing tobacco use with patients in the context of busy care settings such as ED. In addition, key staff responsible for delivering SC plan visits (*e.g.*, nurse, nurse practitioner, or pharmacist) attended an intensive 1-day training session to learn how to conduct the quit plan and follow-up visits. In brief, targeted training, incentive structures, and the integration of dedicated SC nurses within ED teams will be key mechanisms for fruitful strategies and effective solutions.

Im *et al.* [13] investigated Individual and interpersonal triggers to quit smoking and reported that individual triggers were stronger than interpersonal ones for quitters. While similar proportions of smokers endorsed individual (24.4%) and interpersonal triggers (24.0%), quitters endorsed more individual (61.1%) than interpersonal (48.3%) triggers. However, the most common triggers (personal health concerns; setting an example to children) were the same, endorsed by two-thirds of quitters and a quarter of smokers, as were the least common triggers (warning labels; cigarette price), endorsed by 1 in 10 quitters and 1 in 20 smokers. Xu *et al.* [44] recently reported that acute aerobic exercise can significantly reduce craving and withdrawal symptoms among individuals attempting to quit smoking, demonstrating a certain role in smoking cessation.

The stability in SC in individuals with high scores according to FTND should be taken as a whole with other parameters of the scale, not only depending on the number of cigarettes smoked per day, because according to statistics, it has been observed that individuals with high FTND scores have lower motivation to quit smoking, rather than the number of cigarettes consumed per day [45].

The fact that individuals with high FTND scores have significantly lower quit rates reveals that the severity of smoking addiction is a critical determinant in the SC process. In addition, high quit rates in the early period do not necessarily guarantee that SC will be successful in the long term. Long-term follow-up of the SC process and continuity of supportive programs are important for achieving successful results in the long term. Many hazards and mortality attributed to smoking mandated the development of strategies promoted by tobacco companies, such as "Beyond nicotine", a slogan that emphasises the future without tobacco and nicotine. The Global Tobacco Industry Watchdog, Stopping Tobacco Organizations and Products (STOP) Project, demonstrated that acquisitions in the tobacco industry are aimed at recreational drugs and drug delivery devices [46].

5. Effect of motivational and behavioral support

It is well-established that a combined approach of pharmacological and behavioural interventions optimises the success of SC in those wishing to stop smoking [25, 47]. US Preventive Services Task Force found these approaches highly cost-efficient, and, consequently, guidelines recommend that health systems provide such care and people take up the offer [48]. For smokers wishing to reduce but not immediately quit, the effects of tobacco harm reduction interventions on abstinence are less certain [49].

Physical activity can support SC for smokers wishing to quit, but there have been no studies on supporting smokers who want only to reduce. Taylor *et al.* [50] studied the effects of interventions that consisted of up to eight face-to-face or telephone behavioral support sessions to reduce smoking and increase physical activity. At 3 months, the intervention participants smoked fewer cigarettes than the control participants (21.1 *vs.* 26.8 per day). Intervention participants were more likely to reduce cigarettes by $\geq$50% by 3 months (18.9% *vs.* 10.5%; AOR 1.98 (95% CI: 1.35 to 2.90)) and 9 months

(14.4% *vs.* 10.0%; adjusted OR 1.52 (95% CI: 1.01 to 2.29)), and reported more moderate-to-vigorous physical activity at 3 months (adjusted weekly mean difference of 81.61 minutes (95% CI: 28.75 to 134.47 minutes)), but not at 9 months. Increased physical activity did not mediate intervention effects on smoking.

For smokers unmotivated to quit, Taylor *et al.* [49] assessed the effectiveness and cost-effectiveness of behavioral support to reduce smoking and increase physical activity on prolonged abstinence in a multi-centric pragmatic two-arm parallel randomized controlled trial. At 3 and 9 months, the proportions self-reporting reducing cigarettes smoked from baseline by ≥50%, for intervention versus conventional treatment, were 18.9% versus 10.5% (p = 0.009) and 14.4% versus 10% (p = 0.044), respectively.

6. Use of ED visits as an opportunity for SC

Smoking prevalence is considerably high among emergency department (ED) patients, and there is a close relationship with tobacco smoking with most ambulatory care sensitive conditions. Many authors contemplate EDs as missed opportunities for interventions to quit tobacco consumption [51]. However, most hospital EDs do not have systematic programs implemented to initiate SC interventions for smokers. Interestingly, the National Emergency Department Inventory (NEDI)-USA reported that SC screening was among the services that were more commonly offered in 2022–2023 when compared to those in 2008–2009, together with intimate partner violence and alcohol risk screening [52].

In most communities, being concerned about individual health problems and increasing cigarette costs are among the factors that will make people quit smoking [13]. Smoking rates will decrease in society with a motivating approach to the change in the well-being of active smokers who are admitted to a health institution for any reason after SC. Im *et al.* [13] studied the reasons for SC in China and showed that individual and interpersonal triggers play an important role in SC. In this context, these results are similar to the literature findings in that motivational approaches could be effective in reducing cigarette consumption in active smokers who present to a healthcare facility with acute respiratory infections (ARI), and the change in the well-being of individuals supports this process.

Boudreaux *et al.* [53] examined the impact of cognitive and affective constructs on the prediction power of an acute cardiac health event on smoking relapse. They reported that only 8.9% remained abstinent 84 days post visit. Time to relapse was positively associated with age, actual illness severity, self-efficacy, and quit intentions. Their results confirmed the pattern of high lapse back to smoking after an acute health event and the preeminence of several key constructs, including actual illness severity, intentions to quit smoking, and smoking-related self-efficacy, in predicting abstinence for the 7 days after discharge, as well as time to lapse over the 84 days after discharge.

Acute respiratory illnesses as an opportunity to quit: Without doubt, EDs are among the most critical referral centers for individuals with health problems resulting from the direct and indirect effects of smoking. Individuals may be more motivated to change their smoking habits, especially during acute attacks of respiratory diseases [1]. The American College of Emergency Physicians (ACEP) and similar associations recommend that interventions for SC should be implemented by physicians and nurses in the form of counseling for patients with active smoking who receive treatment for ARI in EDs. On the other hand, primary health care institutions are conducting interventions for SC, and some research indicates that most emergency physicians think that EDs are not the appropriate place for these interventions, and their professional responsibilities do not cover these SC activities [10, 54, 55].

Recently, COVID-19 pandemic has had a great impact on the world's perceptions on health threats on lifestyles, expectations, and practices. During the pandemic era, dedicated clinics for SC reduced visits, and smokers did not benefit from therapeutic approaches and information on tobacco health risks; this was particularly important for the specific groups of the population who probably needed these tools the most [56]. Studies on patients diagnosed with chronic obstructive pulmonary disease (COPD) have shown that recurrent ED visits with respiratory complaints of patients who are active smokers are significantly higher than non-smokers [57]. Especially for patients with recurrent visits to EDs, the well-being of individuals will be supported by motivating interventions for SC that can be initiated at each visit. It is reported in the literature that SC attempts are likely to be successful in the short term, but relapse rates increase in the long term.

On the contrary, the COVID-19 pandemic has changed patterns of smoking, other substance use, and other health-related behaviors. Although ED referrals constituted a larger proportion of the whole healthcare workload in the pandemic period, a well-designed study indicated that the success of SC programs fell during the pandemic, with the decline consistent with an effect of "exposure" to the pandemic-era environment [58]. This finding can be explained by the staff priorities, triage protocols, and limited staff time within this period.

According to the study conducted by Notley *et al.* [1], especially EDs were evaluated as circumstances in which these selected patients may have a fulcrum point and may be more likely to undergo successful interventions. It has been shown that SC interventions applied in the ED setting may be effective in the early period, especially during emergency admissions due to reasons including ARI.

In an earlier well-designed study, authors reported that smokers with a diagnosis of cardiovascular, respiratory, or malignant disease were more interested in quitting than others (median ladder score = 4 *vs.* 6, $p < 0.001$), were more likely to believe they had a smoking-related illness, and were more likely to believe their ED visit was related to smoking [59]. Smokers with a presenting complaint of chest pain or dyspnea were more interested in quitting than others (median ladder score = 4 *vs.* 6, p = 0.002). Smokers with tobacco-related diagnoses, or who believed their ED visit was related to smoking, were more interested in quitting. These findings suggest that the ED visit may provide a teachable moment to reach smokers who have tobacco-related problems.

Interestingly, adult ED parenting smokers are more likely to

quit and take steps to limit their children's secondhand smoke exposure, although groups did not differ in nicotine addiction [60].

The uptake of an Internet cessation intervention was also investigated among self-quitters and authors noted higher levels of website utilization and greater likelihood of community use among smokers early in their quit attempt compared to those with a longer period of abstinence at enrollment [61]. The intention-to-treat analysis of a recent multicentric, parallel-group, randomized controlled superiority trial (COSTED) opportunistic smoking cessation intervention reported that the 6-month biochemically-verified abstinence rate was 7.2% in the intervention group and 4.1% in the control group (relative risk 1.76; 95% CI: 1.03 to 3.01; $p = 0.038$) [62]. FTND scores were reduced significantly with intervention (3.70 + −2.21) compared to controls (4.17 + −2.24) ($p = 0.022$). This study represents a SC intervention taking advantage of the acute health crisis which encompasses brief advice, an e-cigarette starter kit and referral to quit smoking services is effective for sustained smoking abstinence with few reported adverse events. Similar research supported that a SC intervention in the ED resulted in a significantly higher rate of long-term smoking abstinence when compared to those receiving conventional treatments. SC interventions conducted in acute disease and ED settings may be effective for individuals with low ND and a strong intention to quit. A structured SC intervention delivered at a time when individuals are seeking care for an acute and serious health issue may have a greater impact than other approaches. The term "structured interview" is mostly used to define interventions which follow a topic guide, specifically designed to evaluate the current service, and lasting for a predefined period [63]. In this context, some research also utilized specialized tools such as WHO STEPwise approach using standardized questionnaires to devise the surveillance [64, 65].

However, the long-term effects of these interventions should be further investigated, and multidisciplinary approaches should be adopted to enhance SC rates. Healthcare professionals should develop strategies focused on increasing the intention to quit smoking and managing ND. A recent study on patients with cancer pointed out that the "teachable moment" after a cancer diagnosis presents an opportunity to integrate SC support into routine care [66]. The authors emphasized that practical strategies for cancer patients wishing to quit include the development of alternative behaviors, effective stress management techniques, and further enhancement of legal restrictions.

Drawbacks of ED-based interventions are important to note. Patients admitted to the ED are typically not receptive to behavioral interventions due to the acute nature of their visit and the constraints of the ED environment. The practical realities of ED workflows, staff role perceptions, and the absence of mechanisms for continuity of care are major challenges for all ED-based interventions except for resuscitative measures and emergency care. Effective SC support requires ongoing engagement, which is far better suited to ambulatory care settings or during inpatient hospitalizations, where continuous support and follow-up can be realistically implemented. Real-world barriers to implementation should be kept in mind, including: (1) Limited staff time; (2) Competing acute clinical demands; (3) Inadequate follow-up mechanisms for ongoing support. In conclusion, ED visits due to ARI and other respiratory problems offer a good opportunity to tackle in most patients as an excuse to launch a fresh beginning, including SC. Access to the addicted patients who are not reached by other measures comprises the main benefit of this opportunity, boosted by the impact of the health crisis, or the individual's experience at the time of the visit. Healthcare personnel should devise and benefit from instruments previously developed by researchers in most instances, including EDs, to ignite a robust process for SC.

Overall, selecting an appropriate SC strategy should be guided by patient-specific factors, including ND level, psychiatric history, contraindications, and previous cessation attempts. Personalized approaches incorporating both behavioral therapy and pharmacologic interventions often yield superior outcomes [67]. Table 1 (Ref. [9, 15, 32–34, 37, 38, 67–77]) provides a brief overview of SC strategies mentioned in previous research.

Future studies should evaluate the effectiveness of SC interventions more comprehensively by conducting long-term follow-ups with larger populations and incorporating biochemical verification methods. Long-term follow-up studies may help us better understand the impact of early quitting behavior on long-term success. Therefore, SC interventions should focus not only on early success but also on long-term sustainability.

Future research should also delineate the potential benefits and drawbacks of these "opportunistic smoking cessation interventions" in the ED visits when compared to outpatient clinics, media campaigns, pharmacological interventions, *etc*. Pilot studies can be designed that could enhance the scientific impact and generalizability of the SC interventions in acute care settings. For example, in busy EDs, where time and resources are limited, recommending vaping as a lower-risk alternative to smoking can serve as a practical mitigation strategy. Another study can evaluate the effectiveness of a brief structured ED counseling intervention against usual care. Participants can be randomized to a control group (standard medical care) and an intervention group (standard care + structured SC counseling). Level of ND can be measured by the FTND, and patients can be grouped regarding their ND level and abstinence or quit rates in predefined timeframes.

7. Conclusion

SC interventions to help patients quit smoking in various settings have produced limited success. EDs can serve as an opportunity, especially for patients with acute presentations or a "health crisis" in any part of the lifespan. NRT and/or medications intended to help patients in their SC efforts should also be used as valuable adjuncts, tailored for the patients, considering the effect and safety profiles. Structured SC intervention designed for use in acute care settings may have a greater impact than other strategies when used properly. Research showed that structured SC interventions can be used to augment SC rates in adult patients with acute infections in the EDs. Alternative approaches should be chosen on a

TABLE 1. Smoking cessation strategies and their characteristics as cited in the medical literature.

Strategy	Advantages	Drawbacks	Indications	Contraindications	Dosage	Adverse Effects
Nicotine Replacement Therapy (NRT)	Reduces withdrawal symptoms; multiple formulations available (patch, gum, lozenge, inhaler) [15]	May lead to continued nicotine dependence; skin irritation (patch); jaw pain (gum) [32]	First-line treatment for smokers; effective in gradual dose reduction approach [67]	Symptoms of nicotine overdosage (bradycardia, dyspnea, headache, syncope, tachycardia, vomiting, or weakness) [68]	Patches: 21 mg/day (adjust based on withdrawal symptoms); gum: 2–4 mg per use, up to 20 pieces daily [69]	Local irritation, insomnia (patch), nausea (gum) [9]
Varenicline	Reduces craving by acting on nicotinic receptors; superior efficacy compared to NRT [33]	Potential for psychiatric side effects; nausea common; risk of cardiovascular events in some patients [70]	Recommended for heavy smokers with failed NRT attempts; highly effective [71]	Avoid in individuals with unstable psychiatric conditions; severe renal impairment [34]	Initiation: 0.5 mg/day; maintenance: 1mg twice daily for 12 weeks [32]	Nausea, sleep disturbances, neuropsychiatric effects [72]
Bupropion	Dopamine and norepinephrine reuptake inhibitor; reduces nicotine craving; non-nicotine alternative [68]	Increases seizure risk; potential psychiatric adverse effects [73]	Beneficial for smokers with comorbid depression; alternative to NRT [74]	Contraindicated in seizure disorders, history of eating disorders [73]	Initiation: 150 mg once daily; maintenance: 150 mg twice daily for 7–12 weeks [75]	Dry mouth, insomnia, increased seizure risk
Cytisinicline	High smoking cessation efficacy and excellent tolerability [76]. It more than doubled the odds of long-term smoking cessation [68]			Should be used with caution in patients with known coronary artery disease [77]	Cytisinicline, 3 mg, 3 times daily	Insomnia, abnormal dreams, nausea, and headache can be remarkable
Behavioral Therapy	Enhances motivation, coping skills, and relapse prevention; no pharmacological side effects [67]	Requires sustained effort and trained professionals; variable success rates [37]	Suitable for all smokers; especially effective in combination with medication [15]	Not applicable	Individual or group therapy; frequency varies [69]	None reported
Combination Therapy (NRT + Medication)	Improves quit rates; tackles both physical and psychological dependence [38]	Increased complexity in management; possible additive side effects [15]	Recommended for heavy smokers or failed single-agent attempts [67]	Follow individual contraindications of NRT and medication used [69]	Tailored to individual patient needs [38]	Risk of compounded adverse effects [32]

case-by-case basis and individualized with consideration of benefits and hazards. Population-wide education on addiction and smoking habits is invaluable to ensure long-term impact on the societal, cultural, and traditional factors.

AVAILABILITY OF DATA AND MATERIALS

Data and materials are not publicly available but are available to the corresponding or first authors upon reasonable request.

AUTHOR CONTRIBUTIONS

CA and OK—conceptualization, methodology; supervision; validation, formal analysis, investigation; visualization; writing–original draft preparation–review and editing. CA—data curation. Both authors have read and agreed to the published version of the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. Ozgur Karcioglu is serving as one of the Editorial Board members of this journal. We declare that Ozgur Karcioglu had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to WCC.

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