Review Article

A review on strategies for smoking cessation and the management of nicotine dependence

Marwah Y. Abdullah[1]*, Eman H. Alsaleh[2], Naima A. Alkhulaiwi[3], Mayssan H. Almalki[4], Bayan T. Zamil[5], Abdassalam F. Alenezi[6], Abdulaziz K. Alferaih[7], Mahir A. Ahmed[8], Safaa F. Mehawish[9], Khalid A. Khalifa[10]

[1]Department of Family Medicine, East Jeddah Hospital, Jeddah, Saudi Arabia
[2]Emergency Medical Services, Almaarefa University, Riyadh, Saudi Arabia
[3]Primary Health Care, Ministry of Health, Dammam, Saudi Arabia
[4]Department of Internal Medicine, King Abdullah Medical Complex, Jeddah, Saudi Arabia
[5]Department of Family Medicine, Mecca Health Cluster, Mecca, Saudi Arabia
[6]Department of Family Medicine, Hail Family Medicine Academy, Hail, Saudi Arabia
[7]College of Medicine, Dar Al Uloom University, Riyadh, Saudi Arabia
[8]Emergency Medical Services, King Abdulaziz International Airport, Jeddah, Saudi Arabia
[9]Department of Psychiatry, Eradah Mental Health Complex, Jeddah, Saudi Arabia
[10]College of Medicine, Batterjee Medical College, Jeddah, Saudi Arabia

*Correspondence:
Dr. Marwah Y. Abdullah,
E-mail: marwahyq@gmail.com

ABSTRACT

This review explores strategies for smoking cessation and the management of nicotine dependence, focusing on behavioural treatments, pharmacotherapies, and the integration of both approaches. Smoking is a major contributor to numerous health conditions, and effective cessation strategies are vital for improving public health outcomes. Current evidence-based treatments include individual, group, and telephone counselling, along with Food and Drug Administration (FDA) - approved pharmacotherapies, which have proven successful across diverse populations, including those with low socioeconomic status or comorbid conditions. Nicotine dependence, recognized as a chronic and relapsing condition, requires systematic treatment approaches in healthcare settings. Behavioural therapies, such as cognitive behavioural therapy (CBT), motivational interviewing, and acceptance and commitment therapy (ACT), show efficacy in addressing both the physiological and psychological aspects of nicotine addiction. Combining these interventions with pharmacotherapies often yields the highest cessation rates. The review highlights the importance of personalized treatment plans that consider individual motivations, socioeconomic factors, and the chronic nature of nicotine dependence, advocating for comprehensive approaches to smoking cessation.

Keywords: Smoking cessation, Nicotine dependence, Behavioural therapy, Pharmacotherapy, Cognitive behavioural therapy, Acceptance and commitment therapy

INTRODUCTION

Smoking is a significant factor in the development of various diseases and contributes to the decline of overall health. The detrimental effects of smoking extend beyond individual diseases, leading to a general deterioration in smokers' well-being.[1] The United States Surgeon General's reports have thoroughly outlined the extensive negative health impacts of smoking. A substantial body of evidence highlights that diverse treatment strategies can significantly enhance smoking cessation success rates. Combining various methods can potentially double or even

triple the likelihood of quitting smoking, offering a critical advantage in overcoming nicotine dependence, and improving overall health outcomes for smokers.[2]

Current evidence-based methods for smoking cessation include a range of behavioural treatments, such as individual, group, and telephone counselling, along with pharmacotherapies approved by the United States Food and Drug Administration (FDA). These approaches have demonstrated effectiveness across various settings, platforms, and populations, including those disproportionately affected by tobacco use, such as low-income individuals and those with additional medical or behavioural health conditions.[1] Research indicates that combining behavioural interventions with pharmacotherapies produces the highest success rates in cessation.[3,4] However, several of these treatments are also effective on their own.[1] Recognizing nicotine dependence as a chronic, relapsing condition has redefined smoking cessation as chronic disease management. This shift has led to more systematic approaches for delivering nicotine dependence treatment within healthcare settings, improving the effectiveness and continuity of care for those seeking to quit smoking.[5,6]

Nicotine dependence affects approximately 13% of the general population, representing half of all current nicotine users.[7] As most smokers continue to smoke throughout their lives, experiencing cycles of remission and relapse, nicotine dependence is now widely acknowledged as a chronic and relapsing condition.[8] While 75–85% of smokers wish to quit, multiple attempts are often necessary before quitting successfully, with fewer than 50% managing to stop permanently before age 60.[9] Both pharmacological and non-pharmacological interventions effectively treat nicotine dependence, yet there is growing interest in understanding the factors influencing smoking cessation and relapse. These factors encompass the psychoactive effects of nicotine, associative learning processes, and environmental culture, including access to tobacco products, cultural acceptability, and parental or peer modelling. Additionally, individual characteristics such as genetic predispositions and personality traits play significant roles in influencing smoking behaviours and outcomes. Identifying these factors can help tailor more effective strategies for quitting and sustaining abstinence from tobacco, and heritability with twin studies suggesting a genetic influence of about 50% on cigarette smoking prevalence, quitting ability, and daily consumption.[10,11] Nicotine dependence and the psychological distress experienced during cessation attempts are recognized as particularly significant predictors of smoking cessation.

METHODS

This study is based on a comprehensive literature search conducted on 15 August 2024, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any

research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed strategies for smoking cessation and the management of nicotine dependence. There were no restrictions on date, language, participant age, or type of publication.

DISCUSSION

The relation between smoking and low socioeconomic status (SES) has intensified in all industrialized nations despite the implementation of anti-tobacco measures.[9] Increasing research is exploring how sociodemographic variables affect the likelihood of quitting smoking. Quitting is more common among individuals with higher education levels, older adults, those from less disadvantaged socioeconomic backgrounds, and smokers who live with a spouse or partner.[9] One explanation for these findings is that better-educated individuals are more receptive to information about the negative effects of smoking compared to those with lower education levels. Additionally, smokers with lower SES often experience less social support and have less confidence in their ability to quit.[12] Lower-SES women may view smoking as a means of managing stress and challenging life circumstances.[9] Older individuals tend to have higher success rates due to their greater likelihood of adhering to treatment programs, lower risk of relapse, and higher incidence of smoking-related health issues.[13] Regarding marital status, quitting is easier for married individuals compared to those who are unmarried. Literature suggests that married individuals, especially men, have better adherence to treatment programs.[14,15]

Pathophysiology of nicotine dependence

Inhaled nicotine reaches the brain within 10–20 seconds after smoking and has an elimination half-life of about 2 hours in chronic smokers. As a result, nicotine blood levels remain stable only with frequent smoking.[16] Nicotine activates central nicotinic cholinergic receptors, which leads to the release of various neurotransmitters in the brain. Dopamine, produced primarily in the ventral tegmental area and the nucleus accumbens, is particularly significant as it induces pleasurable sensations that reinforce nicotine use. Other neurotransmitters, including norepinephrine, acetylcholine, serotonin, γ-aminobutyric acid (GABA), glutamate, and endorphins, contribute to the arousal, mood enhancement, performance improvement, analgesic effects, and weight loss associated with smoking.

With repeated nicotine exposure, neuroadaptation occurs, and desensitization of nicotine receptors leads to their upregulation in the brain. Chronic smokers experience cravings and withdrawal symptoms when desensitized receptors become responsive during abstinence, such as during sleep. To avoid withdrawal symptoms, smokers adjust their smoking patterns throughout the day to keep nicotine plasma levels sufficiently high. Additionally,

conditioned smoking cues help sustain smoking behaviour during receptor saturation and desensitization periods.[9]

Over time, associative learning may occur between environmental stimuli (e.g., specific moods, situations) and the rewarding effects of nicotine, as well as withdrawal symptoms. Such cues can trigger cravings and drug-seeking behaviour (e.g., smoking after a meal). Effective treatment for nicotine dependence should address both the positive reinforcement (mood enhancement and withdrawal symptom relief) and conditioning aspects. While smoking cessation medications manage withdrawal symptoms, they do not replicate the pleasurable effects of smoking. Behavioural counselling is crucial for helping smokers handle conditioning, with evidence showing a strong dose-response relationship between counselling duration, frequency of sessions and quitting success.[8]

Advancements in the behavioral and social sciences have enriched the understanding of the psychosocial dimensions of nicotine dependence and led to the development of innovative treatment approaches. Despite the alleviation of acute nicotine withdrawal over time, persistent challenges such as negative emotional states, urges to smoke, and environmental triggers can hinder long-term cessation efforts. Adapted intensive behavioral treatments targeting these factors have demonstrated improved quit rates, especially among individuals with mental health conditions and substance use disorders. Effective strategies include behavioral therapy, cognitive behavioral therapy (CBT), motivational interviewing, acceptance and commitment therapy, contingency management, and medications. These approaches, whether individual or group-based and varying in intensity and delivery method, show a positive dose-response relationship, with greater treatment intensity correlating with higher rates of sustained cessation.[1]

Behavioural therapy

Extensive research underscores the effectiveness of behavioural therapy in aiding smoking cessation.[17] This therapy, which can be administered by various healthcare providers or counsellors, is designed for individuals or groups. It is particularly beneficial for those contemplating or preparing to quit smoking, addressing both the historical learning processes related to smoking and the current contextual challenges (e.g., social, behavioural, and environmental factors) that complicate quitting.[18]

Evidence supports the success of both brief and more extensive interventions. It is indicated that both minimal (<20 minutes in a single session) and intensive (≥20 minutes plus one or more follow-up visits) interventions delivered by clinicians are effective in increasing the proportion of adults who quit smoking and remain abstinent for at least six months, often referred to as recent successful cessation.[1] Furthermore, these guidelines suggest a dose-response relationship: the intensity of counselling is positively correlated with quitting success.

Thus, behavioural therapy for smoking cessation typically spans several weeks, addressing the physiological, psychological, social, and environmental aspects of nicotine dependence.[1] Group sessions are usually held weekly over several weeks, with each session lasting 60 to 90 minutes.[19,20] For instance, Public Health England (2017) recommended weekly sessions for 6–12 weeks for individuals (30–45 minutes per visit) and groups (60 minutes per visit).[1]

Behavioural therapy equips smokers with practical strategies to manage triggers, cravings, and withdrawal symptoms. Topics typically covered include quitting strategies, evaluating past quit attempts, assessing current motivation, identifying and managing smoking cues and triggers, mood management, and promoting adherence to treatment and continued engagement. Treatment adherence is supported by skill development, self-management of withdrawal symptoms, acceptance of social support, and addressing associated health issues such as stress and mood disturbances.

Cognitive therapy

Cognitive therapy, including CBT, is based on the principle that behavioural issues can be perpetuated by cognitive factors such as automatic thoughts and beliefs about certain situations. This approach employs specific therapeutic techniques to address and modify maladaptive cognitions and behaviours.[21] Modern applications of CBT emphasize cognitive factors as well as emotional, physiological, and behavioural components that can reinforce behaviours.[21,22] CBT is one of the most extensively researched psychotherapeutic approaches, with evidence supporting its effectiveness in treating various behavioural and cognitive disorders, including smoking cessation.[23]

Research indicates that CBT-based treatments are highly effective for smoking cessation.[1]

CBT has been shown to be more effective than nicotine replacement therapy (NRT) alone in meta-analyses, both as a standalone treatment and when combined with NRT.[24] CBT combined with NRT, or other cessation medications has been particularly effective for tobacco users with comorbid substance use or mental health conditions. However, results are mixed regarding CBT for smokers with schizophrenia, with studies showing variable outcomes.[1]

Recent studies have aimed to enhance smoking cessation outcomes from previous CBT trials. For instance, a 2017 RCT involving a community-based adult sample (n=219) found that extending CBT treatment to 48 weeks did not improve cessation outcomes compared to 26 weeks of treatment.[25] Additionally, research has explored adapting CBT to mobile health (mHealth) and web-based platforms, including testing CBT in app-based formats (versus non-

CBT apps) and incorporating virtual reality to create immersive cue exposure paradigms.[26,27]

Motivation for smoking cessation

Quitting smoking involves losing the pleasurable effects of nicotine and experiencing withdrawal symptoms, which can significantly impact daily habits and social behaviours tied to smoking. As a result, nicotine dependence can create a high personal cost of quitting, making the process extremely challenging (i.e., potentially too uncomfortable, or disruptive to personal functioning). Success in quitting smoking depends on balancing the individual's motivation to stop (i.e., the perceived benefits of cessation) with the level of nicotine dependence. The trans-theoretical model suggests that smokers who plan their quit attempts well in advance are more likely to succeed. Therefore, motivation is crucial for engaging in a smoking cessation attempt, particularly in assisted programs. For smokers with smoking-related diseases, a more aggressive approach focusing on at least reducing smoking has been recommended.[9]

Motivation is also linked to self-perception. For example, many teenagers see themselves as smokers but do not view themselves as addicted. Although interested in quitting, they often do not prioritize it due to concerns about social image. Smoking is perceived as a social behaviour and a means to reinforce social bonds. Being around smoking friends can undermine quitting efforts. Consequently, this group may be less receptive to traditional cessation services and require a deeper understanding of the social factors supporting their smoking, along with insights into how support can enhance quitting success.[28]

Acceptance and commitment therapy (ACT)

Acceptance and commitment therapy (ACT) builds on cognitive therapies but emphasizes a direct approach to changing psychological events by focusing on their function and the individual's relationship with them. ACT aims to alter the way individuals experience their thoughts, emotions, and physical sensations, such as nicotine withdrawal or cravings, by fostering acceptance of these experiences rather than attempting to control or avoid them. This involves two main components: acceptance, which involves embracing intense sensations and associated emotions, and commitment, which centers on identifying personal values to guide and motivate behaviour change, such as quitting smoking. ACT has demonstrated effectiveness across various conditions, including major depression, anxiety disorders, borderline personality disorder, chronic pain, and substance abuse, including tobacco use.[1]

Recent adaptations of ACT include smartphone applications and web-based interventions. For instance, a pilot trial of the SmartQuit® 2.0 app reported 21% quit rates for 7-day point prevalence and 11% for 30-day point prevalence at 2 months follow-up, with program completers showing higher quit rates (33% and 28%, respectively).[29] ACT has also been explored in specific populations such as smokers with depressive symptoms, and weight concerns. More research is needed to determine ACT's comparative effectiveness and potential advantages over other cognitive therapies in smoking cessation.[1]

Contingency management and monetary incentives

Contingency management, which involves using incentives (e.g., money, gift cards) to motivate behaviour change, has substantial support in the literature. This approach aims to maintain abstinence from substances, including tobacco. Monetary incentives have been tested both alone and in combination with cessation medication or counselling to boost adherence to treatment and sustained abstinence.[1]

The success of incentive-based approaches may hinge on the specific behaviour being incentivized (e.g., quitting versus engaging in treatment) and how the incentive is framed (e.g., rewards vs. penalties). For example, higher insurance premiums for smokers, rather than rewards for quitting, can lead to unintended consequences such as individuals forgoing health insurance or hiding their smoking status.[30]

Medications help in smoking cessation

Various medications are available to assist patients in quitting smoking, each offering unique benefits. Nicotine replacement therapy, bupropion, and varenicline are effective options (Table 1).[31]

Table 1: Medications assist patients in smoking cessation.[31]

Medication	Description	Key points
Nicotine replacement therapy (NRT)	Available in various formulations (patch, gum, inhaler, lozenge, oral spray) providing temporary nicotine replacement.	Reduces motivation to smoke and alleviates nicotine withdrawal symptoms. Patch delivers nicotine over 16 or 24 hours; other forms provide more rapid but short-lived effects. Caution advised for patients with cardiovascular disease or those who are pregnant.
Bupropion	An atypical antidepressant that weakly inhibits the uptake of norepinephrine, serotonin, and dopamine.	Increases the odds of quitting smoking. Strict contraindications for patients at increased risk of seizure.

Continued.

Medication	Description	Key points
Varenicline	A nicotine receptor partial agonist/antagonist that reduces withdrawal symptoms and smoking satisfaction.	Maintains moderate dopamine levels and prevents nicotine attachment to certain receptors. More effective when combined with NRT. Combined treatment with bupropion increases short-term cessation rates.
Combination therapy	Combines NRT (e.g., patch with gum, lozenges, inhalers, or oral sprays) or NRT with bupropion.	More effective than NRT alone and bupropion alone. Combination with NRT has no increase in adverse events compared to bupropion alone. Combination of varenicline with NRT is more effective than varenicline alone.

Future directions

Future directions in smoking cessation and nicotine dependence management should focus on personalized interventions that integrate behavioural, pharmacological, and technological approaches. Emerging research should further explore the role of genetic factors in nicotine dependence, enabling tailored treatment strategies that consider individual genetic profiles. Expanding the use of mobile health (mHealth) platforms and virtual reality (VR) for CBT and ACT offers promising avenues for enhancing accessibility and engagement. Additionally, more studies are needed to refine contingency management approaches, particularly in underserved populations, and to evaluate the long-term effectiveness of combining these strategies with traditional therapies. Finally, public health initiatives should prioritize reducing socioeconomic disparities in smoking cessation success, ensuring that interventions are culturally relevant and accessible to all.

CONCLUSION

Effective smoking cessation requires a multifaceted approach, combining behavioural therapies and pharmacological treatments. Recognizing nicotine dependence as a chronic, relapsing condition is crucial in guiding interventions. Tailored strategies, incorporating motivational and psychological therapies, alongside innovative digital tools, offer promising avenues for enhancing quit rates and managing nicotine dependence across diverse populations.

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