Challenges and perspectives of tobacco cessation in special groups of patients and populations

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Education and awareness regarding the health benefits of tobacco abstinence in special subgroups of the population or groups of patients remain of utmost importance https://bit.ly/3Xywa8l

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Abstract

During the first 2 years of the coronavirus disease 2019 pandemic, health systems worldwide were put under extreme pressure, and healthcare professionals had to manage unprecedented health crises as well as provide healthcare services to an increased number of patients. Therefore, public health policies with respect to smoking and education of the general population regarding the harmful effects of active and second-hand smoking may not have received adequate attention during this period. More specifically, certain subpopulations suffering from chronic diseases may not have received adequate information about the effects of smoking on the course and outcome of their disease; high-level, evidence-based pharmaceutical therapies; and the potential for follow-up. However, adequate education and awareness regarding short- and long-term health benefits from smoking cessation for the general population as well as special subgroups remains of utmost importance. Healthcare professionals should understand that it is only through high-quality evidence and results from independent studies that they will be able to provide their expertise and scientific knowledge concerning newer tobacco products and their effects on human health.

Introduction

Even though tobacco smoking can be a preventable and avoidable health factor, it remains the leading cause of early morbidity and mortality from cardiovascular and respiratory diseases worldwide [1]. This is the main reason why tobacco control is vital and must be managed correctly and targeted at specific population groups with well-planned state level smoking cessation campaigns. Viewing tobacco smoking as a preventable cause of death, the significance of prevention strategies and public health interventions becomes evident. By implementing evidence-based tobacco control policies, promoting education and awareness, and providing access to cessation resources, societies can reduce the prevalence of smoking and its associated health risks [2]. According to the most recent reports, tobacco smoking is the greatest threat to public health globally; it is estimated that, annually, 8 million deaths are caused by smoking, with 87.5% related to complications of direct tobacco use [3] and more than 1.2 million being the result of environmental tobacco smoke and thirdhand smoke. The World Health Organization (WHO) latest report estimates that smoking prevalence among adults over the age of 15 years is ~17.5%, with the main focus now turned on newly released nicotine and tobacco products and their detrimental impact on health outcomes [4].

Although pharmaceutical and/or behavioural therapies for tobacco dependence have been proven cost-effective, the implementation of smoke-free legislation and preventive interventions will reduce the potential harmful effects of tobacco smoke exposure on overall public health [5].

In the past decade, public awareness of tobacco cessation strategies and treatment approaches has been increasing; however, there is scant evidence on smoking cessation interventions targeting special subgroups of the population. Studies have shown that tobacco control is crucial among special groups of patients or disadvantaged populations who may face unique challenges related to tobacco use, as support services tailored to their specific needs are essential in reducing tobacco consumption and improving their overall health outcomes [6]. Tobacco smokers with bronchial asthma, COPD patients, diabetic patients, pregnant and lactating women, and adolescents, the latter being a particularly important group to focus on when it comes to tobacco control, are often not included in scientific research studies, even though they exhibit high rates of nicotine addiction and represent great challenges in terms of tobacco screening and cessation counselling [7].

Novel technological tools and tailored approaches could enhance the effectiveness of anti-tobacco interventions by increasing the accessibility of evidence-based tobacco cessation knowledge to users [8]. The rapid expansion of digital information among smokers and vulnerable groups with limited access to healthcare services could be an alternative option, but specific requirements and precautions should be established to prevent the proliferation of medical misinformation and distortion of the harms of tobacco smoking [9].

Furthermore, during the coronavirus disease 2019 pandemic, tobacco control policies and cessation actions have not been implemented properly due to the increased demand on health services across the globe [10]. Consequently, smoking cessation clinics reduced visits, and smokers didn't 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 [11].

It is essential for healthcare professionals not only to inform patients about the harmful effects of smoking and treat them, but also to prevent addictive and potentially toxic substance use, and to remain up to date on the latest developments and regulatory changes in the tobacco industry, to provide the most accurate and current information. The role of the tobacco industry, which remains a significant "player" in the cigarette business by presenting a new portfolio of alternative products to tobacco smoking, should be identified and investigated.

In this review, our aim was to review current evidence on tobacco cessation strategies in special populations of patients and to highlight potential challenges compared with the general population. In addition, we sought to determine shifts in tobacco industry approaches and the overall impact of novel tobacco products.

Smoking cessation in asthma

Asthma is characterised by chronic airway inflammation and presents with variable degrees of wheezing, cough, and chest discomfort or tightness depending on the severity of airflow obstruction [12]. Although corticosteroids remain the cornerstone of disease management, primary preventive measures, including avoidance of environmental tobacco smoke and active smoking, are equally important.

Evidence has shown that smoking rates seem to be similar among the general population and asthma patients, while 20% of adult asthma patients are active smokers [13]. Asthmatic smokers have a 71% higher risk for asthma attacks than nonsmokers [14], with nicotine dependence being linked with more severe symptoms and an increased risk of hospitalisation [15]. Exposure to tobacco smoke during childhood has been identified as a triggering factor for developing asthma in adult life. More specifically, maternal prenatal and postnatal smoking may stimulate certain mechanisms of wheezing and asthma exacerbations in children aged <5 years (adjusted rate ratio 0.87, 95% CI 0.85–0.88; p<0.001) [14]. Furthermore, smoke-free policy implementation in public indoor spaces yielded a protective effect on asthma control and daily symptoms, resulting in decreased admissions in paediatric emergency departments [14]. A retrospective, cross-sectional study demonstrated that nicotine has a dose–dependent effect on decreased bronchodilator responsiveness testing and rapid loss of forced expiratory volume in 1 s (FEV_1) in lung function tests, as well as moderate alteration of exhaled nitric oxide values [16].

During the past few years, there has been a tendency for increased asthma prevalence worldwide, with significant rates of mortality and morbidity. Although data on early diagnosis and treatment are accurate, abundant, and support effectiveness, the rates of asthma underdiagnosis or misdiagnosis differ significantly due to socioeconomic factors, dissimilar environmental triggers, and inequitable access to current medication [17].

The negative impact of tobacco smoking on asthmatic patients with frequent exacerbations, more severe clinical symptoms such as life-threatening attacks, and accelerated decline in lung function tests, moderate responses to corticosteroid treatment, and poor outcomes due to active and passive cigarette smoking exposure is very well described in the literature [18]. However, addressing nicotine dependence in asthmatic smokers remains a challenge for health professionals [13].

Anand *et al.* [19] aimed to raise awareness of new tobacco products and their health consequences among asthmatic users, particularly among the young population, as they consider them a less harmful choice than tobacco smoking. A survey of 58 336 students aged 12–18 years noted that the combination of newer tobacco products, *i.e.* conventional cigarettes, vaping and heated tobacco products, by adolescents has been reported as a potential factor of allergic multimorbidity of asthma (adjusted odds ratio (AOR) 1.59, 95% CI 1.17–2.15; AOR 1.22, 95% CI 1.05–1.42; and AOR 1.64, 95% CI 1.36–1.98, respectively) [20]. Airway physiology findings have linked alterations in lung functional tests with the short-term use of nicotine e-cigarettes, which may also impact respiratory symptoms in the group of asthmatic patients who smoke [21]. In addition, a survey of young e-cigarette users demonstrated an increased risk for more severe asthma symptoms compared with non-users (OR 1.39, 95% CI 1.15–1.68) [22], as well as for asthma attacks after a month of use [22]. However, additional data are needed to confirm a potential association between airway inflammation and new tobacco products.

The benefits of tobacco cessation for asthmatic patients are well recognised, but unfortunately a small number of studies in literature show it not routinely supported by health professionals, even during a hospitalisation after an asthma exacerbation. Data showed that, even under these circumstances, the smoking cessation procedure remains suboptimal, and asthmatic smokers may not receive the appropriate counselling before discharge from hospital [23].

Evidence has shown that asthma patients that quit smoking exhibit significantly improved spirometric values, reduced corticosteroid tolerance and airway inflammation severity markers, as well as reduced exacerbations, while maintaining adequate symptom control and improved quality of life [24].

The SmokeHaz group [18], after analysing the results of systematic reviews and meta-analyses, concluded that continuous and targeted patient counselling with regards to the deleterious effects of smoking, the impairment of spirometric values, the loss of symptom control [25], the more frequent use of reliever medications, and the increase in hospitalisations plays a prominent role.

A combined behavioural and pharmacological approach is the mainstay for smoking cessation. Even though each method is highly effective by itself, their combination achieves much higher success rates. Whenever asthmatic patients come to a healthcare facility, healthcare workers should ask them whether they smoke, and if so, they should document a brief smoking history and the level of nicotine dependence. The “5 A’s” model (ask, advise, assess, assist, and arrange) is a widely used initial approach; studies have proven that it can provide individualised motivation to smokers and promote reconsideration of health-related priorities [26].

Evidence-based treatment is the cornerstone of smoking cessation approaches. High success rates have been obtained with nicotine replacement therapy (NRT), varenicline, and bupropion hydrochloride in asthmatic smokers. A personalised therapeutic scheme, as well as the adjustment of the appropriate dosage through close follow-up and supervision, will help eliminate nicotine dependence [26].

In a prospective study, Tønnesen *et al.* [27] allocated 220 asthmatic patients to receive NRT (chewing gum or oral inhaler or both) for 12 weeks against placebo and found that abstinence from smoking was associated with improved quality of life and reduced use of rescue β_2-agonists, inhaled corticosteroids, daytime symptoms and bronchial hyperreactivity. Westergaard *et al.* [28] compared varenicline use to placebo for quitting smoking in asthmatic patients and found significantly higher rates of quitting for varenicline (69% *versus* 36%), albeit with a high probability for relapse. In another study, no significant differences in continuous abstinence rates were noted between asthmatic patients and controls at 12 months of follow-up; however, the authors used different pharmacological approaches (NRT, bupropion and varenicline) and did not reach any conclusions regarding a potential superior effectiveness of one over the others [29]. Moreover, Tønnesen *et al.* [30] concluded that asthmatic patients, as well as other patients with smoking-related diseases, had lower abstinence rates compared with controls, with varenicline being the most effective agent. In summary, there is lack of evidence from high-quality studies regarding the efficacy of different pharmacological approaches to smoking cessation in asthmatic patients; therefore, further investigation with rigorously designed trials is warranted.

Regular communication between asthmatic patients and personnel through follow-up visits is highly important during smoking cessation attempts. Enhancing personal motivation, reminding of the health risks due to disease decompensation, and enabling modification of the overall approach and treatment depending on potential exacerbations and severe withdrawal symptoms are equally important. Valuable aids in this respect may be the endorsement of novel technologies, and the formulation of group therapy sessions with the use of social media.

Tobacco dependence is a chronic disorder requiring frequent and repetitive interventions. These interventions should be more persistent in asthmatic smokers as they constitute a special population. Instructions for these patients should be simple, feasible, practical, flexible, and, more importantly, adapted to personal needs and overall benefit regarding asthma management and control.

Smoking cessation in COPD

COPD is a global health problem that affects over 300 million people [31]. Smoking is the leading cause of COPD [32]. Today, the general concept is that COPD is a preventable disease through prohibiting all kinds of smoking and preventing exposure to air pollution [31].

In mild-to-moderate COPD patients in the Lung Health Study cohort, smoking cessation reduced the rate of FEV_1 decline by half compared with continuing smokers (31±48 mL per year *versus* 62±55 mL per year; $p<0.001$) [33]. A reduction in daily cigarette consumption resulted in smaller declines in FEV_1 and minimal changes in chronic respiratory symptoms compared with those who did not reduce their consumption, suggesting the importance of quitting [34]. Additionally, ex-smokers with COPD showed lower mortality risk (hazard ratio (HR) 0.78, 95% CI 0.70–0.87), hospitalisation risk (HR 0.82, 95% CI 0.74–0.89), and emergency department admission risk (HR 0.78, 95% CI 0.70–0.88) compared with current smokers [35].

COPD patients carry several features that may cause difficulties in quitting [36]. First, compared with healthier smokers, COPD patients have higher levels of nicotine dependence [37]. Secondly, COPD patients have higher levels of carbon monoxide in their exhaled air than nonsmokers, which suggests that these individuals have a certain smoking habit that involves breathing cigarette smoke more deeply and smoking more frequently each day [37, 38]. Thirdly, weight gain, a well-known side-effect of quitting smoking, may be a barrier, particularly in obese patients [39, 40]. Finally, repeated quitting advice from previous physicians might cause a “tolerance” to quitting advice in COPD patients [36]. In addition, COPD patients face barriers accessing smoking cessation medications [38]. Only a small portion (3.6–5%) receive smoking cessation prescriptions [40, 41].

Quitting smoking is the most effective strategy for preventing COPD, slowing down its course, and reducing mortality and morbidity [42]. Pharmacotherapy and behavioural counselling are currently the two cornerstones of smoking cessation [43]. The COPD patient population is a rather well-studied patient population for smoking cessation.

High-quality research indicates that behavioural counselling should be applied intensively and over an extended period [44]. COPD patients who smoke may be more receptive because a recent diagnosis of a chronic disease provides a basis for a teachable moment [38]. The benefits and importance of quitting smoking for improving health should be addressed during patients visits. It is highly recommended that spirometry be performed both to determine the severity of the disease and as a motivational aid. Counselling includes steps starting with choosing a quit date, understanding the nature of nicotine dependence and nicotine withdrawal symptoms, identifying high-risk situations that could lead to relapse, developing coping strategies for those high-risk situations, and assisting with a well-structured follow-up period [38].

There are three first-line treatment options in pharmacotherapy: NRT options (nicotine transdermal patches, nicotine gum, nicotine inhaler, nasal/oral spray and tablet/lozenge), bupropion sustained release (SR) and varenicline. Currently, a growing body of high-quality evidence shows that all the first-line treatment options increase the likelihood of smoking cessation in the smoker population compared with placebo, with no severe adverse effect profile [45–47].

In a double-blind clinical trial, Tønnesen *et al.* [48] randomly assigned 370 COPD patients to receive NRT (sublingual nicotine tablets) for 12 weeks against placebo, along with either low or high behavioural support. 6- and 12-month biologically verified abstinence point prevalence rates for NRT and placebo were 23% *versus* 10% (OR 3.46, 95% CI 1.58–5.20) and 17% *versus* 10% (OR 1.97, 95% CI 1.06–3.67),

respectively [48]. Abstinence rates were comparable (OR 1.50, 95% CI 0.88–2.55) between the low and high behavioural support groups [48]. The most common adverse events were itching in the mouth, cough, exacerbation, unpleasant taste, flu, diarrhoea, dyspepsia, nausea and dizziness. The odds of behavioural smoking cessation counselling combined with NRT had the highest prolonged bio-verified abstinence rates (abstinence rate after 6 months) compared with usual care (OR 5.08, 95% CI 4.43–5.97; p<0.001), as opposed to behavioural smoking cessation counselling alone (OR 2.80, 95% CI 1.49–5.26; p=0.001) or behavioural smoking cessation counselling combined with an antidepressant (OR 1.53, 95% CI 0.71–3.30; p=0.28) [49]. In this meta-analysis, high-intensity counselling plus NRT had odds of relative efficacy of 5.22 (95% CI 4.43–6.15; p<0.001) compared with usual care, 1.81 (95% CI 1.04–3.15; p=0.04) compared with low-intensity counselling plus NRT, and 1.61 (95% CI 0.62–4.17; p=0.32) compared with high-intensity counselling plus antidepressant [49]. The odds of relative efficacy of high-intensity counselling plus antidepressant was 3.23 (95% CI 1.25–8.35; p=0.015) compared with usual care, and 1.88 (95% CI 1.02–3.48; p=0.04) compared with only high-intensity counselling [49].

In a placebo-controlled trial of COPD patients, continuous smoking abstinence rates at the 26th week were greater in those who received bupropion SR (18% *versus* 10%; p<0.05) than in those in the placebo arm [43]. Similar to the previous study, bupropion was more effective than placebo in aiding patients with COPD to maintain a prolonged abstinence rate during the 6-month follow-up period (29.7% *versus* 14.6%; p=0.03) [50]. Bupropion SR was well-tolerated in COPD patients, with the most common adverse events being insomnia, dry mouth, diarrhoea or constipation [50, 51].

Odds of continuous smoking abstinence were 8.40 (95% CI 4.99–14.14) for weeks 9 to 12, and 4.04 (95% CI 2.13–7.67) for weeks 9–52 for patients receiving varenicline tartrate compared with those received placebo in a double-blinded, randomised study that enrolled mild and moderate COPD patients who smoked. Nausea, vivid dreams and insomnia were the most common adverse events reported in COPD patients, similar to non-COPD smokers [52]. It is noteworthy that the COPD patients enrolled in those trials were older, had higher cumulative life-time smoking exposure, and higher nicotine dependence scores [53, 54].

Although the usual administration period for varenicline is 12 weeks, extending treatment to 24 weeks is secure and can raise success rates [55].

An open-label, follow-up study with severe COPD patients receiving 24-weeks of varenicline with brief counselling reported continuous abstinence rate during weeks 9–24 of 36.8% in patients who performed at least 24 weeks of follow-up. The researchers reported no major cardiovascular or neuropsychiatric side-effects and a significant improvement in quality of life assessed by COPD Assessment Test above the minimal clinical importance thresholds [56].

To analyse the effectiveness of pharmaceutical therapies in conjunction with behavioural support, VAN EERD *et al.* [44] examined 16 studies involving 13 123 smokers with COPD. Table 1 summarises the key findings of this extensive meta-analysis. Regarding concerns, there is substantial evidence to support the neuropsychiatric and cardiovascular safety profiles of smoking cessation drugs [57, 58].

TABLE 1 Success of smoking cessation strategies for people with COPD

Smoking cessation strategy	Prolonged abstinence for 6 months, risk ratio (95% CI)
Behavioural *versus* usual care	25.38 (8.03–80.22)
Low-intensity behavioural therapy *versus* usual care	1.98 (0.74–5.31)
High-intensity behavioural therapy *versus* usual care	9.33 (7.26–11.99)
High-intensity behavioural therapy *versus* low-intensity behavioural therapy	2.18 (1.05–4.49)
NRT (nicotine sublingual tablet) *versus* placebo	2.60 (1.29–5.24)
Bupropion *versus* placebo	1.96 (1.18–3.25)
Varenicline *versus* placebo	3.34 (1.88–5.92)
Pharmacotherapy plus high-intensity behavioural therapy *versus* placebo plus high-intensity behavioural therapy	2.53 (1.83–3.50)

NRT: nicotine replacement therapy. Data from [44].

Although monotherapy with first-line treatment options enhances the rate of smoking cessation, it is not effective for all smokers. Higher doses of NRT (*e.g.* 22 mg per day of nicotine patch) and combination NRT (*e.g.* nicotine patch and inhaler) have been studied to boost the efficacy of NRT.

There are few studies that examine the effectiveness of extended use of combined pharmacotherapies. In a randomised controlled trial, 737 current smokers (including those with a history of psychiatric illness) who indicated a willingness to quit, were randomised to varenicline alone (1 mg twice daily for up to 24 weeks), NRT alone (maximum 21 mg daily patches for 10 weeks) and extended use of combined NRT formulations (maximum 35 mg daily and gum or inhaler for up to 22 weeks) arms. There were no differences in the continuous abstinence rates for weeks 5 to 52 between the varenicline alone, NRT alone, and extended NRT arms, which were 15.3%, 10%, and 12.4%, respectively. At weeks 5–22, patients in the varenicline group experienced a higher rate of sustained abstinence than those in the NRT group (OR 2.01, CI 1.20–3.36). Both extended NRT and varenicline were more effective than NRT at 22 weeks, according to 7-day prevalence rates (OR 1.72, CI 1.04–2.85; and OR 1.96, CI 1.20–3.23), indicating that the effects of extended NRT and varenicline treatment are short-lived but eventually wear off [59].

In 222 smokers who were unable to reduce their smoking by more than 50% after 1 week of treatment with a nicotine patch, Rose and Behm [60] conducted a double-blind, randomised, controlled trial of combination therapy with varenicline and either bupropion or placebo. The results were most positive in male smokers and those who were highly nicotine dependent. Combination therapy with varenicline plus bupropion was associated with significantly higher abstinence rates over 8–11 weeks after the target quit date than varenicline plus placebo (39.8% *versus* 25.9%, respectively). The combination therapy was well-tolerated [60].

In conclusion, quitting smoking can significantly reduce the risk of developing COPD. Quitting smoking halved the rate of FEV_1 reduction, indicating that disease progression may be slowed, symptoms may improve, and COPD mortality may be decreased. A combination of behavioural therapy and pharmacotherapy for smoking cessation is the most effective strategy for smokers with COPD. However, studies addressing the efficacy of combination or extended dose therapies report promising outcomes for increasing abstinence rates in smoker COPD patients, even though they were mostly undertaken in general smoker populations rather than COPD patients.

Smoking cessation in diabetic patients

The hazards of smoking related to type 2 diabetes and metabolic syndrome are underestimated. Namely, the relative risk of type 2 diabetes in heavy smokers (⩾20 cigarettes per day) is 1.61 in comparison with light smokers. The main underlying mechanisms are dysglycaemia, insulin resistance, chronic pancreatitis and increasing cortisol levels. Additionally, all diabetes complications, such as the risk of macrovascular disease, risk of coronary heart disease, stroke and myocardial infarction, are increased due to smoking, by 54%, 44%, and 52%, respectively, compared with nonsmokers. Therefore, smoking cessation in patients with diabetes is a priority. The European Association for the Study of Diabetes and the European Society of Cardiology recommend smoking cessation as a grade A recommendation [61]. Additionally, the American Diabetes Association advises all diabetic patients not to use cigarettes or other tobacco products, such as e-cigarettes [62]. However, there are many barriers to smoking cessation in diabetic patients, with post-cessation weight gain being a major one [63]. Other barriers are poor knowledge of the negative impact of smoking on diabetes, the use of smoking as a coping mechanism for stress and as part of social routines, and high dependence levels. Although post-cessation weight gain does not attenuate cardiovascular benefits, it is a major concern for diabetic patients that should be addressed since most of them are overweight or obese.

All diabetic smokers should be offered combined assistance to quit, with behavioural support and pharmacotherapy that achieve the highest cessation rates for smokers. Ideally, smoking cessation should be a routine component of their care and individualised [64, 65], as follows.

1) Smoking cessation should be a part of diabetes education.
2) Behavioural support should be offered according to the WHO recommendations using the 5 A's model (ask, advise, assess, assist, and arrange).
3) The 5 R's (relevance, risks, rewards, roadblocks, and repetition) should be used in unmotivated smokers.
4) Nicotine dependence should be assessed using the Fagerström test.
5) The readiness of diabetic smokers should be assessed by asking two questions in relation to "importance" and "self-efficacy".
6) Exhaled carbon monoxide should be measured.

7) A WHO/International Society of Hypertension risk prediction chart for European countries, showing the 10-year risk of a fatal or nonfatal cardiovascular event by age, sex, systolic blood pressure, smoking, cholesterol levels and the presence or absence of diabetes mellitus, could be helpful in motivating diabetic smokers.
8) Pharmaceutical treatment should be considered early, including NRT, bupropion (although there is caution for hypoglycaemia, it has not been observed in clinical practice), or varenicline. Combination treatment can also be used to achieve abstinence.
9) Weight management education without strict dieting should be offered.
10) Activities tailored to each diabetic patient should be proposed.
11) Follow-up should be used in diabetic smokers to prevent relapses and ensure long-term abstinence.

Epidemics of youth tobacco consumption

The youth tobacco epidemic is undeniably a top public health threat [66]. The smoking prevalence of the paediatric population has remained high over the years: the global average is ∼10% (boys 13%; girls 7%), with 13.8% for European boys and 11.5% for European girls [67]. Importantly, nearly 90% of adult smokers initiated tobacco consumption in their childhood or teenage years, and the average age of smoking onset is 15 years in Europe [68]. Youth smoking cessation poses unique challenges and perspectives. The immature physiological and psychiatric characteristics of youths who smoke early in life trigger neurological and social changes later in life [66].

Challenges and perspectives in youth cessation

∼70% of teenage smokers have tried to quit, but 90% relapse within a year, and few succeed [69]. Although efforts have been made for youth cessation, the available evidence is limited, as most existing cessation strategies are developed for adults and not tailored to youths [70].

Community-based uptake prevention strategies (family-, school-, or medical setting-based interventions, such as parental education programmes and campus-wide smoke-free policies) and measures from the tobacco control administrations (to reduce accessibility of tobacco products to children) are very important to prevent youth from starting smoking [71]. However, few data exist on smoking cessation for those who have already started. Overall, mixed results are found regarding the effectiveness of individual-level interventions and population-level tobacco control policies targeting children. Several challenges make youth cessation so difficult to progress. First, nicotine is highly addictive while children's brains are still developing, and addiction together with withdrawal symptoms are the largest barriers [72–74]. First-line pharmacological interventions include NRT, antidepressant bupropion and partial agonist varenicline. However, available evidence on their safety and effectiveness in teenage smoking cessation is rare, controversial, and of limited research quality [70]. Future well-designed and powered trials are warranted to build the clinical practice guidelines for cessation of drugs in children. In-depth exploration of the multifactorial aetiology of youth nicotine addiction may provide a holistic understanding of how nicotine and its metabolites affect children and provide therapeutic targets in precision treatment [73].

Protocols with group-based medical and behavioural combination support have the highest likelihood of enhancing quitting in children [70–72]. This is in line with the finding that 50% of adolescent smokers are in the early stages of the transtheoretical health behavioural change model, while behavioural supports like motivational interviews can help individuals move forward [74]. Nonetheless, most of those existing trials have unignorable heterogeneity in study design, imprecision in effect size estimation, and study risk of bias. Future well-developed studies with longer follow-ups and biological validations of their effectiveness are urgently needed. Low recruitment and retention rates remain another problem. A recent review raised the point that research with person-to-person contact targeted at smokers with chronic illness, with shorter follow-up and financial incentives, is shown to have higher retention rates [75]. However, it is unknown whether this conclusion captured by adults applies to minors. Besides, children seldom seek help when quitting, and can even be unaware of their nicotine dependence and lack knowledge of tobacco-related harmful effects and cessation methods. Health education on smoking hazards and cessation knowledge should be delivered, and the process of transferring smoking teens to cessation specialists should be established. An updated review summarised that "self-confidence in cessation, no intention to smoke, negative beliefs in smoking, older onset age, and positive health perceptions" predict successful cessation, while "smoking friends and households around, being a daily smoker, higher smoking frequency, and nicotine dependence level" predict unsuccessful cessation in children [72]. Combining these identified factors in youth cessation may boost quit rates.

As for legislation, most tobacco control policies are based on the WHO Framework Convention on Tobacco Control [76, 77]. Whereas few policies target paediatric populations, children's tobacco control

laws are mandatory and should prioritise youth smoking prevention [77]. Increasing tobacco taxes is promising, while youth use of smokeless products like e-cigarettes and their cessation are emerging challenges to combat. Alongside widespread public smoking bans, children's study areas, recreational areas and homes should be smoke free. In parallel, governmental restrictions on tobacco marketing and advertising should be tightened.

To conclude, there is relatively little existing evidence regarding smoking cessation in children, and the efficacy of interventions varies by individuals' sociodemographic, psychosocial, behavioural, smoking-related, environmental, health-related, and genetic factors. Validating and promoting such interventions requires future trials. Epidemics, barriers and facilitators of youth cessation should be considered when developing youth tobacco control strategies. Governments, schools, parents and caregivers all play crucial roles in this battle.

Is the tobacco industry going out of cigarette business?

The tobacco industry causes 8 million deaths, USD 4 trillion of economic harm, in order to earn USD 760 billion each year [78]. As awareness about the health hazards of tobacco increases among the public, tobacco consumption decreases. Cigarette smoking, the primary mode of tobacco consumption among adults, has been decreasing from 33% in 2000, to 23.5% in 2018 [79]. Losing customers changed the strategy of the industry. They moved away from the concept of classical combustible cigarettes and embraced a terminology that resonated with health, such as "harm reduction" and "smoke-free world". The tobacco industry started promoting smoke-free products for the potential positive public health perception. Major tobacco companies marketed so-called "reduced risk products", such as electronic nicotine delivery systems (ENDS) and heated tobacco products [80].

These products were introduced with the slogan "better alternatives for those adult smokers who would otherwise continue to smoke" and were sometimes promoted as cigarette cessation tools in order to lobby the regulators. At the same time, USD 1.4 billion of youth-focused, aggressive marketing campaigns were carried out on social media [81].

Many tobacco companies use their website to announce their novel products in the pipeline, which renders website surfing useful for strategic planning in tobacco control and smoking cessation. The website of Philip Morris International (PMI), like many other industry websites, discloses the future business plans and product portfolio of the company. The slogans "going smoke free" and "future with smoke-free products" dominate the main page [82]. Instead of a tobacco company or cigarette manufacturer, PMI wants to be recognised as the company that replaced cigarettes with smoke-free alternatives. The company clearly expresses its need for government regulation to market more smoke-free products, which they claim are better for adults who would otherwise continue to smoke. The news section announces the launch of an affordable heated tobacco product and the acquisition of 93% of the shares in Swedish Match and its oral nicotine portfolio, which are expected to accelerate the smoke-free journey. The company also announced that smoke-free products would account for 50% of revenues by 2025 [82]. Moreover, PMI Chief Executive Officer Jacek Olczak told the press "The UK government should treat cigarettes like petrol cars and ban them in 10 years" [83], indicating that the company will not be interested in marketing combustible cigarettes in the future. Similarly, the British American Tobacco (BAT) website indicates investments in products other than combustible cigarettes. BAT's Chief Growth Officer, during his keynote speech at the 2022 Global Tobacco and Nicotine Forum, mentioned aiming for 50 million adult consumers using non-combustible products by 2030 through the "A Better Tomorrow" project. He also demanded "freedom to responsibly inform adult smokers" as part of harm reduction, or in other words, advertising freedom [84].

The determination displayed by these two companies in their smoke-free portfolio may be important in planning cessation activities for the future. It is obvious that physicians will need to do more than combustible cigarette smoking cessation.

"Beyond nicotine" is a slogan used by most tobacco companies that emphasises the future without tobacco and nicotine. The replacement botanical product seems to be cannabis, considering the recent investments of the tobacco companies. The Global Tobacco Industry Watchdog, STOP Project, demonstrated that acquisitions in the tobacco industry are aimed at recreational drugs and drug delivery devices. Tobacco companies started seeing opportunity in the cannabis industry, which is quite different from the highly regulated tobacco market. As recreational cannabis is being legalised in many North American and European countries, while the acceptability of cigarette smoking is declining, tobacco companies have invested in cannabis companies [85].

In 2018, Imperial Brands invested in Oxford Cannabinoid, and Altria Group acquired 45% of the stakes in the Canadian cannabinoid company Cronos Group. In 2019, Imperial Brands invested in the Canadian Auxly Cannabis Group, a manufacturer of wellness and recreational cannabis products. In 2021, BAT launched a cannabidiol (CBD) vaping product, VUSE CBD Zone, and its Btomorrow Ventures invested in cannabinoid research company Trait Biosciences [78]. Tobacco companies not only invested in cannabis but also lobbied; Altria became the first tobacco company to lobby on cannabis sales at the state or federal level in the USA [86].

The tobacco and cannabis industries have a mutual interest in this venture. The tobacco industry, while diversifying its products with heated tobacco and ENDS, can also offer new perspectives with cannabis products. The cannabis industry can thus find space among the mainstream industries during legalisation through medical and recreational use arguments. Acquisition of respiratory drug delivery companies by the tobacco/cannabis industries will undoubtfully be instrumental in the development of future products. However, with the development of novel products to increase the profits of the industry, the monitoring of the product portfolio and the need to derive new methods of cessation will be of utmost importance. Smoking cessation is an exercise carried out after the addiction and damage are settled. There is a unique opportunity in the case of new products. Clinicians and researchers are urged to identify the potential harms of the products and warn the public before addiction and lung damage occur. Decision-makers can adopt precautionary measures when scientific evidence about an environmental or human health hazard is uncertain, and the stakes are high. This time, the precautionary principle of public health can be applied.

Conclusions

The process of tobacco cessation is crucial among special groups of patients and certain groups of the population, as it can effectively manage their disease condition and improve their overall health and well-being status. Health professionals should access tailored strategies and techniques, determine the most suitable approach based on an individual's needs, and target personalised motivational interventions and evidence-based medication therapy. Even though cigarette smoking is and will be the main mode of tobacco and nicotine use for some time, health professionals need to be aware of the biased efforts and inherent conflict of interest of the tobacco industry in the promotion and development of novel tobacco products, which have limited data on health effects to date.

Self-evaluation questions

1. Which is the most effective smoking cessation approach with high rates of abstinence?
2. Can asthma symptoms be more easily controlled if the asthmatic patient smokes?
3. COPD patients should improve their spirometric values and symptoms with the tobacco cessation process. True or false?
4. If an adolescent starts smoking, how easily may they quit?

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References

1 Mulshine JL, Healton C. Tobacco control since the 1964 Surgeon General's Report: reflecting back and looking forward. *Oncology (Williston Park)* 2014; 28: 180, 182–183, 210.
2 Wipfli H, Samet JM. One hundred years in the making: the global tobacco epidemic. *Annu Rev Public Health* 2016; 37: 149–166.
3 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: 2337–2360.
4 Burki TK. WHO releases latest report on the global tobacco epidemic. *Lancet Oncol* 2021; 22: 1217.
5 Semple S, Dobson R, O'Donnell R, *et al.* Smoke-free spaces: a decade of progress, a need for more? *Tob Control* 2022; 31: 250–256.
6 Castaldelli-Maia JM, Harutyunyan A, Herbec A, *et al.* Tobacco dependence treatment for special populations: challenges and opportunities. *Braz J Psychiatry* 2020; 43: 75–82.
7 Polosa R, Thomson NC. Smoking and asthma: dangerous liaisons. *Eur Respir J* 2013; 41: 716–726.
8 Whittaker R, McRobbie H, Bullen C, *et al.* Mobile phone-based interventions for smoking cessation. *Cochrane Database Syst Rev* 2016; 4: CD006611.
9 Ortis A, Caponnetto P, Polosa R, *et al.* A report on smoking detection and quitting technologies. *Int J Environ Res Public Health* 2020; 17: 2614.

10 The Lancet Respiratory Medicine. Pandemic fans the flames of smoking and health inequity. *Lancet Respir Med* 2021; 9: 435.
11 Kim J, Lee S. Impact of the COVID-19 pandemic on tobacco sales and national smoking cessation services in Korea. *Int J Environ Res Public Health* 2022; 19: 5000.
12 Reddel HK, Bacharier LB, Bateman ED, *et al.* Global Initiative for Asthma Strategy 2021: executive summary and rationale for key changes. *Eur Respir J* 2022; 59: 2102730.
13 Thomson NC, Chaudhuri R, Livingston E. Asthma and cigarette smoking. *Eur Respir J* 2004; 24: 822–833.
14 Ciaccio CE, Gurley-Calvez T, Shireman TI. Indoor tobacco legislation is associated with fewer emergency department visits for asthma exacerbation in children. *Ann Allergy Asthma Immunol* 2016; 117: 641–645.
15 Polosa R, Caponnetto P, Sands MF. Caring for the smoking asthmatic patient. *J Allergy Clin Immunol* 2012; 130: 1221–1224.
16 Watai K, Sekiya K, Hayashi H, *et al.* Effects of short-term smoking on lung function and airway hyper-responsiveness in young patients with untreated intermittent adult-onset asthma: retrospective cross-sectional study at a primary-tertiary care hospital in Japan. *BMJ Open* 2019; 9: e023450.
17 Safiri S, Carson-Chahhoud K, Karamzad N, *et al.* Prevalence, deaths, and disability-adjusted life-years due to asthma and its attributable risk factors in 204 countries and territories, 1990–2019. *Chest* 2022; 161: 318–329.
18 Jayes L, Haslam PL, Gratziou CG, *et al.* SmokeHaz: systematic reviews and meta-analyses of the effects of smoking on respiratory health. *Chest* 2016; 150: 164–179.
19 Anand V, McGinty KL, O'Brien K, *et al.* E-cigarette use and beliefs among urban public high school students in North Carolina. *J Adolesc Health* 2015; 57: 46–51.
20 Lee A, Lee SY, Lee KS. The use of heated tobacco products is associated with asthma, allergic rhinitis, and atopic dermatitis in Korean adolescents. *Sci Rep* 2019; 9: 17699.
21 Palamidas A, Tsikrika S, Katsaounou PA, *et al.* Acute effects of short term use of ecigarettes on airways physiology and respiratory symptoms in smokers with and without airway obstructive diseases and in healthy non smokers. *Tob Prev Cessat* 2017; 3: 5.
22 Osei AD, Mirbolouk M, Orimoloye OA, *et al.* The association between e-cigarette use and asthma among never combustible cigarette smokers: behavioral risk factor surveillance system (BRFSS) 2016 & 2017. *BMC Pulm Med* 2019; 19: 180.
23 Westergaard CG, Porsbjerg C, Backer V. The effect of smoking cessation on airway inflammation in young asthma patients. *Clin Exp Allergy* 2014; 44: 353–361.
24 Strzelak A, Ratajczak A, Adamiec A, *et al.* Tobacco smoke induces and alters immune responses in the lung triggering inflammation, allergy, asthma and other lung diseases: a mechanistic review. *Int J Environ Res Public Health* 2018; 15: 1033.
25 Chaudhuri R, Livingston E, McMahon AD, *et al.* Effects of smoking cessation on lung function and airway inflammation in smokers with asthma. *Am J Respir Crit Care Med* 2006; 174: 127–133.
26 Perret JL, Bonevski B, McDonald CF, *et al.* Smoking cessation strategies for patients with asthma: improving patient outcomes. *J Asthma Allergy* 2016; 9: 117–128.
27 Tønnesen P, Pisinger C, Hvidberg S, *et al.* Effects of smoking cessation and reduction in asthmatics. *Nicotine Tob Res* 2005; 7: 139–148.
28 Westergaard CG, Porsbjerg C, Backer V. The effect of Varenicline on smoking cessation in a group of young asthma patients. *Respir Med* 2015; 109: 1416–1422.
29 Gratziou C, Florou A, Ischaki E, *et al.* Smoking cessation effectiveness in smokers with COPD and asthma under real life conditions. *Respir Med* 2014; 108: 577–583.
30 Tønnesen P, Lawrence D, Tonstad S. Medication-assisted quit rates in participants with smoking-related diseases in EAGLES: post hoc analyses of a double-blind, randomized, placebo-controlled clinical trial. *Tob Induc Dis* 2022; 20: 46.
31 Christenson SA, Smith BM, Bafadhel M, *et al.* Chronic obstructive pulmonary disease. *Lancet* 2022; 399: 2227–2242.
32 Yang IA, Jenkins CR, Salvi SS. Chronic obstructive pulmonary disease in never-smokers: risk factors, pathogenesis, and implications for prevention and treatment. *Lancet Respir Med* 2022; 10: 497–511.
33 Scanlon PD, Connett JE, Waller LA, *et al.* Smoking cessation and lung function in mild-to-moderate chronic obstructive pulmonary disease. The Lung Health Study. *Am J Respir Crit Care Med* 2000; 161: 381–390.
34 Simmons MS, Connett JE, Nides MA, *et al.* Smoking reduction and the rate of decline in FEV_1: results from the Lung Health Study. *Eur Respir J* 2005; 25: 1011–1017.
35 Josephs L, Culliford D, Johnson M, *et al.* Improved outcomes in ex-smokers with COPD: a UK primary care observational cohort study. *Eur Respir J* 2017; 49: 1602114.
36 Tønnesen P, Carrozzi L, Fagerström KO, *et al.* Smoking cessation in patients with respiratory diseases: a high priority, integral component of therapy. *Eur Respir J* 2007; 29: 390–417.
37 Jiménez-Ruiz CA, Masa F, Miravitlles M, *et al.* Smoking characteristics: differences in attitudes and dependence between healthy smokers and smokers with COPD. *Chest* 2001; 119: 1365–1370.

38 Jiménez-Ruiz CA, Lewis KE. COPD patients. *In:* Belo Ravara S, Dağli E, Katsaounou P, *et al.* Supporting Tobacco Cessation (ERS Monograph). Sheffield, European Respiratory Society, 2021; pp. 154–164.
39 Nides M, Rand C, Dolce J, *et al.* Weight gain as a function of smoking cessation and 2-mg nicotine gum use among middle-aged smokers with mild lung impairment in the first 2 years of the Lung Health Study. *Health Psychology* 1994; 13: 354.
40 Tøttenborg SS, Clark AJ, Thomsen RW, *et al.* Socioeconomic inequality in the use of prescription medications for smoking cessation among patients with COPD: a nationwide study. *Int J Chron Obstruct Pulmon Dis* 2018; 13: 1775–1781.
41 Kwak MJ, Kim J, Bhise V, *et al.* National trends in smoking cessation medication prescriptions for smokers with chronic obstructive pulmonary disease in the United States, 2007–2012. *J Prev Med Public Health* 2018; 51: 257–262.
42 Chen-Yuan C. After UPLIFT: smoking cessation remains the best intervention in smokers with COPD. *Int J Tuberc Lung Dis* 2009; 13: 151–152.
43 Warnier MJ, van Riet EE, Rutten FH, *et al.* Smoking cessation strategies in patients with COPD. *Eur Respir J* 2013; 41: 727–734.
44 van Eerd EA, van der Meer RM, van Schayck OC, *et al.* Smoking cessation for people with chronic obstructive pulmonary disease. *Cochrane Database Syst Rev* 2016; 8: CD010744.
45 Cahill K, Lindson-Hawley N, Thomas KH, *et al.* Nicotine receptor partial agonists for smoking cessation. *Cochrane Database Syst Rev* 2016; 5: CD006103.
46 Hartmann-Boyce J, Chepkin SC, Ye W, *et al.* Nicotine replacement therapy *versus* control for smoking cessation. *Cochrane Database Syst Rev* 2018; 5: CD000146.
47 Howes S, Hartmann-Boyce J, Livingstone-Banks J, *et al.* Antidepressants for smoking cessation. *Cochrane Database Syst Rev* 2020; 4: CD000031.
48 Tønnesen P, Mikkelsen K, Bremann L. Nurse-conducted smoking cessation in patients with COPD using nicotine sublingual tablets and behavioral support. *Chest* 2006; 130: 334–342.
49 Strassmann R, Bausch B, Spaar A, *et al.* Smoking cessation interventions in COPD: a network meta-analysis of randomised trials. *Eur Respir J* 2009; 34: 634–640.
50 Tashkin D, Kanner R, Bailey W, *et al.* Smoking cessation in patients with chronic obstructive pulmonary disease: a double-blind, placebo-controlled, randomised trial. *Lancet* 2001; 357: 1571–1575.
51 Wagena EJ, Knipschild PG, Huibers MJ, *et al.* Efficacy of bupropion and nortriptyline for smoking cessation among people at risk for or with chronic obstructive pulmonary disease. *Arch Intern Med* 2005; 165: 2286–2292.
52 Tashkin DP, Rennard S, Hays JT, *et al.* Effects of varenicline on smoking cessation in patients with mild to moderate COPD: a randomized controlled trial. *Chest* 2011; 139: 591–599.
53 Gonzales D, Rennard SI, Nides M, *et al.* Varenicline, an alpha4beta2 nicotinic acetylcholine receptor partial agonist, *vs* sustained-release bupropion and placebo for smoking cessation: a randomized controlled trial. *JAMA* 2006; 296: 47–55.
54 Jorenby DE, Hays JT, Rigotti NA, *et al.* Efficacy of varenicline, an alpha4beta2 nicotinic acetylcholine receptor partial agonist, *vs* placebo or sustained-release bupropion for smoking cessation: a randomized controlled trial. *JAMA* 2006; 296: 56–63.
55 Williams KE, Reeves KR, Billing CB Jr, *et al.* A double-blind study evaluating the long-term safety of varenicline for smoking cessation. *Curr Med Res Opin* 2007; 23: 793–801.
56 Jiménez-Ruiz CA, Garcia Rueda M, Martinez Muñiz MA, *et al.* Varenicline in smokers with severe or very severe COPD after 24 weeks of treatment. A descriptive analysis: VALUE study. *Monaldi Arch Chest Dis* 2017; 87: 874.
57 Kotz D, Viechtbauer W, Simpson CR, *et al.* Cardiovascular and neuropsychiatric risks of varenicline and bupropion in smokers with chronic obstructive pulmonary disease. *Thorax* 2017; 72: 905–911.
58 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: 2507–2520.
59 Tulloch H, Pipe A, Els C, *et al.* Flexible and extended dosing of nicotine replacement therapy or varenicline in comparison to fixed dose nicotine replacement therapy for smoking cessation: rationale, methods and participant characteristics of the FLEX trial. *Contemp Clin Trials* 2014; 38: 304–313.
60 Rose JE, Behm FM. Combination treatment with varenicline and bupropion in an adaptive smoking cessation paradigm. *Am J Psychiatry* 2014; 171: 1199–1205.
61 Cosentino F, Grant PJ, Aboyans V, *et al.* 2019 ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD. *Eur Heart J* 2020; 41: 255–323.
62 American Diabetes Association. 5. Facilitating behavior change and well-being to improve health outcomes: Standards of Medical Care in Diabetes – 2020. *Diabetes Care* 2020; 43: Suppl. 1, S48–S65.

63 Driva S, Korkontzelou A, Tonstad S, *et al.* The effect of smoking cessation on body weight and other metabolic parameters with focus on people with type 2 diabetes mellitus. *Int J Environ Res Public Health* 2022; 19: 13222.

64 Georges A, Galbiati L, Clair C. Smoking in men and women with type 2 diabetes: a qualitative gender-sensitive exploration of barriers to smoking cessation among people with type 2 diabetes. *PLoS One* 2019; 14: e0221783.

65 Pantazopoulos I, Tsikrika S, Kolokytha S, *et al.* Management of COVID-19 patients in the emergency department. *J Pers Med* 2021; 11: 961.

66 Cavallo DA, Krishnan-Sarin S. Nicotine use disorders in adolescents. *Pediatr Clin North Am* 2019; 66: 1053–1062.

67 Fouad H, Commar A, Hamadeh R, *et al.* Estimated and projected prevalence of tobacco smoking in males, Eastern Mediterranean Region, 2000–2025. *East Mediterr Health J* 2021; 27: 76–82.

68 Marcon A, Pesce G, Calciano L, *et al.* Trends in smoking initiation in Europe over 40 years: a retrospective cohort study. *PLoS One* 2018; 13: e0201881.

69 Bancej C, O'Loughlin J, Platt RW, *et al.* Smoking cessation attempts among adolescent smokers: a systematic review of prevalence studies. *Tob Control* 2007; 16: e8.

70 Fanshawe TR, Halliwell W, Lindson N, *et al.* Tobacco cessation interventions for young people. *Cochrane Database Syst Rev* 2017; 11: CD003289.

71 Mannocci A, Backhaus I, D'Egidio V, *et al.* What public health strategies work to reduce the tobacco demand among young people? An umbrella review of systematic reviews and meta-analyses. *Health Policy* 2019; 123: 480–491.

72 Mahajan SD, Homish GG, Quisenberry A. Multifactorial etiology of adolescent nicotine addiction: a review of the neurobiology of nicotine addiction and its implications for smoking cessation pharmacotherapy. *Front Public Health* 2021; 9: 664748.

73 Vallata A, O'Loughlin J, Cengelli S, *et al.* Predictors of cigarette smoking cessation in adolescents: a systematic review. *J Adolesc Health* 2021; 68: 649–657.

74 Rios LE, Herval ÁM, Ferreira RC, *et al.* Prevalences of stages of change for smoking cessation in adolescents and associated factors: systematic review and meta-analysis. *J Adolesc Health* 2019; 64: 149–157.

75 Bricca A, Swithenbank Z, Scott N, *et al.* Predictors of recruitment and retention in randomized controlled trials of behavioural smoking cessation interventions: a systematic review and meta-regression analysis. *Addiction* 2022; 117: 299–311.

76 Thrul J, Stemmler M, Goecke M, *et al.* Are you in or out? Recruitment of adolescent smokers into a behavioral smoking cessation intervention. *Addict Behav* 2015; 45: 150–155.

77 Ranabhat CL, Kim CB, Park MB, *et al.* Situation, impacts, and future challenges of tobacco control policies for youth: an explorative systematic policy review. *Front Pharmacol* 2019; 10: 981.

78 STOP. Big tobacco's investments in and acquisitions of pharmaceutical companies. Date last updated: February 2022. https://exposetobacco.org/wp-content/uploads/STOP-Pharma-Brief-3.15.22.pdf

79 O'Connor R, Schneller LM, Felicione NJ, *et al.* Evolution of tobacco products: recent history and future directions. *Tob Control* 2022; 31: 175–182.

80 Philip Morris International. Our science: new research suggests potential positive public health impact of introducing smoke-free products. Date last updated: 7 November 2022. Date last accessed: 8 December 2022. https://www.pmi.com/our-science/new-research-japan-positive-public-health-impact-of-smoke-free-products

81 World Health Organization. New products, old tricks? Concerns big tobacco is targeting youngsters. Date last updated: 24 February 2021. Date last accessed: 8 December 2022. https://www.who.int/news-room/feature-stories/detail/new-products-old-tricks-concerns-big-tobacco-is-targeting-youngsters

82 Philip Morris International. Philip Morris International progresses toward sole ownership of Swedish Match, further supporting our ambition to deliver a smoke-free future. Date last updated: 5 December 2022. Date last accessed: 8 December 2022. https://www.pmi.com/media-center/news/PMI-progresses-toward-sole-ownership-of-swedish-match

83 Dunkley E. Tobacco giant Philip Morris will stop selling cigarettes in Britain within the next ten years marking the end of the Marlboro brand on UK shelves after a century – as it looks to push less harmful 'modern alternatives'. Date last updated: 25 July 2021. Date last accessed: 11 December 2022. https://www.dailymail.co.uk/news/article-9822189/Tobacco-giant-Philip-Morris-stop-selling-cigarettes-Britain-ten-years.html

84 BAT. News release: BAT calls for collaboration to accelerate tobacco harm reduction. Date last updated: 29 September 2022. Date last accessed: 8 December 2022. https://www.bat.com/group/sites/UK__9D9KCY.nsf/vwPagesWebLive/DOCJPHZN

85 Dewhirst T. 'Beyond nicotine' marketing strategies: Big Tobacco diversification into the vaping and cannabis product sectors. *Tob Control* 2023; 32: 402–404.

86 Virginia Mercury. Altria joins lobbying effort on marijuana legalization in Virginia. Date last updated: 9 February 2021. Date last accessed: 11 December 2022. https://www.virginiamercury.com/blog-va/altria-joins-lobbying-effort-on-marijuana-legalization-in-virginia/

Suggested answers

1. The combination of motivational interview counselling with high-level, evidence-based pharmaceutical therapy presents the highest success rates in tobacco cessation.
2. Tobacco smoking and environmental tobacco exposure increase the risk of asthma exacerbation and deterioration of poor control of asthma symptoms.
3. True. Tobacco cessation improves the course and outcome of COPD patients including spirometric results, inflammatory biomarkers and chronic respiratory symptoms.
4. Quitting smoking is very difficult to achieve among adolescents, as relapse rates are high and nicotine is strongly addictive.