

MINI-REVIEW

Present status and future perspectives on the tobacco and nicotine epidemic with a focus on men: a narrative review

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Abstract

Tobacco smoking is one of the main factors of disease burden worldwide. This narrative review presents an overview of this burden, focusing primarily on men. We also discuss the prevention strategies that have been implemented to address this issue, including tobacco control policies, stemming mainly from the World Health Organization Framework Convention on Tobacco Control, as well as lung cancer screening programmes. Additionally, we comment on how the tobacco epidemic has given rise to the widespread use of nicotine due to the popularisation of novel nicotine and tobacco-related products, including electronic nicotine and non-nicotine delivery systems, heated tobacco and nicotine pouches.

Keywords

Lung cancer; Male; Nicotine; Smoking; Tobacco control

1. Introduction

1.1 Global burden of tobacco use

Tobacco smoking is one of the main preventable risk factors for premature morbidity and mortality worldwide. Indeed, smoking is causally associated with multiple conditions, including various types of cancers (*e.g.*, lung cancer), respiratory (*e.g.*, chronic obstructive pulmonary disease), cardiovascular (*e.g.*, coronary disease) and metabolic diseases (*e.g.*, diabetes). In 2019, smoking was responsible for 7.7 million deaths globally, including the death of 6.2 million males [1]. Overall, among males, approximately one in five deaths is associated with smoking [1]. Smoking-related mortality is disproportionately high in males compared to females, potentially due to the high prevalence of smoking and earlier initiation of smoking among males, since in developed countries, males began smoking decades before females. This pattern aligns with descriptive models that explain the lag between smoking prevalence and smoking-specific mortality [2]. Additionally, the mortality burden associated with secondhand-smoke exposure is significant, such that there were approximately 1.29 million of global deaths attributable to secondhand-smoke exposure in 2021 [3]. Besides its negative effects on health, smoking poses an enormous toll on the economy [4] and contributes to environmental pollution [5].

1.2 Tobacco control policies and lung cancer screening

Given the multiple deleterious effects of the tobacco epidemic, tobacco control policies have been implemented at various

levels. Tobacco control policies primarily stem from the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) [6], which is the most relevant treaty on tobacco control worldwide. Besides, the WHO has released guidelines for implementation of different FCTC Articles and the MPOWER package [7] to promote the execution of the WHO FCTC at an international level. These MPOWER measures aim to monitor tobacco use, protect people from tobacco smoke, offer quitting guidances, warn about the dangers of tobacco, enforce tobacco advertising promotion and sponsorship (TAPS), and raise taxes on tobacco. There is still room for improvement in the worldwide implementation of these measures since only one domain is implemented at the highest level in over 100 countries (*i.e.*, policies regulating graphic warnings in packs) [8]. Approximately 38% of the countries have monitoring systems to collect recent, representative and periodic data of tobacco use for adults and adolescents. This percentage is equal to that of countries with complete policy implementation to regulate smoke-free environments. Globally, only 32 countries have complete policies in place for cessation services. Complete implementation of the TAPS policy is also scarce, with only 66 countries that have achieved complete policy implementation. In terms of tobacco taxation, the proportion of policy-adopting countries drops to just over 20%. Due to tobacco control efforts, the prevalence of tobacco smoking has decreased [9, 10], such that there is a global reduction in the age-standardized prevalence of tobacco smoking in males by 27.5% from 1990 to 2019 [1]. Despite this reduction, however, the estimated prevalence of tobacco use in males aged 15 and older in 2020 remains high at 36.7% [11]. As a result, it is expected that the burden of disease associated with

tobacco smoking will continue to be significant for the decades to come.

Among the smoking-related conditions, lung cancer poses a particularly high disease burden, with over 60% of lung cancer deaths occurring in smokers [1], and a 5-year survival rate from diagnosis that is less than 20% [12]. Notably, there is an approximate 30 years lag between the initiation of tobacco smoking and lung cancer mortality [13]. In 2020, 2.2 million new cases of lung cancer and 1.8 million of deaths have been estimated to have occurred across both sexes [14]. In males, lung cancer contributes to 21.5% of the mortality and 14.3% of the cancer-attributable incidence [14].

Although the most effective strategy to reduce lung cancer incidence (and hence mortality), as outlined in tobacco control policies, is primary prevention (*i.e.*, no initiation and smoking cessation) [15], some young adults in new generations continue to take up smoking, while some current smokers fail to achieve cessation permanently. In addition, although lung cancer risk decreases following smoking cessation, former smokers still have a higher risk of developing lung cancer than those who have never smoked [16]. Therefore, a number of trials for lung cancer screening using low-dose computed tomography (LDCT) have been carried out worldwide [17]. The most relevant trials, considering the number of participants recruited, were the National Lung Screening Trial (NLST) in the United States [18] and the Nederlands Leuvens Screening Onderzoek (Dutch Belgian randomized lung cancer screening: NELSON trial) [19]. In the NLST trial, the group receiving LDCT demonstrated a 20.0% decrease in lung cancer-specific mortality in comparison to the group receiving chest X-ray. This finding prompted a grade B recommendation from the US Preventive Services Task Force (USPSTF) in 2013 to promote annual lung cancer screening with LDCT in high-risk population [20]. In the ten years follow-up of the NELSON trial, the group receiving LDCT had a 24% and 33% reduction of lung cancer mortality for males and females, respectively [19]. Relevantly, up to 57% of lung cancers are diagnosed at stage IV as an incidental finding in the general population, at which the prognosis is poor. In contrast, an estimated 77% of lung cancers diagnosed via a lung cancer screening program using LDCT are in phase I, which has a much better prognosis [21].

Given the accumulating evidence on the efficacy of LDCT in reducing lung cancer-specific and all-cause mortality [22], the European Commission recommended advancing studies on the effectiveness of lung cancer screening and the feasibility of implementing lung cancer screening programs in Europe [23]. As of today, various associations and organizations in Europe and the US, including still the USPSTF [24], recommend the implementation of these screening programs.

1.3 From the tobacco epidemic to the nicotine epidemic

In response to the decreasing trend in tobacco smoking due to the efforts in tobacco control, the loss of profit in different regions worldwide and the new demands of users [25], the tobacco industry began the development and commercialisation of novel tobacco and nicotine products. This has shifted the

public health concern from a tobacco epidemic to a nicotine epidemic. These novel products primarily include electronic nicotine and non-nicotine delivery systems (EN(N)DS) (*e.g.*, e-cigarettes), heated tobacco products (HTP) (*e.g.*, IQOS by Philip Morris) and nicotine pouches. While EN(N)DS are devices that aerosolize a liquid (most often containing nicotine), HTP are devices that heat tobacco without combustion, also generating aerosols. Nicotine pouches, which are among the most recent additions to the market, consist of small pouches placed between the lip and gum, often containing synthetic nicotine and other components.

As part of the tobacco harm reduction approach, the marketing of these products has been accompanied by the tobacco industry's claims of lower health risks associated with the use of these forms of nicotine intake as opposed to smoking combustible products [26]. While the long-term risk profile of these novel products are yet to be fully assessed, including their benefit-risk balance as an alternative to combustible tobacco products from a public health perspective, there is substantial evidence supporting the fact that using these products is not as safe as abstaining from any tobacco or nicotine product. In terms of e-cigarettes, while there is evidence of the effectiveness of the use of ENDS to increase quit rates in comparison to nicotine replacement therapies [27], there is also evidence of the deleterious short-term health effects associated with its use. These effects include poisoning, toxicity and e-cigarette or vaping product use-associated lung injury (EVALI) [28], a severe pulmonary disease associated with the inclusion of vitamin E acetate in tetrahydrocannabinol e-liquids [29]. Long-term clinical outcomes regarding the use of e-cigarettes are still unknown [28]. On the other hand, evidence regarding the effectiveness of HTP as a method for smoking cessation is not available [30]. While the concentration of certain risk markers appears to be lower in HTP-users than continuing smokers, alterations in mitochondrial functions and microbial adherence to the respiratory tract have been described [31].

Most importantly, novel tobacco and nicotine products have been associated with a gateway effect in adolescents and young adults, who are the primary target population of these products due to their appealing designs (*e.g.*, modern formats, striking colours for some of their components). The gateway effect occurs when the use of these products hooks new consumers into nicotine intake, increasing the risk of practicing combustible tobacco smoking in the future [32, 33]. In the general population of Europe, around 59% of e-cigarette users and 79% of HTP users use these products concurrently with combustible tobacco (*i.e.*, they are dual users) [34]. As a consequence of this pattern of tobacco intake among the new generations, objectives such as those outlined in the European Union's Europe Beating Cancer Plan, which aims to achieve a prevalence of tobacco use under 5% by 2040 [35] may be jeopardized.

2. Conclusions

Despite the implementation of tobacco control measures and other prevention activities, the disease burden posed by smoking remains high. Although this burden has increased among women in recent years due to the rise in smoking prevalence in recent decades, the burden is still higher among men today.

Furthermore, public health efforts carried out so far may be hindered by the emergence of novel nicotine and tobacco products, which have transformed the tobacco epidemic into a nicotine epidemic.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

AUTHOR CONTRIBUTIONS

AGM—wrote the manuscript. The author contributed to editorial changes in the manuscript. The author read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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