

How does the Excise Tax Affect Secondhand Smokers and the Health Consequences of such Addiction?

BEDNÁROVÁ, L.¹, ŠIMKOVÁ, Z.¹, BEHÚNOVÁ, A.¹, WOZNY, A.²

1 | Technical University in Košice, Faculty of Mining, Ecology, Process Control and Geotechnologies, Košice, Slovakia

2 | Technical University in Rzeszow, Faculty of Management, Poland

Citation | Bednárová, L., Šimková, Z., Behúnová, A., & Wozny, A. (2023). How does the excise tax affect secondhand smokers and the health consequences of such addiction? *Adiktologie*, 23(2), 123–136. <https://doi.org/10.35198/01-2023-001-0005>

INTRODUCTION: Smoking and tobacco products are long-term tolerated and socially accepted in many societies. In some socioeconomic groups and regions, this is considered standard practice. One of the ways to limit not only direct but also secondary smoking is an increase in the tax burden and an effective anti-smoking campaign. Adults exposed to secondhand smoke have a higher chance of acquiring coronary heart disease, stroke, and lung cancer as they age. Secondhand smoking has significant negative effects on the cardiovascular system and has been related to coronary heart disease and stroke in individuals who are susceptible. **METHODS:** The sources of data for this research were publicly available from the World Health Organization (WHO), Office on Smoking and Health, Global Information System on Alcohol and Health (GISAH), Center for Chronic Disease Prevention (CDC), Tax Foundation, and Eurostat. In the paper, selected scientific methods are used (analysis, synthesis, induction, and deduction). For the literature review, Scopus and Web of Science (WoS) were used.

RESULTS: Based on the information obtained, it can be proven that in countries with a higher tax burden, the consumption of cigarettes has decreased, but the consumption of alternative tobacco products has increased. Eliminating smoking is the only way to fully protect people from secondhand smoke exposure. The damage caused by passive smoking is possible to prevent. Eliminating smoking is the only way, which can to fully protect people from second-hand smoke, thus protecting lives and reducing the cost burden on the health sector. **CONCLUSIONS:** In many countries, it was confirmed so that higher tax led to lower consumption of tobacco and cigarettes. With that spectacular tool as a tax, we also can confirm the positive impact on secondhand smokers. For example, we can use information from New Zealand, which earns from Scorecard, scoring 4.63 on a scale of 5 by decreasing using cigarettes because of the high tax level.

Keywords | Secondhand Smoker (SHS) – Excise Tax – Cigarettes – Consumption – Public Health

Submitted | 11 April 2023

Accepted | 15 May 2023

Grant affiliation | This research was funded by Scientific Grant Agency MESRaS SR a SAV VEGA 1/0590/22, Slovak Research and Development Agency under the contract No. APVV-21-0188.

Corresponding author | Lucia Bednárová, Technical University in Košice, Faculty of Mining, Ecology, Process Control and Geotechnologies, Park Komenského 19, 04001 Košice Slovakia

lucia.bednarova@tuke.sk

1 INTRODUCTION

Smoking remains the number one cause of death worldwide. Tobacco use is the largest avoidable behavioral health risk factor in the European Union and the most significant cause of premature death in EU countries, accounting for approximately 700,000 deaths per year and 8 million worldwide people. Statistics are clear that cigarette smoke kills more people than all violent deaths combined, including accidents, crimes, and suicides. Smoking was responsible for one in five cancers in European countries in 2018, despite an increase in tobacco control programs. Strengthening tobacco control strategies and promoting compliance are key to reducing the burden of cancer in the future. Every smoker or non-smoker is aware that cigarettes are harmful, but even so, it is very, very difficult to get rid of the addiction. The global smoking epidemic resulted in 100 million deaths in the 20th century, and unless effective measures are put in place, tobacco will kill a billion people in the 21st century. In 2020, 22.3% of the world's population used tobacco (WHO, 2022c). Despite all the consequences mentioned above, 26% of the adult population smokes in Slovakia. It is an addiction that is a problem, an even bigger problem because of the toxic substances contained in cigarette smoke. Without it, smokers and their surroundings would be exposed to a much lower health risk. Passive smoking today represents a serious problem affecting non-smokers, especially in homes, workplaces, and public places. Evidence on the negative effects of passive smoking has been collected for more than 40 years. Even passive smoking most often affects the respiratory tract. Exposure to secondhand tobacco smoke (SHS) was one of the leading risk factors for deaths globally in 2019, accounting for approximately 1.3 million deaths and contributing to 37 million Disability-Adjusted Life Years (DALYs), with 11.2% of the burden in children under the age of 5 years (TobaccoAtlas, 2022). The World Health Organization (WHO) even associates it with increased severity of illness and death in hospitalized patients with COVID-19 (Papadaki, 2022). WHO has identified the main approaches to tobacco control and reduction: (1) increasing prices through higher taxes; (2) advertising and promotional prohibitions; (3) smoking restrictions; (4) consumer education campaigns; and (5) smoking cessation therapy (Gilbert & Cornus, 2003). Governments in OECD countries use a combination of policies, including increased taxes on tobacco products, bans on smoking in indoor public spaces, restrictions on youth tobacco purchases, advertising restrictions, plain packaging of tobacco products, and other investments in education about the health consequences of tobacco to reduce tobacco consumption (OECD, 2020b).

According to WHO by this day 182 countries ratified this treaty (WHO, 2022d). One of the ways to reduce the purchase of tobacco products and thereby save public finances is a higher tax burden than, for example, in the Scandinavian countries. Taxes are common in everyone's life, so it's nothing new, but they can directly or indirectly affect us in the prices of goods or services and thus also in the selection of the consumer basket. Taxes are commonly found in every person's life (Kolářová et al., 2019). They can influence us either directly or indirectly in the prices of goods or services. Excise taxes are among the indirect taxes, and the most important of this group of taxes are taxes on min-

eral oils since they account for the largest part of the revenues of the state budget. In analyzing the distributional impacts of tobacco taxation, it is not sufficient to only consider the ratio of tax to income at the time the tax is introduced; one should also include the health benefits from reduced consumption in response to a tax. Additionally, different socioeconomic groups respond differently to price changes, and smoking prevalence is also different across socioeconomic groups. As a tax increase on tobacco products aims to reduce both smoking prevalence and the quantity of tobacco consumed, one needs to know the consumption patterns across socioeconomic groups and their responsiveness to price in evaluating whether a tax is regressive or progressive (Summers, 2018). Moreover, as lower socioeconomic groups bear a disproportionately larger morbidity and mortality burden from NCDs (Institute for Health Metrics and Evaluation, 2019), they are likely to bear relatively higher health costs than higher socioeconomic groups. Therefore, lower socioeconomic groups would benefit relatively more through a significant reduction of these indirect costs resulting from reduced consumption (Chaloupka et al., 2023).

2 METHODS

Based on the established research questions, it was necessary to conduct a thorough search of the input information. We decided on this method based on the foundation of a non-systematic literature review performed to identify key sources providing an overview of secondhand smokers together with a literature review of diseases that come from inhalation of cigarettes and tobacco. The search process was performed using PubMed (NCBI), Web of Science, Scopus, CDC, and Healthline online databases as well as WHO and databases from the National Toxicology Program. The search criteria were mainly publications written in English and published between 2006 and 2022. A combination of the following keywords was applied to search for resources: "secondhand smokers", "SHS", "inhalation", and "diseases from exposure to tobacco smoke" and consumption taxes. A total of 56 sources were selected, predominantly research articles, reports, and guidelines. One sub-objective of the research was to examine the relationship between excise tax on tobacco and cigarettes about its influence on purchasing decisions.

Research question no. 1: Are conceptual taxes affecting the consumption of tobacco products?

The second question targeted at the impact of second-hand smoke and its impact on younger age groups from 15 years of age, as well as with regard to the increased morbidity caused by inhaling the given exhalations.

Research question no. 2: How deeply do secondhand smoking (SHS) affect the health and economic system?

3 LITERATURE REVIEW

One of the main arguments from policymakers and other stakeholders in opposition to tobacco taxes is that they are regressive like other indirect taxes. However, the evidence—mostly available for high-income countries but increasingly in low and middle-income countries as well—suggests that this concern may be overstated and that, on the contrary, tobacco tax increases can result in gains in health and welfare for the poor (Sassi et al., 2018). Around 1.3 billion people worldwide used tobacco products in 2020, down from 1.32 billion two years ago. The number of smokers is expected to decrease to 1.27 billion by 2025. This, despite the increase in the global population, indicates a decrease of approximately 50 million users of tobacco products over a seven-year period. Tobacco use is a major risk factor for cardiovascular and respiratory diseases, over 20 different types or subtypes of cancer, and many other debilitating health conditions. In 2020, an estimated 22.3% of the global population aged 15 years and older were current users of some form of tobacco, down from approximately one third (32.7%) in 2000. About one-half of men (49.3%) and one in six women (16.2%) aged 15 years and older in 2000 were current users of some form of tobacco. By 2020, the proportion of men using tobacco had declined to slightly over one in three (36.7%), while that of women had declined to one in thirteen (7.8%; WHO, 2021). Since very limited prevalence data are available from surveys done in 2020 and 2021, the impact of the COVID-19 pandemic on national and global prevalence rates of tobacco use is not yet known. Small-scale studies undertaken during the COVID-19 era have found that levels of tobacco use increased in some instances and decreased in others (Carreras et al., 2021; Denlinger-Apte et al., 2022). There is evidence that tobacco smoking increases the risk of more severe disease progression among those infected with SARS-CoV-2 compared to non-smokers (Alqahtani et al., 2020). Cigarette smoke represents a significant health risk for non-smoking people; therefore, the problem of passive smoking, i.e. inadvertent exposure to cigarette smoke, should not be underestimated by the lay and professional public long after smoking. We can underestimate that health problems appear long after smoking. These substances react with other pollutants in the environment, creating completely new dangerous compounds that affect DNA. They settle around the apartment, even on things that are in another room where, for example, there is no smoking at all. Nicotine is mainly stored in the hair, where it can be detected even after a long time. It was also found in the hair of young children from heavy smoking households, respectively in those children whose mothers did not stop smoking even during pregnancy. Based on studies, it is demonstrable that children of smoker's resort to this bad habit more often than children of non-smokers. Young people are also influenced by the desire to be an adult or to be popular with older peers and in groups. Statistics also show that the first experience with a cigarette does not pass even fourth graders in primary schools.

Analysis of data from Demographic and Health Surveys conducted in 2010–2019 in 49 low- and middle-income countries showed that tobacco smoking among men aged 15–49 years tended to be higher among the poorest and least educated subgroups (Fluharty, 2017) these 49 countries, a median of 25.6%

of men with no education smoked any type of tobacco product compared to 9.1% of those with higher education levels. Similarly, smoking prevalence was highest among men in the poorest quintile, decreasing step-wise across the wealth quintiles (Ansara et al., 2013).

Countries continued to adopt tobacco control measures even during 2019 and 2020, with approximately 5.3 billion people in 146 countries protected by at least one demand-reduction measure at the best practice level. This is an improvement from 2018 when 5.1 billion people in 139 countries were protected in that manner (WHO, 2021).

In addition to the direct effect of cigarette smoke on the smoker, we must not forget the indirect damage to non-smokers who stay in the same room as smokers. This danger increases especially when it comes to children and adolescents. You become a passive smoker as soon as you are forced to remain in closed spaces where smoking is allowed for a longer period of time. When a smoker actively inhales while smoking, the tobacco is burned at a higher temperature, the smoke from it gets primarily into his lungs, and the smoke he exhales is already mixed with air. Research has proven that in smoky rooms without ventilation, the concentration of carbon monoxide rises above the permissible limit for human habitation.

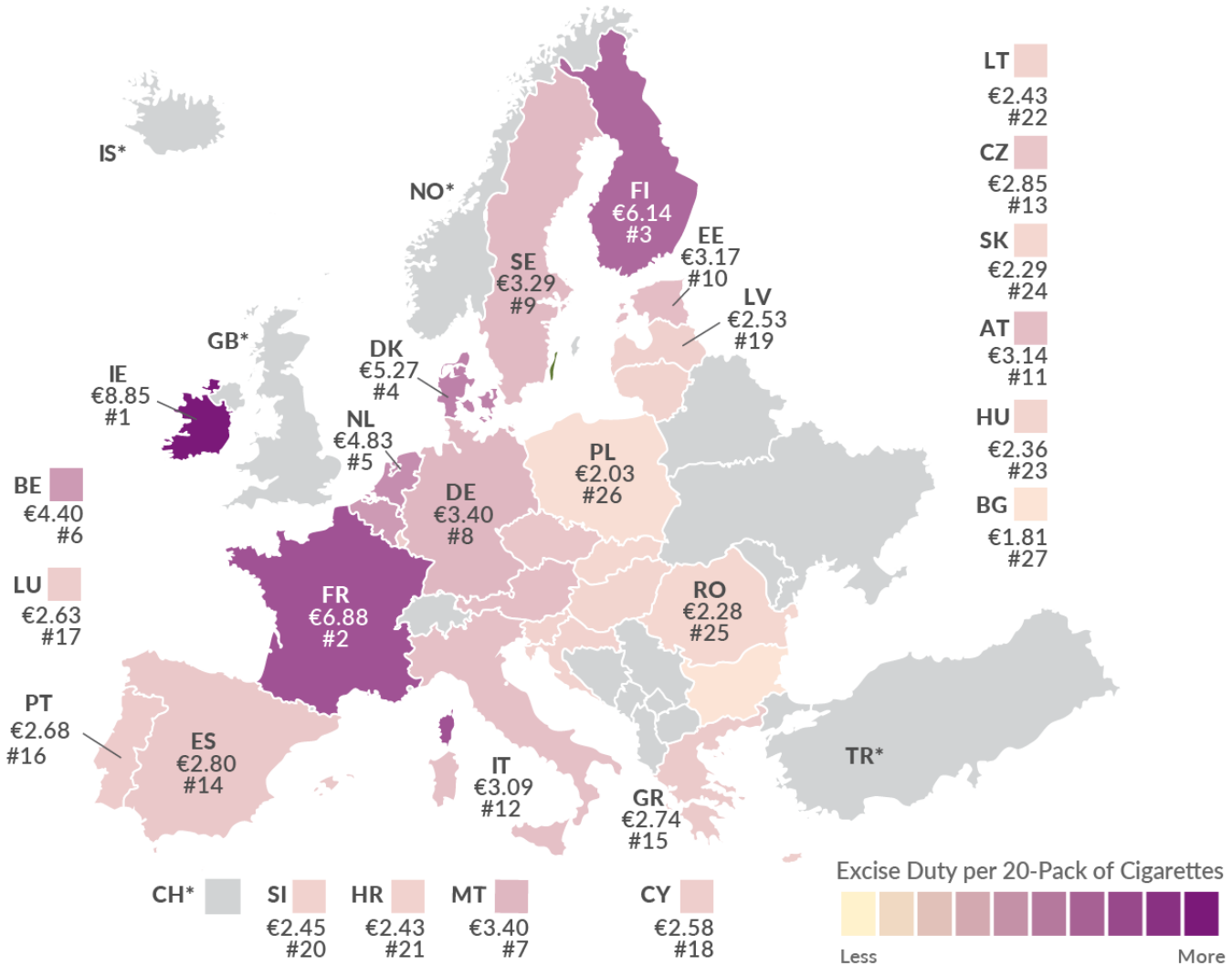
3.1 Tax impact on tobacco and cigarette consumption

Price is a key determinant of tobacco use. While higher prices reduce consumption, cigarettes are relatively price inelastic: an increase in price will result in a less-than-proportional decline in consumption. Therefore, the price must be sufficiently high to reduce consumption enough to generate clear public health benefits. Any metric that compares prices across countries must be based on a measure that considers consumers' purchasing power; in this Scorecard, purchasing power parity (PPP) adjusted prices are used. The highest score goes to a PPP-adjusted price of ten international dollars or higher in 2018, adjusted for inflation, for a pack of 20 of the most-sold brands of cigarettes. On the other side in addition to price, the income also affects demand. Rapid economic growth resulting in increases in income can offset increases in taxes and prices and limit their impact on consumption. Increases in cigarette taxes and prices must be high enough to reduce cigarette affordability and impact use. Shares should be high enough to reduce tobacco use while also allowing governments to gain revenue from the price increase (Townsend et al., 1994). If a price increase results from industry price increases alone—although consumption will fall—the new revenues will go to the tobacco industry. Smokers' main response to price changes is to stop (or start) smoking, to change the number of cigarettes smoked, or to change to a differently priced brand. The data for cigarette consumption combine the first two of these effects (giving more power to detect differences), and so the price elasticities of consumption are mostly higher and more significant than the price elasticities of smoking prevalence (Health and human service, 2010).

Figure 1 | Cigarette taxes in Europe

Cigarette Taxes in Europe

Excise Duty per 20-Pack of Cigarettes in Euros, as of July 2022



Note *Iceland, Norway, Switzerland, Turkey, and the United Kingdom are not part of the European Union (EU).
Source: European Commission, "Taxes in Europe Database."

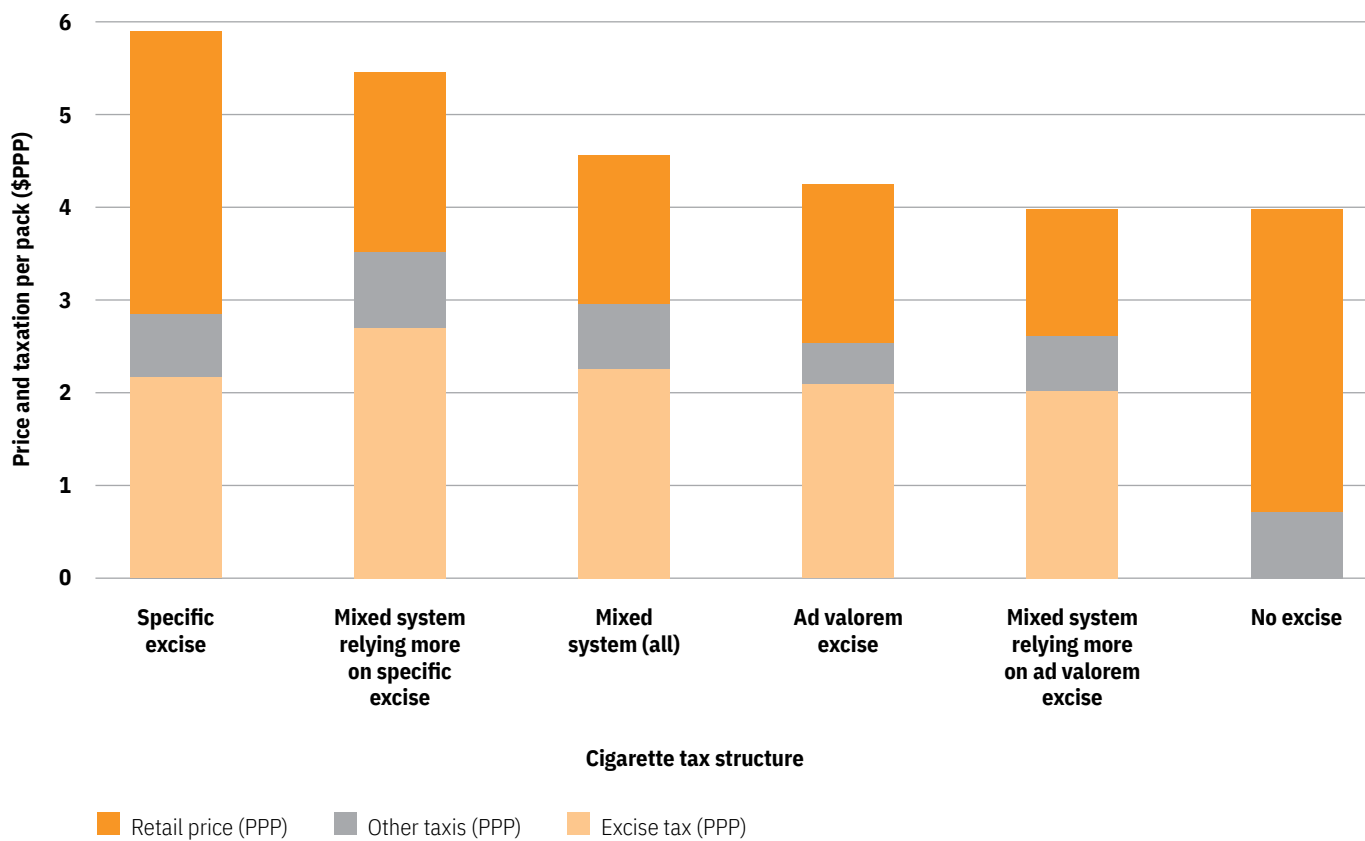
Source: Enache, C. (2022). Cigarette taxes in Europe. Tax Foundation. <https://taxfoundation.org/cigarette-tax-europe-2022/>

In 2020 eight countries received a score of four or higher (twice as many as in 2018), led by Ecuador and New Zealand, scoring 4.63, and followed by the United Kingdom and Canada, with scores of 4.38 and 4.25, respectively. The high scores in Ecuador and New Zealand reflect their very high uniform specific cigarette excise taxes, which result in very high cigarette prices, and regular and significant increases in cigarette taxes in recent years along with adjustments for inflation that have led to reductions in the affordability of cigarettes. Botswana, France, Peru, and Seychelles follow closely behind with overall scores of 4.13. The improvements in the

most recent data show that some governments are making progress in employing tobacco taxes as a public health instrument (Tobacconomics, 2020).

Tobacco taxes are the most effective tobacco control intervention but the least implemented. A sufficiently large tax increase will raise tobacco product prices—making them less affordable—thereby discouraging initiation, encouraging quitting, and driving down consumption. Large tax and price increases prevent tobacco initiation, promote cessation, and reduce overall tobacco consumption *Figure 1*. By reducing tobacco use and

Figure 2 | Cigarette tax structure



Source: Chaloupka, F. J., Powell, L. M., & Warner, K. E. (2019). The use of excise taxes to reduce tobacco, alcohol, and sugary beverage consumption. *Annual Review of Public Health, 40*, 187–201. <https://doi.org/10.1146/annurev-publhealth-040218-043816>

tobacco-induced diseases, higher taxes can alleviate the burden on health systems facing increased strain (The tobacco atlas, 2022). Evidence from every region of the world and from countries at all income levels demonstrates the effectiveness of higher tobacco taxes in reducing tobacco use. On average, tobacco taxes that raise prices by 10% lead to a 4% reduction in overall tobacco use in high-income countries and a 5% reduction in use in low- and middle-income countries. Higher taxes and prices are particularly effective in reducing tobacco use in more vulnerable populations, including youth and lower-income people, given that these groups are particularly sensitive to price (Huesca, 2021).

3.2 Exposure to Secondhand Smoke

The process of passive smoking is characterized by the inhalation of tobacco smoke in indoor and outdoor environments by non-smokers. In addition, passive smoking is also called inhalation of environmental tobacco smoke with the abbreviation ETS (environmental tobacco smoke; Eldridge, 2023). The risk of ETS is primarily based on the fact that while the smoker inhales the particles produced by burning tobacco through a filter, the passive smoker inhales the side stream of smoke without a

filter. The World Health Organization has drawn attention to the risk of serious health complications due to passive smoking in revised recommendations on environmental quality by stating that passive smoking should be recognized as carcinogenic, causing increased morbidity and mortality. Around one-third of the population over the age of 15 smokes in the world (NCI, 2020). An interesting finding is that 80% of all smokers started smoking before their eighteenth birthday. Globally, 47% of men and 12% of women smoke, but these proportions vary from country to country. It is sad that in Central and Eastern Europe around 28% of women smoke. According to the survey, 26% of the adult population smokes in Slovakia. Despite the fact that this percentage has been decreasing for a long time, the age limit when children try smoking for the first time is also decreasing. Despite the fact that this percentage has been decreasing for a long time, the age limit when children try smoking for the first time is decreasing at the same time. The average annual consumption of cigarettes per adult is 2360 cigarettes (50% of smokers have more than 10 cigarettes a day, 5% have more than 20 cigarettes a day; CDC, 2022). The life expectancy of smokers consuming 20–30 cigarettes a day for 30 years is 8 years shorter than the life expectancy of non-smokers. Smoking in Slovakia is still on the rise. There is no safe level of exposure to secondhand smoke as no concentration of smoke

is safe. Tobacco smoke is classified into two types: mainline smoke, which is directly absorbed by the smoker's mouth, and side stream smoke, which is produced by the burning tip of a cigarette mixed with the surrounding air and is referred to as second-hand smoke or passive smoking. Secondhand smoking is also known as environmental tobacco smoke in some quarters. This substance is a mixture of tobacco smoke exhaled by a smoker and smoke produced by burning the cigarette's tip. Breathing in this smoke is commonly referred to as passive smoking in most circles (Health et al., 2016). Active smoking produces smoke as a byproduct, while secondhand smoke is the smoke that is created as a byproduct of active smoking. The majority of it is made up of inhaled mainline and side stream smoke, as well as some air. Exposure to secondhand smoke has been causally linked to adverse health outcomes, including heart disease, stroke, and lung cancer in adults, acute respiratory infections, ear problems, more frequent and severe asthma, and sudden infant death syndrome in children. Being responsible for every year for almost 8 million deaths worldwide, tobacco smoking is the single greatest preventable cause of death globally (WHO, 2021).

To the huge number of deaths attributable to smoking among ever smokers, we also have to add almost 1 million deaths per year among non-smokers who die due to secondhand smoke (SHS) exposure. National factors such as price, health information and promotion, advertising, and restriction on where smoking is allowed can also be powerful influences (Öberg et al., 2011).

Risk reduction also directly affects non-smokers. They are victims of passive smoking when they involuntarily inhale substances that the smoker exhales. Alarming data say that even in Slovakia, an estimated 500 people die every year as a result of second-hand smoke. In addition, they are often diagnosed with diseases that are typical only for smokers. By choosing alternatives, smokers will also affect the lives of non-smokers. Devices for heating tobacco are not a source of passive smoking. Their aerosol does not remain on clothes, in the interior, or in the hair, even in terms of smell. Studies have shown that comprehensive laws prohibiting smoking in all indoor areas of public places, including worksites, restaurants, and bars; voluntary smoke-free rules prohibiting smoking in homes and vehicles at all times; and smoke-free policies in multiunit housing protect nonsmokers from health hazards of secondhand smoke exposure in these environments (Health et al., 2014). The study of the reason for the high level of secondhand smokers group of researchers was responsible for creating *Figure 2*, which should help to eliminate exposure to secondhand smoke.

Secondhand smoke affects anyone near burned or exhaled tobacco, but some groups have the exposure that more smoke:

- **Service industry workers, such as restaurant servers and bartenders:** Anyone who works near groups of smokers may be unable to avoid secondhand smoke.
- **Pregnant women:** Secondhand smoke affects unborn children and their mothers. Lower amounts of oxygen available for the baby can increase fetal

heart rates or lower the birth weight. Women may experience miscarriage, stillbirth, premature delivery, or ectopic pregnancy.

- **Infants, children, and pets:** young children and animals can't always choose to leave a smoke-filled room. The constant exposure increases the harmful effects of secondhand smoke. (CDC, 2020).

3.3 Youth exposure to secondhand smoke

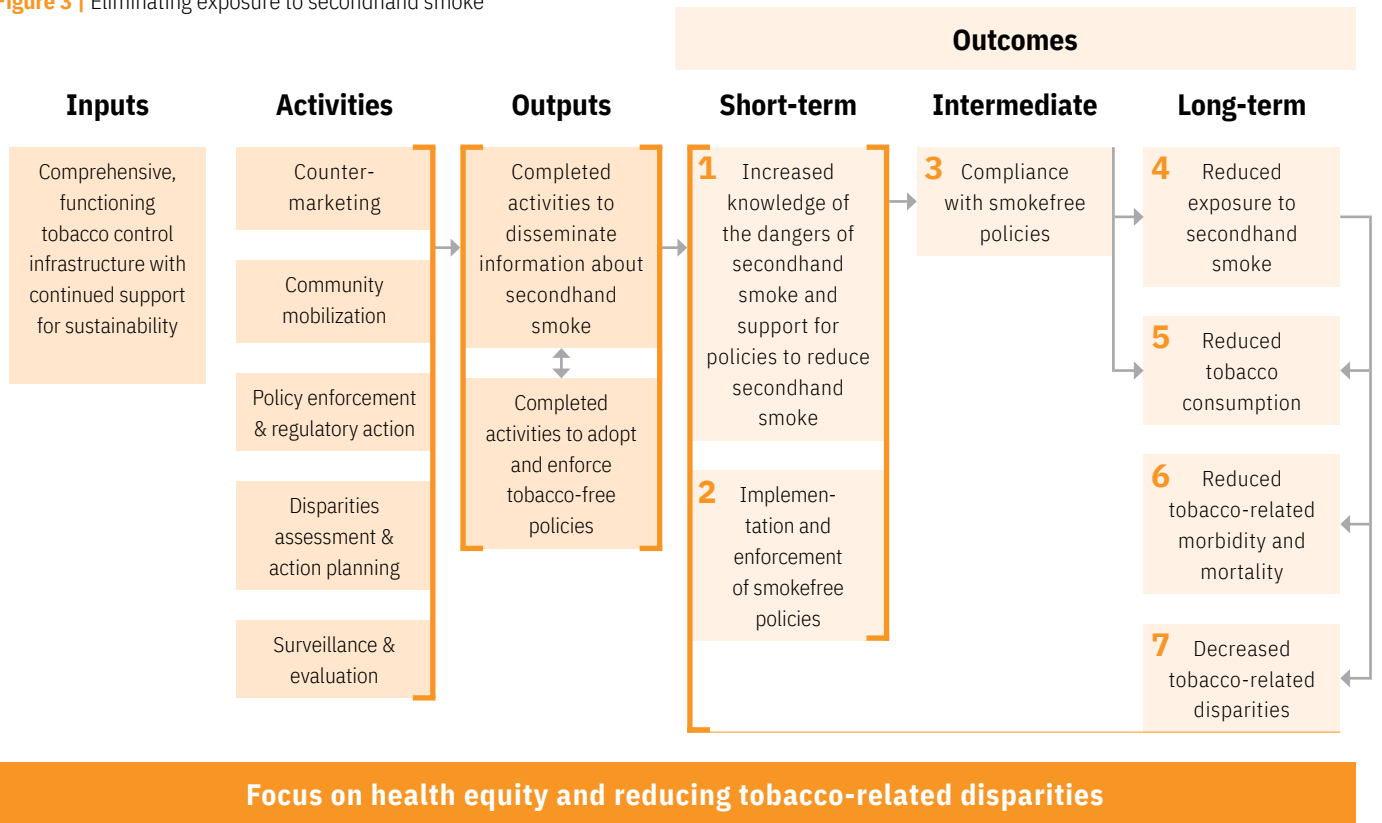
Exposure to secondhand tobacco smoke (SHS) was one of the leading risk factors for deaths globally in 2019, accounting for approximately 1.3 million deaths and contributing to 37 million Disability-Adjusted Life Years (DALYs), with 11.2% of the burden in children under the age of 5 years.

Secondhand smoke (SHS) includes the smoke from the burning end of a cigarette or other smoked tobacco products such as pipes, cigars, etc., and the smoke exhaled by the smoker. It is also referred to as passive smoking, environmental tobacco smoke, and tobacco smoke pollution. It is widely recognized through scientific evidence that there is no safe level of exposure to SHS. It remains in the air for hours after smoked tobacco has been extinguished and can cause or contribute to various adverse health effects in adults and children, even if exposed for a short time.

Evidence shows persistent disparities in secondhand smoke exposure by ethnicity, education, and income level. People with lower educational attainment are typically less knowledgeable about SHS exposure risks. Awareness is also generally lower in low-income countries compared to high-income countries. Youth exposure to secondhand smoke remains an ongoing public health challenge in many countries even though sound policies can largely mitigate it.

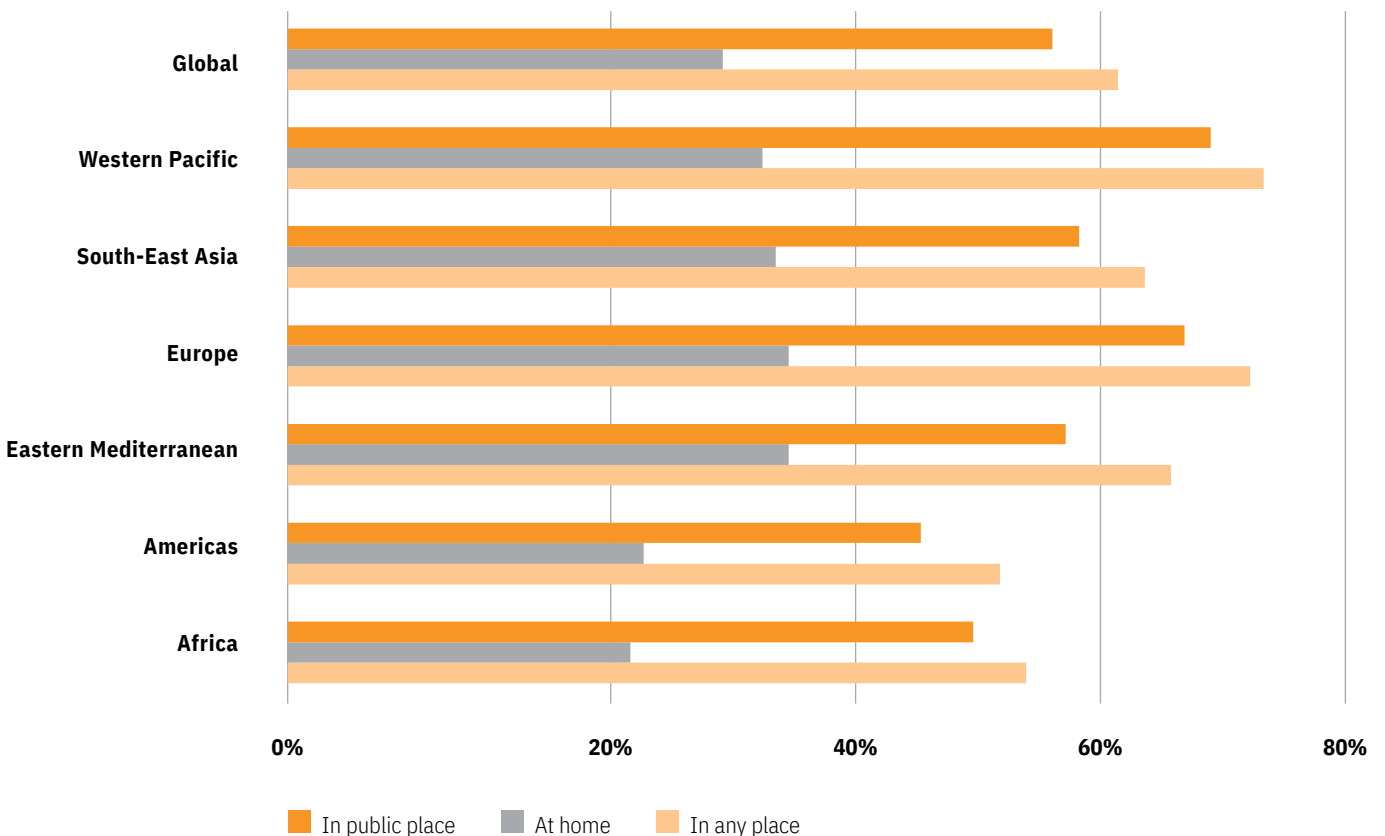
Exposure to secondhand smoke can lead to lung cancer, acute and chronic coronary heart disease (CHD), and eye and nose irritation in adults. Research also shows that CHD risks from passive smoking are essentially indistinguishable from active smoking. Children can suffer from asthma exacerbations, bronchitis and pneumonia, chronic middle ear infections, and chronic respiratory symptoms. Pregnant women exposed to SHS are more likely to have stillbirths and have newborns with congenital malformations and lower birth weights; infants are at significantly higher risk of sudden infant death syndrome (SIDS). The World Health Organization (WHO) Report on the Global Tobacco Epidemic 2021 (RGTE) includes information on smoke-free legislation for 195 countries, and as of 2020, 1.8 billion people in 67 countries are covered by fully smoke-free indoor public spaces, workplaces, and public transport. These 67 countries include 19 high-income countries, 39 middle-income countries, and 9 low-income countries. While these 67 countries (34%) show best practice levels of comprehensive smoke-free bans, there are still 37% of countries and 38% of the world's population with partial smoke-free bans. The remaining 56 countries (29%) fail to comprehensively protect

Figure 3 | Eliminating exposure to secondhand smoke



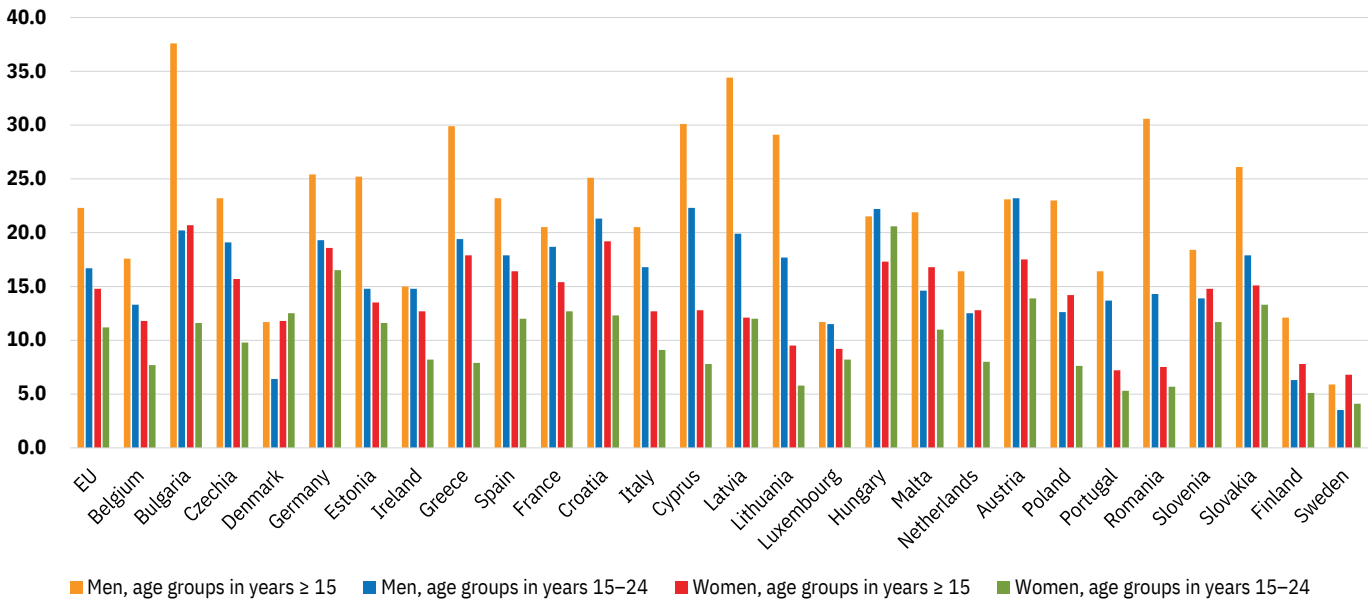
Source: modified by World Health Organization. (2021). WHO report on the global tobacco epidemic. Addressing new and emerging products.

Figure 4 | Youth exposure to secondhand smoke



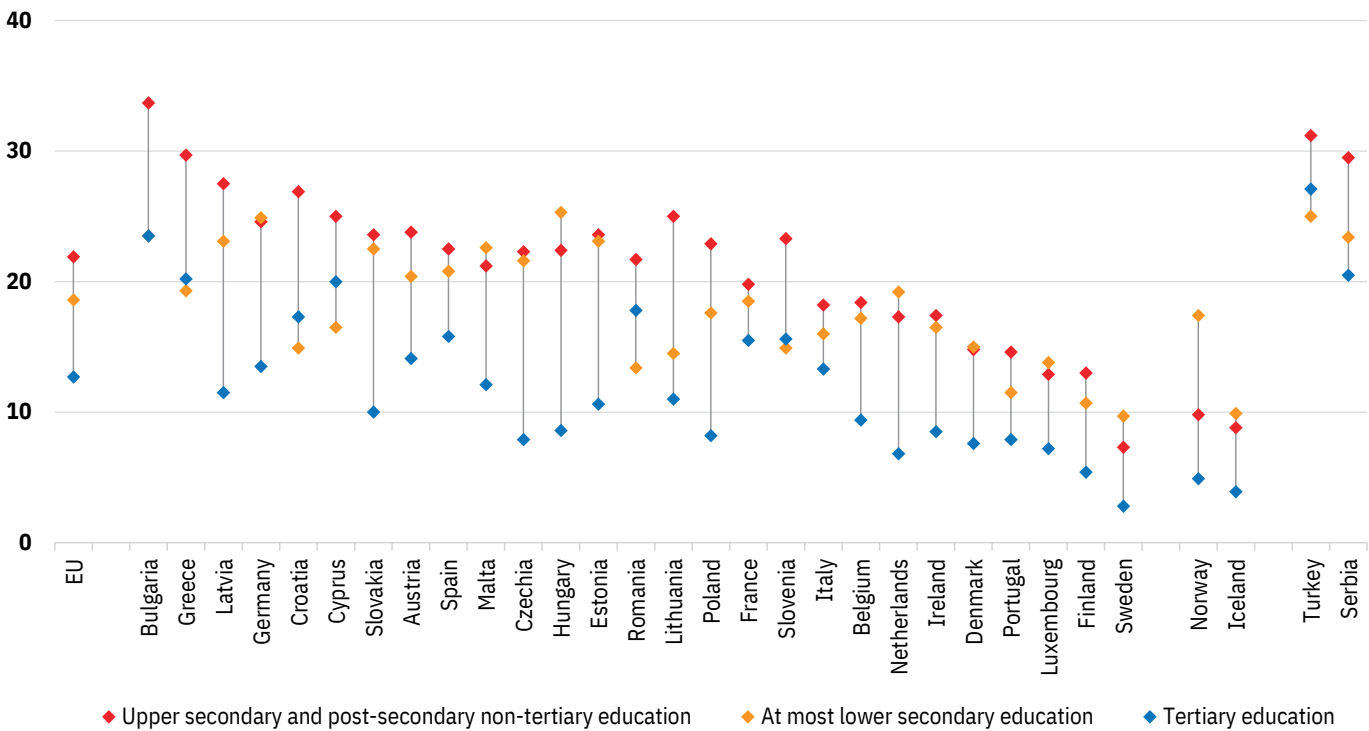
Source: modified by <https://tobaccoatlas.org/challenges/secondhand-smoke/>

Figure 5 | Share of daily smokers of cigarettes, by sex and age group, 2019



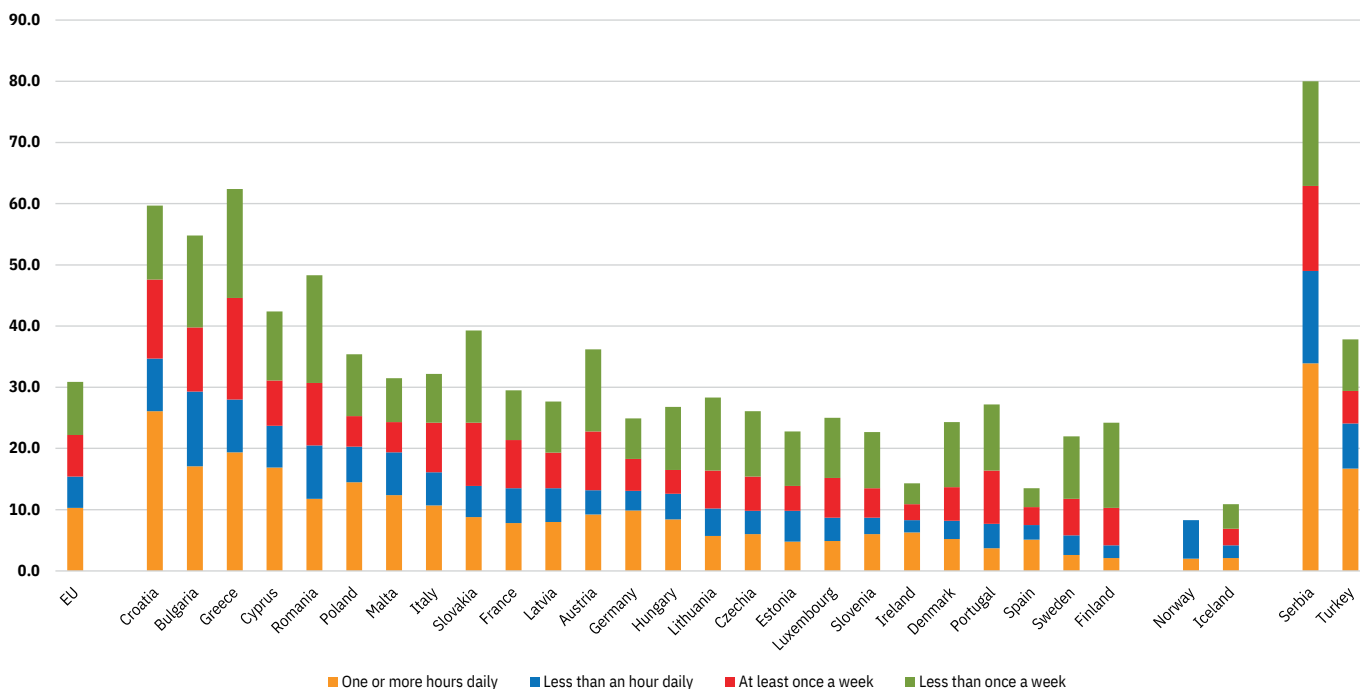
Source: modified by Eurostat (online data code: hlth_ehis_sk3e)

Figure 6 | Share of daily smokers of cigarettes among persons aged 15 and over, by educational attainment level, 2019



Source: modified by Eurostat (online data code: hlth_ehis_sk3e)

Figure 7 | Distribution of the frequency of exposure to tobacco smoke among persons aged 15 and over, 2019



Source: Eurostat (online data code: hlth_ehis_sk4e)

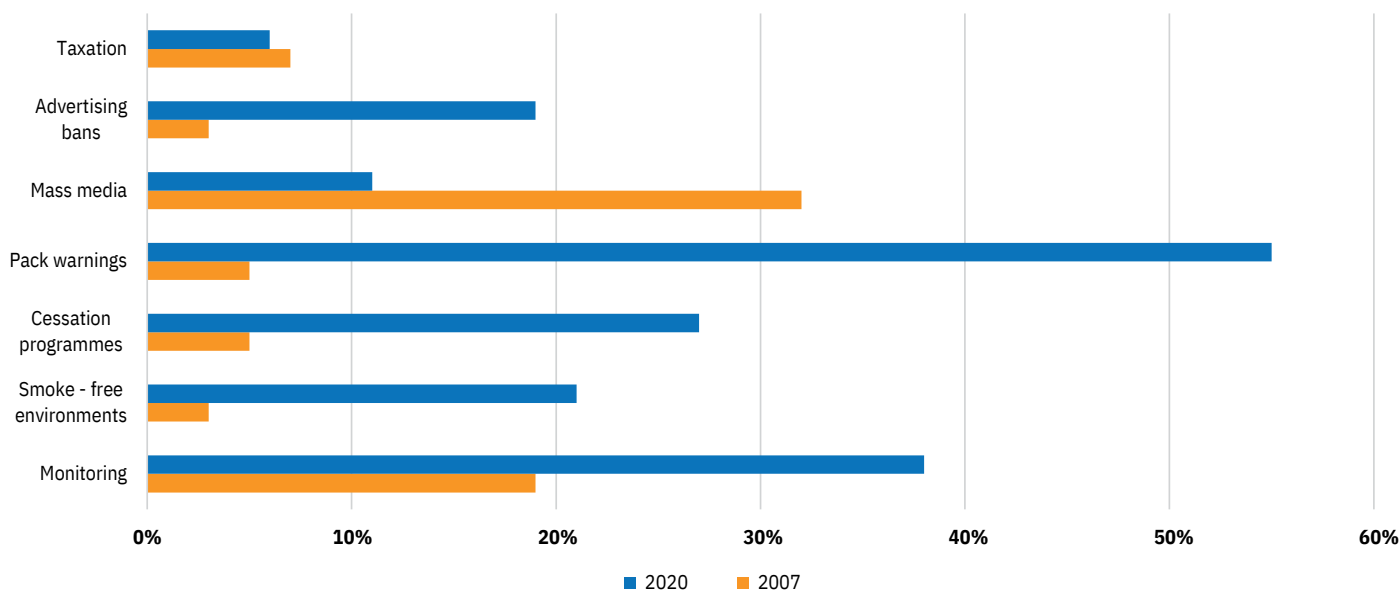
people from passive smoking by having no or minimal smoking bans. Results from the Global Youth Tobacco Survey (GYTS) conducted in 142 countries from 2010 to 2018 indicate that adolescents aged 12–16 years were highly exposed (≥ 1 day in the past 7 days) to SHS at any site (62.9%), at home (33.3%) and in public places (57.6%). Although the prevalence of passive smoking at home decreased in 86 (65.6%) countries, the prevalence in public places did not change in 46 (35.1%) countries and increased in 40 (30.5%) *Figure 3*.

Percentage of youth exposed to secondhand smoke (≥ 1 day in the last 7 days) in any location, at home, and in public by WHO region, aged 12–16 years, GYTS 2010–2018. If we were to look at the daily number of smokers, it is an incredible percentage in the ≥ 15 -year-old male group, while the highest proportions of smokers were found in countries where the tax burden is lower and, at the same time, education is not at the required level. Looking at the development of the structure among women under the age of 15, it is much better, although there is also a relatively high number of smokers, see *Figure 4*.

Within the structure of smokers, their education is also a very significant variable. Here it can be concluded that the higher the level of education, the lower the smoking addiction. It is probably also due to the understanding of the negative effects of smoking and, at the same time, societal pressure in the given groups – see *Figure 5*.

The exposure to cigarette smokes itself is as follows in the age group from 15 years. The highest proportion refers to the group that is exposed to daily exposure. In this case, it is also confirmed by the previous WHO research mentioned above; see *Figure 6*, which talks about being exposed in public spaces by up to 63% of respondents.

Second-hand emissions have the potential to harm bystanders. Studies show that the use of ENDS increases airborne particulate concentrations above background levels when measured indoors (69–71). Levels of nicotine, particulates and potential carcinogens in second-hand aerosols (SHA) exceed the maximum recommended levels set out in the WHO FCTC guidelines (72–74). This is concerning because human exposure to particles generated during ENDS use—including fine and ultrafine particles (which can penetrate alveoli), volatile organic compounds, heavy metals, and nicotine (75)—is associated with an increased risk of heart and lung disorders. Although the health risks associated with SHA from ENDS are not yet well understood, a systematic review concluded that ENDS “fumes” have the potential to harm bystanders (71). Further research is needed to fully understand the health effects of secondary exposure to ENDS aerosols. In accordance with the WHO Framework Convention on Tobacco Control (WHO FCTC, 2020), WHO introduced MPOWER measures in 2008. MPOWER is a set of six cost-effective, high-impact measures to help countries reduce tobacco demand. According to the results of WHO surveys and subsequent statistical modeling, it

Figure 8 | Increase in the world population covered by selected tobacco control policies, 2007 to 2020

Source: Statista. (2021). Increase in the world population covered by selected tobacco control policies, 2007 to 2020.

shows that without the implementation of MPOWER measures, tobacco use may increase. Full implementation of MPOWER, including a 100% increase in tobacco product prices, could reduce smoking prevalence by almost half *Figure 7*.

Today, more than half of all countries, with nearly 40% of the world's population (2.8 billion people), have implemented at least one MPOWER measure to the highest level of achievement. Increasing tobacco tax and prices has proven to be one of the most effective, yet least utilized tobacco control measures that countries can use to address various issues. For example, by increasing prices, taxation protects the poor from exposure to a product that kills and causes disease. Taxation, in fact, is the most effective means to motivate current, mostly male, tobacco users to quit. This is especially so for lower-income populations, and tobacco users in low- and middle-income countries, where 75% of smokers live (WHO, 2020).

According to the WHO, smoking is mainly responsible for the emergence of the following groups of diseases:

- 30% of cancerous diseases, with the most prominent share being lung cancer (90% in men and 70% in women), but also cancerous diseases of the mouth, larynx, esophagus, stomach, pancreas, colon, rectum, liver, bladder, and even breast, cervix and penis.
- 20% of cardiovascular diseases – CHD, atherosclerosis, and ischemia of lower limb vessels.

- 75% of chronic bronchitis which can result in chronic obstructive pulmonary disease and emphysema (WHO, 2021).

Smoking has a proven connection with the occurrence of cerebrovascular diseases, complications in pregnancy and childbirth, as well as adverse effects on the fetus and neonatal mortality. As mentioned in the previous section, every 10 seconds in the world 1 person dies as a result of smoking. As a result of secondhand smoke, persons who have never smoked develop lung cancer. Nonsmokers who are exposed to secondhand smoke at work or at home have a 20–30% higher risk of lung cancer as is shown in the latest *Figure 8*.

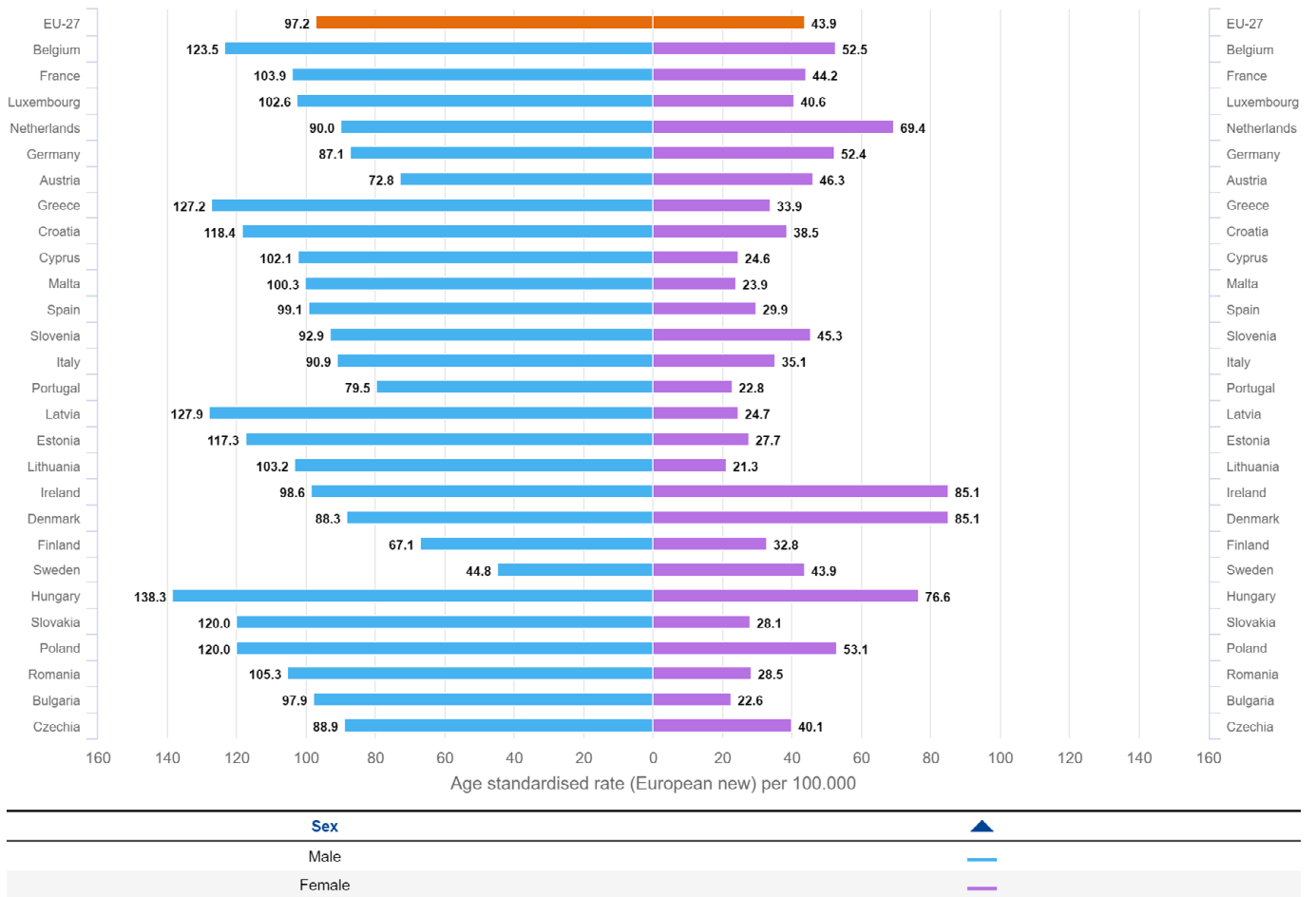
4 DISCUSSIONS

Smoking has not only an adverse health impact but also an economic impact on the smoker and society. Based on the calculations of economic experts, the World Bank concluded that the implementation of the Framework Convention on Tobacco Control should have a positive impact not only on global health but also on the global economy. Unlike other consumer products that a person buys for benefit and pleasure, tobacco products ultimately cause suffering and premature death to their regular consumer. Increasing tobacco taxes to achieve a 10% increase in tobacco prices will reduce consumption by 4% in high-income countries and around 5% in low- and middle-income countries. At a young age, when they start smoking, they gradually become addicted smokers and underestimate the late onset of the health consequences of smoking.

Figure 9 | Overview of lung cancer by gender and country

Estimated incidence by country – Comparison by sex

EU27, Both sexes, Lung, All ages, 2020



Source: European Cancer Information System. (2023). Estimates of cancer incidence and mortality in 2020, for all countries.

According to research and various surveys, approximately 70–75% of smokers wish to quit smoking, but they cannot overcome their addiction and so they “have” to buy cigarettes against their will.

We must remember that non-smokers also pay the costs of smoking. These are the costs of health damage to smokers (medical costs of treatment but also premature disability), but also the price of environmental pollution for non-smokers, and the health consequences of passive smoking. In developed countries, healthcare costs related to smoking-related diseases account for around 6–15% of all annual costs. In Slovakia, according to data from the Statistical Office of the Slovak Republic, 32% of adults smoke regularly and 14% occasionally. About 11,000 people die from smoking-related

diseases every year. According to scientific studies and calculations, a smoker loses an average of 8 years from the life expectancy of a non-smoker. Those who die as a result of smoking in middle age (35–69 years) lose on average up to 20–25 years of their life. In total, approximately 50% of smokers die from smoking-related diseases. Quitting smoking makes sense even if the smoker already gets sick. The goal of preventive activities is mainly to prevent a person’s interest in cigarettes. Therefore, prevention should first of all comprehensively try to influence attitudes towards addictions, among which smoking undoubtedly belongs.

5 CONCLUSIONS

Changes in cigarette prices seem to have had a strong impact on smoking; the greatest impact is on groups that are least responsive to health publicity measures but have the highest prevalence of smoking. This suggests that real increases in the price of cigarettes will both reduce smoking and help to reduce the differences in the prevalence of smoking and smoking-related diseases between socioeconomic groups. Special measures are necessary to ameliorate any effects on the cost of living of the most deprived families. Taxation is one of the most effective ways of reducing tobacco use. Higher tobacco taxes raise tobacco prices leading to reductions in tobacco consumption. Increasing the price of tobacco reduces tobacco use by discouraging initiation among potential users, encouraging current users to quit, and helping to prevent relapse in those who have stopped. Men and women in lower socioeconomic groups are more responsive than those in higher socioeconomic groups to changes in the price of cigarettes and less to health publicity. Women of all ages, including teenagers, appear to have been less responsive to health publicity than men but more responsive to price. Response to health publicity decreased linearly with age. Real price increases in cigarettes could narrow differences between socioeconomic groups in smoking and the related inequalities in health, but specific measures would be necessary to ameliorate effects on the most deprived families, which may include members who continue to smoke. The use of a policy to steadily increase cigarette tax is likely to help achieve the government's targets for smoking and smoking-related diseases. Adults who are exposed to second-hand smoke are more likely to develop coronary artery disease, stroke, and lung cancer. Secondhand smoking has a negative impact on the cardiovascular system in vulnerable people and can lead to coronary heart disease and stroke. The research has certain limits; among other things, it does not address the amount of tax in the context of the purchasing power parity of individual countries. For further research, it would be appropriate to use exploratory and confirmatory analysis to gain a deeper understanding of the connection between the amount of excise tax and the consumption of cigarettes and tobacco. Furthermore, the research could focus on the analysis of time series, i.e. on the connection between the amount of excise tax and consumption in selected countries considering the number of health costs caused by smoking.

Authors' contributions: LB: Structure of the paper's outline, establishing research question as well as data research within the WHO and CDC databases. Conceptualization of general conclusions and evaluation of obtained data and the formal side of the contribution. ZŠ: Data research within the ECIS and Eurostat databases, their processing, and drawing conclusions from the information obtained. Formation of general conclusions and evaluation of obtained data and the formal side of the

contribution. AB: Data processing and formal styling. Processing of literature review. AW: Structure of establishing results and discussion part, language corrections, and processing data to figures with description.

Declaration of interest: The authors of the article do have not any conflict of interest.

REFERENCES

- Alqahtani, J. S., Oyelade, T., Aldahir, A. M., Alghamdi, S. M., Almeahadi, M., Alqahtani, A. S., Quaderi, S., Mandal, S., & Hurst, J. R. (2020). Prevalence, severity and mortality associated with COPD and smoking in patients with COVID-19: A rapid systematic review and meta-analysis. *PloS One*, *15*(5), Article e0233147. <https://doi.org/10.1371/journal.pone.0233147>
- Ansara, D. L., Arnold, F., Kishor, S., Hsia, J., & Kaufmann, R. (2013). *Tobacco use by men and women in 49 countries with demographic and health surveys. DHS Comparative Reports 31*. ICF International. <https://dhsprogram.com/pubs/pdf/CR31/CR31.pdf>
- Bommele, J., Hopman, P., Walters, B. H., Geboers, C., Croes, E., Fong, G. T., Quah, A. C. K., & Willemssen, M. (2020). The double-edged relationship between COVID-19 stress and smoking: Implications for smoking cessation. *Tobacco Induced Diseases*, *18*, 63. <https://doi.org/10.18332/tid/125580>
- Carreras, G., Lugo, A., Stival, C., Amerio, A., Odone, A., Pacifici, R., Gallus, S., & Gorini, G. (2022). Impact of COVID-19 lockdown on smoking consumption in a large representative sample of Italian adults. *Tobacco Control*, *31*(5), 615–622. <https://doi.org/10.1136/tobaccocontrol-2020-056440>
- Centers for Disease Control and Prevention. (2022). *Current cigarette smoking among adults in the United States*. National Center for Chronic Disease Prevention and Health Promotion. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm#print
- Chaloupka, F., Fuchs Tarlovsky, A., Gonzalez Icaza, M. F., Rodriguez-Iglesias, G., & Vulovic, V. (2023). *A toolkit for estimating the distributional impact of tobacco taxes*. World Bank Group. <https://tobacconomics.org/research/a-toolkit-for-estimating-the-distributional-impact-of-tobacco-taxes/>
- Chaloupka, F. J., Straif, K., Leon, M. E., & Working Group, International Agency for Research on Cancer. (2011). Effectiveness of tax and price policies in tobacco control. *Tobacco Control*, *20*(3), 235–238. <https://doi.org/10.1136/tc.2010.039982>
- Centers for Disease Control and Prevention. (2020, September 10). *Second-hand Smoke Facts*. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/secondhand_smoke/general_facts/index.htm
- Denlinger-Apte, R., Suerken, C. K., Ross, J. C., Reboussin, B. A., Spangler, J., Wagoner, K. G., & Sutfin, E. L. (2022). Decreases in smoking and vaping during COVID-19 stay-at-home orders among a cohort of young adults in the United States. *Preventive Medicine*, *156*, Article 106992. <https://doi.org/10.1016/j.ypmed.2022.106992>
- Eldridge, L. (2023). *Definition and dangers of passive smoking*. <https://www.verywellhealth.com/information-about-passive-smoking-2249146>
- Enache, C. (2022). *Cigarette taxes in Europe*. Tax Foundation. <https://taxfoundation.org/cigarette-tax-europe-2022/>
- European Cancer Information System. (2023). Estimates of cancer incidence and mortality in 2020, for all countries. [https://ecis.jrc.ec.europa.eu/explorer.php?\\$0-0\\$1-All\\$2-All\\$4-1,2\\$3-22\\$6-0,85\\$5-2020,2020\\$7-7\\$CEstByCountry\\$X0_8-3\\$X0_19-AE27\\$X0_20-No\\$CEstBySexByCountry\\$X1_8-3\\$X1_19-AE27\\$X1_-1-1\\$CEstByIndiByCountry\\$X2_8-3\\$X2_19-AE27\\$X2_20-No\\$CEstRelative\\$X3_8-3\\$X3_9-AE27\\$X3_19-AE27\\$CEstByCountryTable\\$X4_19-AE27](https://ecis.jrc.ec.europa.eu/explorer.php?$0-0$1-All$2-All$4-1,2$3-22$6-0,85$5-2020,2020$7-7$CEstByCountry$X0_8-3$X0_19-AE27$X0_20-No$CEstBySexByCountry$X1_8-3$X1_19-AE27$X1_-1-1$CEstByIndiByCountry$X2_8-3$X2_19-AE27$X2_20-No$CEstRelative$X3_8-3$X3_9-AE27$X3_19-AE27$CEstByCountryTable$X4_19-AE27)
- Eurostat (2022) Daily smokers of cigarettes by sex, age and educational attainment level https://ec.europa.eu/eurostat/databrowser/view/HLTH_EHIS_SK3E__custom_2755811/bookmark/table?lang=en&bookmarkId=21823a56-fdc-4a48-8932-a4f0aff70876
- Fluharty, M., Taylor, A. E., Grabski, M., & Munafò, M. R. (2017). The association of cigarette smoking with depression and anxiety: A systematic review. *Nicotine & Tobacco Research*, *19*(1), 3–13. <https://doi.org/10.1093/ntr/ntw140>
- Gallet, C. A., & List, J. A. (2003). Cigarette demand: A meta-analysis of elasticities. *Health Economics*, *12*(10), 821–835. <https://doi.org/10.1002/hec.765>
- Gilbert, A., & Cornuz, J. (2003). *Which are the most effective and cost-effective interventions for tobacco control?* World Health Organization. Regional Office for Europe. <https://apps.who.int/iris/handle/10665/363754>
- Hidayat, B., & Thabrany, H. (2010). Cigarette smoking in Indonesia: Examination of a myopic model of addictive behaviour. *Int J Environ Res Public Health*, *7*(6), 2473–2485. <https://doi.org/10.3390/ijerph7062473>
- Ho, L. M., Schafferer, C., Lee, J. M., Yeh, C. Y., & Hsieh, C. J. (2018). Raising cigarette excise tax to reduce consumption in low-and middle-income countries of the Asia-Pacific Region: A simulation of the anticipated health and taxation revenues impacts. *BMC Public Health*, *18*(1), Article 1187. <https://doi.org/10.1186/s12889-018-6096-z>
- Huesca, L., Sobarzo, H., & Llamas, L. (2021). *A general equilibrium analysis of the macroeconomic impacts of tobacco taxation*. CIAD. <https://www.tobacconomics.org/files/research/723/reporte-tabaco-en.pdf>
- International Labour Organization. (2014). *Tobacco sector – Employment statistical update*. https://www.ilo.org/wcmsp5/groups/public/-ed_dialogue/-sector/documents/publication/wcms_329284.pdf
- Kolářová, E., Homola, D., Kolářová, V., & Kramná, E. (2019). Analysis of substance use and its relation to the tax policy of the Czech Republic. *Adiktologie*, *19*(1), 27–34. <https://doi.org/10.35198/01-2019-001-0003>
- Kosendiak, A., Król, M., Ściskalska, M., & Kepinska, M. (2021). The changes in stress coping, alcohol use, cigarette smoking and physical activity during COVID-19 related lockdown in medical students in Poland. *Int J Environ Res Public Health*, *19*(1), 302. <https://doi.org/10.3390/ijerph19010302>
- Mushtaq, N., Mushtaq, S., & Beebe, L. A. (2011). Economics of tobacco control in Pakistan: Estimating elasticities of cigarette demand. *Tobacco Control*, *20*(6), 431–435. <https://doi.org/10.1136/tc.2010.040048>
- National Cancer Institute. (2020). *Smoking initiation shifting from teens to young adults*. <https://www.cancer.gov/news-events/cancer-currents-blog/2020/smoking-more-young-adults-starting>
- Niedzwiedz, C. L., Green, M. J., Benzeval, M., Campbell, D., Craig, P., Demou, E., Leyland, A., Pearce, A., Thomson, R., Whitley, E., & Katikireddi, S. V. (2021). Mental health and health behaviours before and during the initial phase of the COVID-19 lockdown: Longitudinal analyses of the UK Household Longitudinal Study. *Journal of Epidemiology and Community Health*, *75*(3), 224–231. <https://doi.org/10.1136/jech-2020-215060>
- Oberg, M., Jaakkola, M. S., Woodward, A., Peruga, A., & Prüss-Ustün, A. (2011). Worldwide burden of disease from exposure to second-hand smoke: A retrospective analysis of data from 192 countries. *Lancet*, *377*(9760), 139–146. [https://doi.org/10.1016/S0140-6736\(10\)61388-8](https://doi.org/10.1016/S0140-6736(10)61388-8)
- Organisation for Economic Co-operation and Development. (2020b). *Health at a glance. Europe 2020: State of health in the EU cycle*. OECD Publishing. <https://doi.org/10.1787/82129230-en>
- Papadaki, Š. (2022). The amount of excise tax and its effect on the consumption of alcohol and cigarettes in European countries. *Adiktologie*, *22*(4), 234–243. <https://doi.org/10.35198/01-2022-004-0005>
- Patanavanich, R., Siripoon, T., Amponnavarat, S., & Glantz, S. A. (2023). Active smokers are at higher risk of COVID-19 death: A systematic review and meta-analysis. *Nicotine & Tobacco Research*, *25*(2), 177–184. <https://doi.org/10.1093/ntr/ntac085>

Statista. (2021). Increase in the world population covered by selected tobacco control policies, 2007 to 2020. <https://www.statista.com/statistics/449554/change-in-share-of-world-population-covered-by-select-tobacco-control-policies/>

Summers L. H. (2018). Taxes for health: Evidence clears the air. *Lancet*, 391(10134), 1974–1976. [https://doi.org/10.1016/S0140-6736\(18\)30629-9](https://doi.org/10.1016/S0140-6736(18)30629-9)

The Tobacco Atlas. (2022). *Taxes*. <https://tobaccoatlas.org/solutions/taxes/>

Tobacconomics. (2020, December 15). *Tobacconomics scorecard shines a light on the untapped potential of countries' cigarette tax policies*. <https://tobacconomics.org/news/tobacconomics-scorecard-shines-a-light-on-the-untapped-potential-of-countries-cigarette-tax-policies/>

Townsend, J., Roderick, P., & Cooper, J. (1994). Cigarette smoking by socioeconomic group, sex, and age: Effects of price, income, and health publicity. *BMJ*, 309(6959), 923–927. <https://doi.org/10.1136/bmj.309.6959.923>

U.S. Department of Health and Human Services. (2006). *The health consequences of involuntary exposure to secondhand smoke: A report of the Surgeon General*. <http://www.surgeongeneral.gov/library/reports/secondhandsmoke/fullreport.pdf>

U.S. Department of Health and Human Services. (2010). *How tobacco smoke causes disease: What it means to you*. A report of the Surgeon General. https://www.cdc.gov/tobacco/data_statistics/sgr/2010/consumer_booklet/pdfs/consumer.pdf

U.S. Department of Health and Human Services. (2014) *The health consequences of smoking—50 years of progress. A report of the Surgeon General*. https://www.ncbi.nlm.nih.gov/books/NBK179276/pdf/Bookshelf_NBK179276.pdf

U.S. Department of Health and Human Services. (2016). *E-cigarette use among youth and young adults: A report of the Surgeon General*. <https://www.cdc.gov/tobacco/sgr/e-cigarettes/index.htm>

van Walbeek, C., Filby, S., & van der Zee, K. (2020). Lighting up the illicit market: Smokers' responses to the cigarette sales ban in South Africa. University of Cape Town. https://commerce.uct.ac.za/sites/default/files/content_migration/commerce_uct_ac_za/1107/files/Lockdown%2520Survey%2520Final.pdf

World Health Organization. (2021). *WHO report on the global tobacco epidemic. Addressing new and emerging products*. <https://www.who.int/teams/health-promotion/tobacco-control/global-tobacco-report-2021>

World Health Organization. (2021). *Technical manual on tobacco tax policy and administration*. <https://www.who.int/publications/i/item/9789240019188>

World Health Organization. (2022). *Policy response to alcohol consumption and tobacco use during the COVID-19 pandemic in the WHO South-East Asia Region: Preparedness for future pandemic events. Snapshot series on alcohol control policies and practice*. <https://www.who.int/publications/i/item/9789240057043>

World Health Organization. (2022c). *Tobacco*. <https://www.who.int/news-room/fact-sheets/detail/tobacco>