

Tools to reduce tobacco use among young people in Poland:

addressing affordability and accessibility of tobacco
products through taxation and other measures

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Executive summary

Europe's Beating Cancer Plan aims to create a 'Tobacco-Free Generation' by 2040. To generate a meaningful public health policy to achieve this target, a better understanding of the determinants of youth smoking initiation is needed.

The study presented in this report examines the determinants of cigarette smoking initiation in Poland using data from four youth smoking surveys: the 2003-2016 Global Youth Tobacco Surveys (GYTS) and the 2019 PolNicoYouth survey. The study finds a negative and significant relationship between cigarette prices and the hazard of smoking initiation. Lower hazards of smoking initiation were also associated with a comprehensive advertising ban and with the introduction of pictorial warnings.

The study concludes that cigarette price increases, such as from **higher cigarette excise taxes**, could further significantly reduce cigarette youth smoking initiation in Poland. Poland's support for the meaningful renewal of the EU Tobacco Tax Directive would be crucial to this effort. Removing promotional and advertising elements from cigarette packs and making the health warning more noticeable through **plain packaging** laws would further accelerate the reduction in smoking initiation.

International research points to other measures that could potentially reduce tobacco use by young people and protect their health. Effective **educational campaigns** and **smoking cessation programs** directed at youth are among them. Further policies could include **bans on smoking in vehicles** with a young person on board and **raising the minimum age of sale of tobacco products to 21**.



Introduction

Smoking is one of the most common types of substance abuse in the world. It is estimated that it leads to the death of up to half of the people who consume it. Each year, tobacco kills over 8 million people, of which 7 million die from direct tobacco use and about 1.2 million from exposure to passive smoking. More than 80% of the world's 1.3 billion smokers live in low- and middle-income countries [1]. The problem of smoking and the consumption of tobacco products is particularly important in the context of children and adolescents. The 2016 Global Youth Tobacco Survey report showed that over 30% of the respondents consumed tobacco products [2].

Although in recent years Poland has observed significant drops in tobacco use, nearly 30% of the adult population still smoke [3]. The use of tobacco products places enormous health and economic burdens on society. Each year, over 81 thousand Poles die from tobacco-related diseases [4]. The economic cost associated with tobacco use in Poland amounted to a stunning 32.5 billion international dollars in 2016 [5]. Those costs include the lost productivity of those who become ill or die from tobacco-related diseases, as well as the healthcare-related expenses of treating smoking-attributable diseases.

The use of tobacco products starts and becomes established primarily during adolescence. A recent study conducted among youths in Poland indicates that over 60% of all teenagers and nearly a half of children under the age of 15 have already tried a tobacco product. While

for 30% of those who had already tried tobacco, initiation was through an e-cigarette, most of the surveyed teenagers still began smoking with a regular cigarette [6].

Tobacco product consumption by children and adolescents still poses a significant problem in Poland. The Global Youth Tobacco Survey, a cross-sectional survey of students globally, showed that among respondents aged 13-15 from Poland, 23% had used any tobacco product in 2016 [7]. This was one of the highest scores in WHO EURO region that time: Poland had the fifth highest youth smoking rates after Bulgaria, Bosnia and Herzegovina, Slovakia, and Latvia. Poland was also the leader in the youth use of e-cigarettes – more than 24% of the respondents used them in 2016. This was the highest level in Europe [8]. Effective measures are required to reduce the high rate of consumption of tobacco products among children and adolescents.

Tobacco tax increases are the most effective measure used to reduce tobacco use and the associated health and economic burdens [9]. Significant tax increases affect tobacco product prices and make these products less affordable. Global evidence shows that taxes are especially effective in discouraging tobacco use among young people [10]. This is most likely because young people have a lower disposable income than older people. The relationship between the prices of tobacco products and the use of these products by adolescents is multifaceted. The increase in prices not only directly influences the consumer decisions of individual young people,

but also reduces peer pressure [11]. This is because young people are less likely to share their cigarettes with their peers when cigarette prices rise [12]. The disproportionate effect of tobacco tax policies on the youth makes the tobacco tax particularly attractive for governments intending to reduce the rates of smoking initiation among the younger age groups.

Apart from tobacco-tax increases, other tobacco-control measures may also have affected youth smoking behavior in Poland. The first tobacco-control law, enacted in 1995, implemented, among other things, a ban on cigarette sales to minors, textual health warnings, and the guaranteed free provision of smoking dependence treatment [13]. Although the 1995 law included some provision for advertising bans, a comprehensive advertising ban was only implemented in 1999. A smoke-free policy that banned smoking in all workplaces, public transportation, bars, and restaurants came in over a decade later, in 2011 [13]. Finally, in accordance with the requirement of the EU Tobacco Product Directive, Poland introduced pictorial health warnings on cigarette packs in 2017 [14].

In February 2021, the EU put forward the ambitious Europe's Beating Cancer Plan [15]. The plan, among other things, aims to create a 'Tobacco-Free Generation', in which less than 5% of the EU population uses tobacco by 2040, compared to around 25% today. Although the

plan mentions the Tobacco Products Directive and the Tobacco Taxation Directive as possible instruments to achieve this objective, specific steps that the countries need to take to achieve those goals are not provided. To date there has been no study of the effects of cigarette price increases and other tobacco-control policies on the smoking behavior of young people in Poland that could inform the creation of policies aimed at achieving this ambitious goal.

The project aims to identify factors that contribute to the initiation of tobacco use by teenagers and youth in Poland. The study presented in this report uses survey data from a total of 22 541 students aged 11-18 in Poland to generate new understanding on the determinants of youth smoking initiation. The report also reviews existing evidence to identify factors that contribute to the initiation of tobacco use by youths and aims to identify further research gaps. The findings of this report are intended to impact tobacco-control policy and accelerate the implementation of the Framework Convention on Tobacco Control in Poland and the Baltic region.

The report was commissioned by the Norwegian Cancer Society, in the framework of a project partnership with the Polish Ministry of Health, by leveraging funding from the EEA and Norway Grants. The project is entitled "Healthy lifestyle of children and youth" in the programme "Reducing Social inequalities in health" financed by the Norwegian Financial Mechanism 2014-2021.

International context of tobacco control in Poland

It has been over fourteen years since Poland joined the international community of countries committed to curb the deadly toll of tobacco use through the ratification and implementation of the provisions of the WHO Framework Convention on Tobacco Control (FCTC) [16]. The FCTC is an international treaty negotiated under the auspices of the World Health Organization. It includes a regulatory strategy to address tobacco use through evidence-based measures to reduce both the supply of and demand for tobacco products. Some of the key FCTC measures include monitoring tobacco use and prevention policies, protecting people from tobacco smoke, offering help to those wanting to quit tobacco use, warning about the dangers of tobacco, enforcing bans on tobacco advertising, promotion, and sponsorship, raising taxes on tobacco, and eliminating the illicit trade in tobacco products [17].

When it became a party to the FCTC, Poland's commitment to addressing the public health problem of tobacco use was already significant. In the mid-1990s, Poland passed one of the most comprehensive pieces of tobacco-control legislation of that time [18], including large health warnings and free access to cessation services. The implementation of this law set Poland on the trajectory of continuous declines in smoking rates [18]. By joining the FCTC in 2006, Poland cemented its sustained commitment to this health cause and obliged itself to advance the cause of tobacco control further by implementing the measures outlined in the FCTC. The effective

implementation of the FCTC is further embedded in larger international efforts to reduce the burden of Non-Communicable Diseases (NCDs) [19], which include cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases. Tobacco use is the only common risk factor for all four main types of NCDs and is responsible for one in six deaths from NCDs. In 2011, world leaders, including representatives from Poland, gathered in New York for the first United Nations high-level meeting to give NCDs new prominence in the health and development agendas [20]. Accelerated implementation of the FCTC was one of the commitments that the leaders made during that meeting. The importance of the implementation of the FCTC provisions was further stressed during the 2018 United Nations meetings on NCDs [21].

Multiple initiatives evolved after the United Nations summit, including the formulation of the World Health Organization's Global NCD Action Plan, a set of nine specific targets for preventing major NCDs by addressing their major risk factors [22]. A key target of the plan is a 30% reduction in tobacco-use prevalence by 2025. According to the recent WHO estimates, Poland will likely just barely meet the target [3]. This target became a part of the recently adopted European Union's Beating Cancer Plan [15]. The plan also sets an even more ambitious target to create a 'Tobacco-Free Generation', where fewer than 5% of the EU population use tobacco by 2040.

The economic costs of tobacco smoking

The smoking of cigarettes and tobacco products poses a heavy burden on economic development. Tobacco use is inextricably linked with a greater likelihood of illness and with premature death. These factors have negative consequences for economic development, as they affect the durability and structure of human capital. Specifically, for individuals, health determines the possibility of personal development and economic security. Along with education, it forms the basis of human capital, defining the economic productivity of an individual. It is also a factor determining high work efficiency, effective learning, and the emotional and intellectual development of a person. Thus, it influences the growth of individual activity in many dimensions: economic, social, professional, etc., ultimately affecting the general level of economic activity of a given society [23]. In most nations, including in Poland, tobacco use is associated with lower socioeconomic status. Thus, efforts to decrease tobacco use through measures aimed at reducing tobacco initiation, increasing cessation and preventing relapse, would decrease health inequalities in the society and reduce the negative economic consequences of tobacco use experienced by the poor. Moreover, health positively influences economic growth by improving the quality of work efforts and increasing the productivity of employees across an entire economy. It is estimated that between 2000 and 2011, around 24% of economic growth in low- and middle-income countries can be attributed to improved health in the population [24].

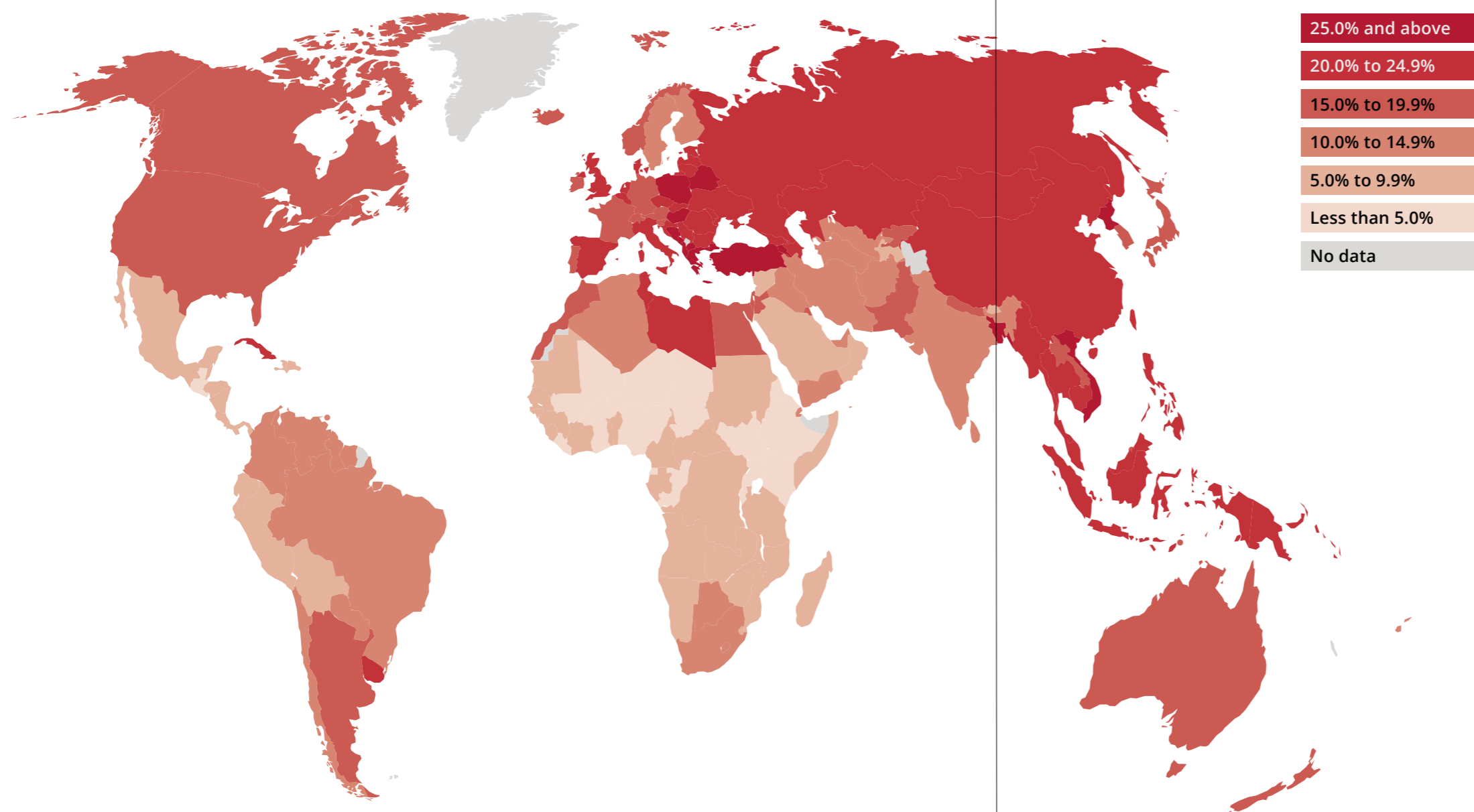


Figure 1 presents the percentage of male deaths that are attributable to tobacco smoking globally. The rate of tobacco-attributable deaths in Poland is one of the highest in the world – a function of historically extreme, and still high, smoking rates.

The global economic cost of consuming tobacco products was nearly \$2 trillion a year at purchasing power parity in 2016. Tobacco products accounted for less than 2% of the world's gross domestic product. Most of the total economic cost of smoking is lost productivity among those who become sick or die from tobacco. Another 30% of these costs are healthcare expenses related to the treatment of diseases caused by smoking. It should be noted that the amount of \$2 trillion a year does not include costs from passive smoking, non-flammable tobacco products, the environmental and health damage of growing tobacco, fire hazards from smoking, littering with cigarette butts and, above all, the immeasurable pain and suffering of the people smoking and their families.

Figure 1. Percentage of male deaths due to tobacco use, all ages, 2016
 Source: The Tobacco Atlas 6th ed. Atlanta: American Cancer Society and Vital Strategies, 2018. tobaccoatlas.org

Tobacco tax as a tool for tobacco control

According to the World Health Organization, among all the FCTC provisions, increasing taxes on tobacco is the most effective way to reduce tobacco use [25]. The mechanisms behind the effectiveness of tobacco taxation as a public health measure are remarkably straightforward. If the government increases tobacco taxes significantly, those who manufacture and sell the products will need to raise product prices in order to stay in business. With higher product prices, many smokers will have to reduce their consumption or quit altogether. Tobacco tax is simple to manage, especially in countries like Poland, where the number of producers is small. Guidelines to FCTC implementation recommend that countries should increase the taxes such that tobacco products become less affordable over time [16]. It has been demonstrated that further substantial increases in the tobacco tax would ensure that the WHO target of the 30% relative reduction in tobacco-use prevalence is met by Poland by 2025 [26].

FCTC provisions and the UN General Assembly declarations are not Poland's only international obligations with regard to levels of tobacco taxation. Since Poland joined the European Union (EU) in 2004, it has also been bound by the provisions of the EU Tobacco Tax Directive [27]. According to the directive, each EU Member State, including Poland, has to levy a cigarette excise tax of at least 90 euro per 1000 cigarettes. Additionally, the countries need to ensure that the tax accounts for at least 60% of the weighted average selling price of cigarettes.

Those provisions had a particular impact in increasing cigarette prices in the Member States that joined in and after 2004 [28]. The directive, however, still allows for relatively low prices of other tobacco products that are substitutes to cigarettes, such as roll-your-own tobacco, and does not address taxes on electronic cigarettes and heated tobacco products [29].

Evidence from more than a hundred studies on the impact of tobacco tax and price strategies on the demand for tobacco products indicates that in high-income countries a 10% increase in the price of tobacco is expected to decrease tobacco consumption by 4%, on average [30]. For low- and middle-income countries, a 10% increase in price would be expected to decrease tobacco consumption by 5% [30]. Higher product prices will also discourage product initiation and encourage cessation. A study that used the Global Adult Tobacco Survey data from 11,106 former and current smokers in Poland, Russia, and Ukraine, found that, during the observation period from 1994 to 2010, a 10% increase in cigarette taxes increased the probability of smoking cessation among smokers in these countries by 1.6% to 2.3%, on average.

Apart from being effective in altering smoking behaviors in general, significant tax and price increases can have particularly strong impact on youth [9]. Higher taxes, that lead to higher prices of tobacco products, reduce smoking participation, reduce the likelihood of initiation, and delay initiation among young people [9].

The observed effects are stronger for youth than for other age groups. This might be due to young people having in general much more constrained budgets than adults. This disproportionate effect of tobacco-tax policies on the youth makes the tobacco tax particularly attractive for governments intending to reduce smoking rates and initiation rates among the younger age groups. However, up until now, there has been no study on the effects of tobacco-tax policies on tobacco use and smoking initiation among young people in Poland.

A tobacco tax impacts not only smoking behaviors. The tax also generates substantial revenue for the government. The size of the revenue depends on the exact price responsiveness of tobacco consumption (price elasticity of demand) as well as the tax share in the price. Because demand for tobacco products is inelastic – one per cent increase in price is associated with a less than one per cent decline in sales – tobacco tax hikes are often followed by tax revenue increases. Those revenues can be directed specifically to finance tobacco control or public health more generally (earmarking). In Poland, until recently, the law stated that 0.5% of the excise tax revenue from tobacco products should have financed the Program for Reducing the Health Consequences of Tobacco Smoking (Polish: Program Ograniczania Zdrowotnych Następstw Palenia Tytoniu). However, there were clear issues with the implementation of the law. A recent study found that the average annual spending on the

program in 2000-2017 amounted to only 3% of the earmarked funds [31].

Figure 2 presents the evolution of cigarette prices, excise tax, tax revenue, and cigarette sales in Poland from 2000 to 2019. Both cigarette taxes and cigarette prices have significantly increased in recent years in Poland. This increase was, however, not always concomitant. Small tax increases in the early 2000s were entirely absorbed by the tobacco industry and did not lead to price increases. Poland joined the European Union (EU) in 2004, and it has since been bound by the provisions of the EU Tobacco Tax Directive, which sets minimum rates for and levels of cigarette excise taxes [27]. The minimum level provisions (currently at 90 euros per 1000 cigarettes were particularly effective in increasing cigarette prices in Poland and other countries that joined the EU at that time [10] [11]. The EU is currently revising its tobacco-control policies. When adjusted for inflation, tax revenue increased from 2004 to 2011 by 62% in real (inflation-adjusted terms). It then declined by 10% from 2011 to 2014. After 2014, when the taxes plateaued, cigarette sales also remained stable. As of October 2020, the excise tax on cigarettes amounts to 228.10 PLN per 1000 cigarettes and 32.05% of the retail selling price. The excise tax on tobacco for cigarette rolling amounted to 155.79 PLN per kilogram and 32.05% of the retail selling price.



Economic evidence on the novel nicotine-containing products is scarce. Existing studies generally find that the use of e-cigarettes might be more responsive to price changes, compared to the responsiveness of cigarette use to cigarette price changes, and that cigarettes and e-cigarettes are economic substitutes, meaning that the increase in price of one product will increase demand for the other product [36]-[40]. One study found that heated tobacco products replaced some cigarette sales, although the effects on smoking participation, cessation, and initiation were not evaluated by that study [41].

Excise taxation on novel products in Poland came into effect very recently, on 1st October 2020. The excise tax on e-cigarettes amounts to 0.55 PLN per 1 milliliter of liquid used in e-cigarettes and 305.39 PLN per kilogram of the heating tobacco units for the heated tobacco products.

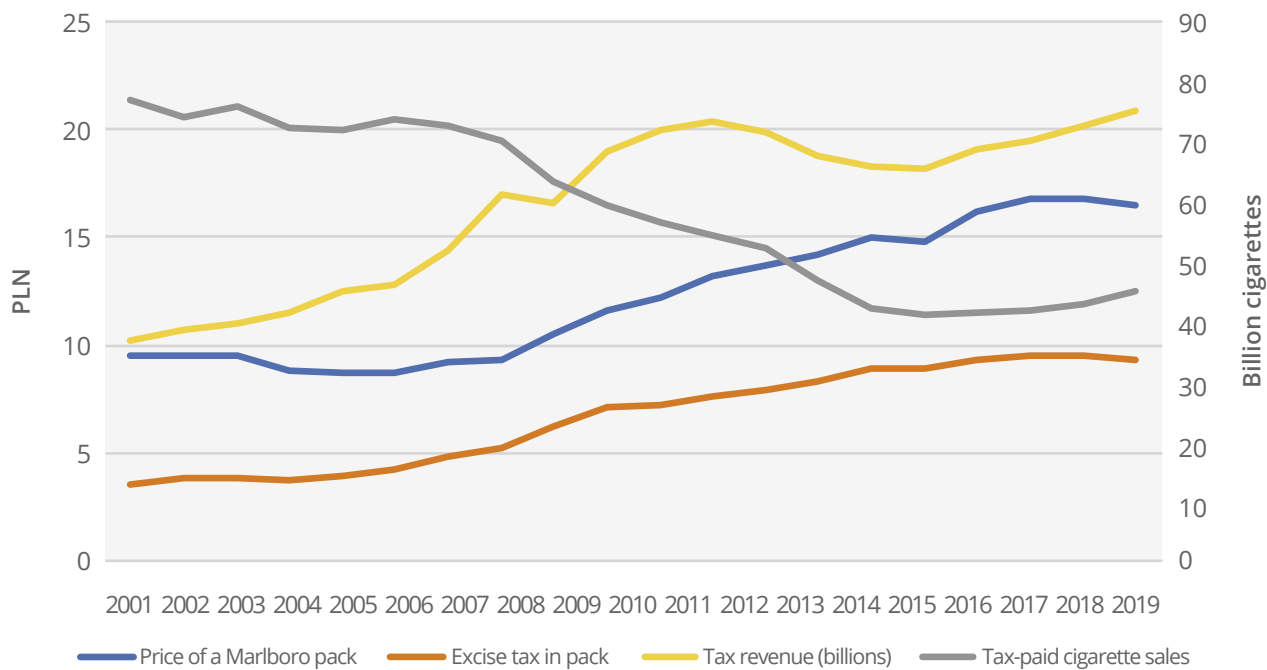


Figure 2. Cigarette price, excise tax, tax revenue and cigarette sales in Poland (2000-2019)

Note: Tax, price, and revenue are inflation-adjusted Price of Marlboro cigarettes from the Economist Intelligence Unit, tax revenue from the Polish Ministry of Finance [32], tax-paid sales from Euromonitor [33], inflation from the International Monetary Fund [34]. Excise tax per pack estimated based on the tax rates published by the Polish Ministry of Finance and the price of Marlboro cigarettes from the Economist Intelligence Unit [35].

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Study of determinants of youth smoking initiation in Poland

Data

Data on individual smoking behavior and demographic characteristics were obtained from the 2003, 2009, and 2016 Global Youth Tobacco Surveys (GYTS) and from the 2019 PolNicoYouth survey. Both GYTS and PolNicoYouth are cross-sectional, school-based surveys, which are devised to monitor tobacco use among young people using a self-administered questionnaire. The GYTS surveyed individuals aged 11-17. Its methodology is standardized globally and includes a two-stage sample design. Schools are selected with a probability proportional to enrollment size in the first stage, i.e., the more students the school had the more probable it was for the school to be selected. The classes are chosen randomly within selected schools in the second stage. While the 2003 and 2009 surveys were conducted in one administrative region only, Mazovia, the 2016 GYTS had national coverage. The sample sizes were 3 691, 3 282, and 5 154 for the 2003, 2009, and 2016 GYTS, respectively. PolNicoYouth gathered data nationally from 16 712 adolescents aged 15-18. Two hundred schools were selected from among all secondary schools in Poland, stratified by administrative region and school type (general education vs. vocational), and all students in each school selected were approached.

A measure of the age of smoking initiation was created from self-reported responses to the question "How old were you when you first tried a cigarette?" In GYTS, this was a multiple-choice

question, with age categories being provided in two-year intervals (e.g. 10 or 11 years old, 12 or 13 years old, etc.). Therefore, for each individual, the age of smoking initiation randomly was selected between the two years provided in the selected category, as long as the upper age in that category was not higher than the current age of the individual. In the PolNicoYouth survey, the individual was first asked if he or she had ever used cigarettes. The same question was asked regarding other tobacco products. Individuals were then asked which of those tobacco products they used first and how old they were when they first tried the product. The initiation age was coded as a continuous variable. There were 2 422 individuals (14% of the total sample) who indicated that they had tried cigarettes, but whose tobacco-use initiation was through a product other than cigarette. Most of those individuals (68%) initiated through e-cigarettes. Those individuals were removed from the study, as their age of cigarette-smoking initiation was unknown.

To capture the respondent's socio-economic status, measures of mother's and father's educational level (primary or secondary vs. higher) were included. Given the well-established relationship between education and income, this variable is likely to be a good proxy of the household income as well. The question about parents' educational level was not asked in the 2003 GYTS. A variable for parental smoking was also taken into account in the analysis (neither of the parents smoke vs. either or both

parents smoke). The type of school (secondary vs. vocational), the school location (urban vs. rural) and the region of the country the school was in were not provided in the publicly-available GYTS data.

Data on 1994-2019 cigarette prices are derived from the Central Statistical Office of Poland (Główny Urząd Statystyczny – GUS) [42]. Each year, GUS reports the price of a pack of 20 cigarettes. Although currently GUS does not provide the brand name of the cigarettes for which the price is being tracked, this brand clearly belongs to the lower price category. These lower-priced cigarettes are potentially more likely to be considered by adolescents. Because of the laws that prohibit discount cigarette sales, as well as the requirement for the maximum retail price to be printed on each pack, the cigarette price for each brand is uniform across the country and cannot vary between neighborhoods or regions. Prices are adjusted for inflation using the consumer price index, also from GUS.

In addition to the price variable, dichotomous variables to capture the implementation of non-price tobacco-control legislation were created: the first tobacco-control law in 1995, a comprehensive advertising ban in 1999, smoke-free legislation from 2011, and the implementation of large pictorial health warnings on packs in 2011. The variables assume a value of zero for years before a law's implementation and one for the year of implementation and onward.

Analysis

To estimate the relationship between cigarette prices and the age of onset of cigarette smoking in Poland, a survival analysis was employed. Standard survival models assume that the probability of failure approaches one as the time at risk becomes sufficiently large. This assumption, however, does not hold in the case of smoking onset analysis. Some individuals will never start smoking, no matter how long they are observed. Therefore, to relax this assumption, the split-population model is used. In this model, the probability of eventual failure may be less than one for some portion of the population [43]. This method has been used previously to measure the effects of cigarette prices on smoking initiation [44]–[46], on the onset of regular smoking [47], and on delaying the onset of smoking [48][49]. A cubic polynomial specification as the functional form for the duration dependence in the hazard function is used. It is assumed that the individuals are first exposed to the risk of smoking initiation at the age of eight [46].

To obtain the longitudinal data format needed for the duration analysis in this study, the timing of smoking initiation using the self-reported initiation age is retroactively inferred. This allowed the creation of a pseudo-longitudinal dataset, in which the smoking status of eligible respondents is tracked from when they turned eight up to the time of initiation, or until the time of interview, whichever comes earlier.

The hazard of initiation is modelled as a function of price, gender, parents' smoking status, mother's education, and father's education. A separate set of models included dummies to capture the implementation of non-price tobacco-control legislation.

Results

Table 1 summarizes mean values for the key variables in the sample. The mean age of initiation in the sample was 12.7 years old. The age increased with each consecutive survey. On the other hand, the initiation rates, which averaged 0.43 for the entire sample, declined with each consecutive survey. Parental smoking rates also declined. Overall, the inflation-adjusted cigarette price more than tripled during the time of the analysis. However, there were periods of price stagnation and decline, including in the most recent years.

	2003 GYTS	2009 GYTS	2016 GYTS	2019 PNY	Total sample
	Mean (SD)				
Age	10.93 (2.2)	10.98 (2.19)	11.06 (2.19)	11.87 (2.69)	11.49 (2.52)
Gender (female)	0.57	0.54	0.53	0.50	0.52
Age of initiation	11.79 (2.10)	12.07 (2.11)	12.64 (1.90)	13.46 (2.21)	12.77 (2.22)
Initiation	0.53	0.48	0.43	0.39	0.43
Parents' smoking status (either or both parents smoke)	0.55	0.50	0.43	0.38	0.43
Mother's higher education	-	0.44	0.45	0.44	0.44
Father's higher education	-	0.38	0.39	0.33	0.35
Cigarette price (PLN per pack; inflation-adjusted)	6.18 (0.72)	7.08 (1.06)	11.8 (1.37)	12.77 (1.23)	11.14 (2.8)
Number of individuals observed	3258	2,906	4,881	11,496	22,541
Number of person-period observations	19,779	18,341	32,556	94,131	164,807

Table 1. Summary statistics of key variables

The results from the six models of cigarette smoking initiation among Polish youth are presented in Table 2. A negative and significant relationship between cigarette prices and the hazard of smoking initiation was found in all models. The hazard ratio for the price variable is estimated at between 0.86 and 0.91, depending on the model specification. The coefficients for two out of the four tobacco-control laws were also significant. These were the 1999 comprehensive advertising ban (hazard ratio from 0.69 to 0.70) and the 2017 introduction of pictorial warnings (hazard ratio from 0.65 to 0.68). Coefficients for the first tobacco-control legislation in 1995 and the law introducing smoke-free public areas in 2011 were not significant. During the period of observation, girls were less likely to initiate cigarette smoking than boys (hazard ratio from 0.84 to 0.92). Having at least one parent who smoked and having a mother with higher education were also significantly associated with smoking initiation (hazard ratios from 1.89 to 2.08 and from 0.88 to 0.89, respectively).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Hazard ratios					
Cigarette price (in PLN per pack; inflation-adjusted)	0.86**	0.88**	0.89**	0.88**	0.91**	0.89**
1995 first tobacco control legislation				3.5	3.49	-
1999 comprehensive advertising ban				0.70**	0.69**	-
2011 smoke-free law				0.96	0.94	1.14
2017 large pictorial health warnings				0.65**	0.68**	0.65**
Gender (female)	0.84**	0.84**	0.91**	0.84**	0.84**	0.92**
Parents' smoking status (either or both parents smoke)		2.08**	1.93**		2.05**	1.89**
Mother's higher education			0.88**			0.89
Father's higher education			0.94			0.95
Number of individuals observed	22541	21624	13385	22541	21624	13385
Number of person-period observations	164807	157730	101539	164807	157730	101539

Table 2. Determinants of smoking initiation: split-population models

Note: *P<0.05; **P<0.01; All models control for duration dependency (cubic polynomial functional form) and include a constant. The variables for the 1995 and 1999 legislation were dropped from the last model, because the 2003 GYTS, which is the only survey that captured the impacts of those laws, did not ask about the parents' education.

The findings of this study reaffirm that cigarette prices are significantly related to a reduced likelihood of smoking initiation among the youth in Poland. At the average cigarette price in the sample (11.14 PLN per pack), the estimated hazard ratios indicate that a 10% increase in cigarette price would reduce the hazard of smoking initiation at any moment of the observation by 10.0% to 15.6%, on average. The implied price elasticity of smoking initiation in this study (from -1.00 to -1.56) is within the range of what has been found in similar studies of youth smoking initiation in the US (-1.20 among boys) [50], Viet Nam (-1.18) [51], and Nigeria (-1.04) [45].

The study also finds a significant association between smoking initiation and Poland's implementation of a comprehensive advertising ban in 1999, and between smoking initiation and the implementation of the pictorial warnings in 2017. Interestingly, the coefficients for the first tobacco-control legislation in 1995 and the introduction of smoke-free areas in 2011 were not significant. The non-significant effects for the 1995 legislation are likely the result of the very small number of observations from before the law was enacted (only 52 out of the 164,807 person-period observations, or 0.03% of the sample). The non-significant effects for the smoke-free laws is more puzzling. Evidence from the US shows that the implementation of smoke-free laws was associated with reductions in adolescent smoking [52]. A likely explanation is that while the smoke-free laws covered offices,

bars, and restaurants, these are places where people under the age of eighteen rarely spend their time. Therefore, the tobacco-control law that covered those places could not affect the patterns of smoking initiation.

The findings imply that future cigarette tax increases should further reduce cigarette-smoking initiation among the youth, as long as these tax increases are large enough to drive the price of cigarettes up. While for the last five years of this analysis the cigarette excise tax remained unchanged, cigarette prices kept growing and only slightly declined in 2019 (Figure 3). The fact that the tobacco companies were able and willing to increase the net-of-tax cigarette prices from 2014 to 2018 implies that the industry still enjoys high profit margins on the cigarettes and does not see the price increases as a threat to those profits. This is consistent with findings from Britain, where approximately half of the total cigarette price increases across all brands from 2006 to 2009 were due to the tobacco industry's own-price increases, despite Britain having one of the highest cigarette taxes in the world that time [53].

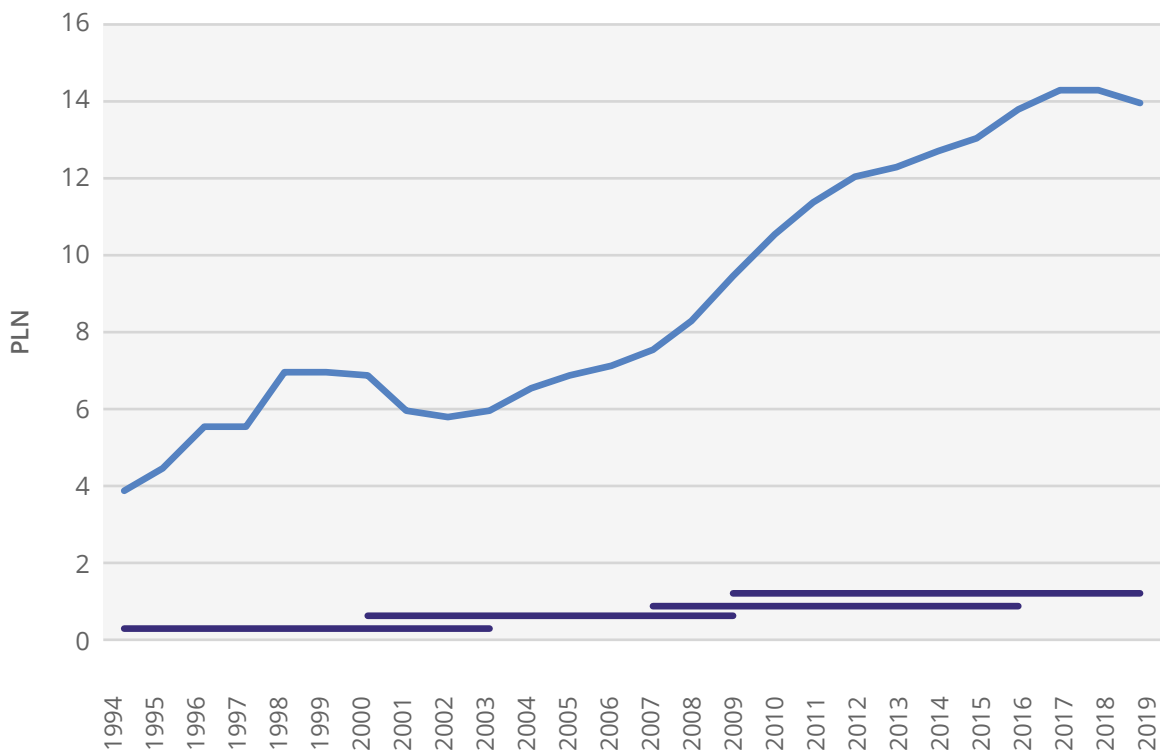


Figure 3. Inflation-adjusted price per cigarette pack from GUS, 1994-2019

Note: Horizontal lines represent observation periods for each of the four surveys.

To maintain high profitability and ensure a steady stream of new customers, tobacco companies forcefully oppose tobacco-tax increases. An analysis of documents presented to the Polish government by entities acting in the interest of the tobacco industry from 2006 to 2012 showed that one of the industry's main arguments against increases in excise duties is the claim that higher taxes will only lead to increased smuggling [54]. However, a comparison of cigarette smuggling estimates provided by tobacco companies with the results of academic research has shown that the industry greatly exaggerates the problem of smuggling in Poland. Tobacco companies' estimates of cigarette smuggling were larger by half than the results of an industry-independent study that analyzed data from a smokers' pack survey and from a littered-pack collection [55]. The experience of many countries around the world shows that it is possible to confront and control the cigarette trade effectively, while still using cigarette-tax increases to protect the health of citizens [56].

In recent years, increasingly more young people initiate tobacco-product use through e-cigarettes [6]. Among those individuals who declared tobacco-product initiation in the 2019 PolNicoYouth survey, 30.5% initiated through e-cigarettes. The initiation behaviors of cigarette smoking and e-cigarette use are likely to be linked. A study conducted on data from the National Youth Tobacco Survey in the US suggested that e-cigarettes and cigarettes are substitutes in the economic sense [57]. That

means that if the price of one product increases, the use of the other product would also increase among the youth. In October 2020, Poland introduced an excise tax on nicotine-containing liquids for e-cigarettes. Future increases in this tax should accompany cigarette-tax increases to avoid between-product substitution.

Another finding of this study is that initiation hazards declined in the years of the introduction of a comprehensive advertising ban and the introduction of large pictorial warnings on cigarette packs. This finding might be especially relevant in a time when ever more countries implement laws that require plain, standardized cigarette packaging. This measure was first implemented in Australia in 2012 and since then plain pack laws have been adopted in at least nineteen countries around the world, including in seven EU countries: Belgium, France, Hungary, Ireland, Netherlands, Romania, and Slovenia. Because the advertising bans and the implementation of pictorial health warnings have been associated with lower smoking initiation rates in the past, the implementation of plain packaging, which removes promotional features from packs and makes the health warning even more noticeable, will likely further decrease smoking initiation rates in Poland. Alcaraz *et al.* [58] assessed the health and economic impact of the use of plain tobacco packaging in seven Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Mexico and Peru. Using a microsimulation model, they assessed the ten-year potential health and cost

impact of current packaging and warning regulations. In their model, they took into account the costs and loss of quality of life associated with major smoking-related diseases. Their research showed that the current graphic warnings already in use in each country could prevent 69,369 deaths and 638,295 disease events in 10 years, adding 1.2 million healthy years of life and saving 5.3 billion dollars in seven countries. An additional 155,857 premature deaths and 4,133,858 diseases could be prevented if these countries implement single-packaging strategies, saving 4.1 million years of healthy life and saving \$13.6 billion in direct healthcare expenditure related to smoking.

Limitations

There are several limitations of this study. First, there is likely to be an error related to the recall of the exact age of smoking initiation. This recall bias is, however, reduced through the use of the youth surveys, as opposed to asking individuals who are already adults. The average period between smoking initiation and the time of the survey was just three years in this study. Second, due to a lack of appropriate data from the surveys used in this study, the models do not control for the household income and the area of residence of the individuals. However, some model specifications control for parents' smoking status and their educational levels. Those variables should be highly correlated with the socio-economic status of the family. Further, the study does not account for price

variation among brands. It is possible that prices of different brands evolved differently during the time of the analysis. In this study, prices of an economy brand provided by the Central Statistical Office (GUS) are used, as it is assumed that young people are more likely to initiate through cheaper brands. Replacing the GUS-reported price with the Marlboro price in the models did not change the model results substantially (e.g. the estimated hazard ratio for the price coefficient was 0.87 and significant in Model 1 when the Marlboro price was used instead of the economy brand price). Finally, due to the lack of data, it is impossible to control for e-cigarette use and e-cigarette prices, which is another potential limitation of this study. If the recent trends in youth initiation rates were altered by e-cigarette rollout, the findings based on the most recent surveys might have been affected. However, some evidence suggests that the use of e-cigarettes was not replacing conventional cigarette smoking among youth in Poland, at least in the first years after the introduction of the product. Dropping the PolNicoYouth survey from the analysis and focusing on the 2003, 2009, and 2016 GYTS surveys only, when e-cigarettes were not yet prevalent, did not change the estimates substantially (e.g. the estimated hazard ratio for the price coefficient was 0.91 and significant in Model 1 without using the PolNicoYouth data).

Study conclusions

This study finds that cigarette-price increases, the comprehensive ban on cigarette advertising, and the implementation of pictorial warnings were all significantly and negatively associated with the hazard of smoking initiation among the youth. There is still room to accelerate the reduction in smoking initiation. Cigarette prices can be further increased through future substantial increases in cigarette taxes. Poland's support for the meaningful renewal of the EU Tobacco Tax Directive would be crucial to this effort. Plain packaging laws would remove promotional and advertising elements from the packs and make the health warning more noticeable. These policies will help to protect future generations from the health and economic burdens of tobacco smoking.

Other policies to address youth tobacco use

While the study presented in this report points to cigarette price increases, advertising bans, and pictorial warnings as determinants of youth cigarette smoking in Poland, there are other policies that could be effective in reducing tobacco use among the youth. Ample international research exists pointing to effective policies aimed at curbing youth tobacco use. Below is a review of some of those policies. These include findings from a recent report for the National Institute of Public Health in Poland as well as from a literature search conducted by the authors [6].

Anti-tobacco education should be part of a universal, countrywide program.

One direct measure to curb tobacco use among the youth is through educational campaigns. An example of an effective anti-smoking campaign targeted on youth is the “Truth” campaign in the US. The Truth has been launching TV, billboard, print, and internet anti-tobacco campaigns since 1998. Recent campaigns are focussed not only on cigarette smoking but also on vaping. An academic evaluation of the effectiveness of this campaign suggests that, as a result of the campaign videos aired on large TV networks in the US from 2000 to 2004, approximately 450,000 fewer adolescents and young adults initiated smoking [59]. The campaign is funded by the Master Settlement Agreement, which recovers the healthcare costs lost to treating tobacco-related diseases from the tobacco companies.

Another example of a successful anti-tobacco campaign is Tips from Former Smokers. It is a federally-paid national tobacco education campaign launched by the Centers for Disease Control and Prevention (CDC) in the US. Although the campaign is directed mainly towards adult smokers, the features that make this campaign extremely effective are worth highlighting. Instead of featuring death, which for most is intangible and hard to imagine, the campaign shows what it would be like to live with the health consequences of smoking. Moreover, people who smoke can see how smoking could affect not only their lives but also the lives of their families. The title of the campaign suggests that quitting is possible. It is estimated that, in the first year alone, the campaign averted about 17 thousand tobacco-related deaths [60].

Every campaign should be designed on the basis of the best evidence available. Periodic evaluation of actions undertaken, and an openness to change, are necessary for effective tobacco-control education.

Smoking cessation programs should be available for young people.

The program should contain elements of interventions that take into account both universal issues related to nicotine addiction and withdrawal and those specific to the age and gender of the participant adolescents. The use of mobile devices could be helpful in these programs.

Electronic cigarettes should not be considered as part of a strategy to aid youth smoking cessation.

The use of tobacco products should be banned in vehicles when children, adolescents, or pregnant women are on board.

Policies protecting children from exposure to secondhand smoke prevent SHS-related negative health outcomes in children and discourage them from taking up smoking in the future. Currently, bans on smoking in cars carrying minors are present in at least eleven countries globally. The ban could potentially include e-cigarettes.

It should be mandatory for the seller to verify the age of the young person purchasing tobacco products.

With no legal requirement to verify the age of each young purchaser and with non-significant fines for failing to do so, many vendors in Poland are still willing to sell cigarettes and other tobacco products to minors under the age of 18. One way to discourage those sales would be to increase the fines for the violations. More severe punishment could be a loss of the ability to sell cigarettes and other tobacco products by vendors violating bans on sales to minors. Although Poland currently does not

have a tobacco sales licencing scheme per se, each vendor is registered in the national tobacco product tracking and tracing system. Losing the ability to be part of the system would be equal to the vendor losing a licence to sell tobacco products.

Raising the minimum age of sale of tobacco products to 21.

Researchers from the American Cancer Society analysed cigarette sales data from twenty-five geographical areas in the US where the minimum age of tobacco sale was raised to 21 (Tobacco21 policy). The researchers evaluated whether the trends in cigarette sales were changed at the moment of the Tobacco21 policy introduction in those places. The evidence strongly indicates that raising the minimum age of the sale of tobacco products from 18 to 21 decreased sales of cigarette brands preferred by youth in places that introduced those laws [61]. Similar policies could be implemented in Poland.

Considerations for future research

There are still substantial gaps in the literature regarding the issues around youth tobacco use in Poland. First, the e-cigarette market has been gradually increasing and was estimated at 2.5 billion PLN in 2020 [33]. While e-cigarettes are likely to be less harmful to use than traditional cigarettes, their uptake among the younger population is a matter of concern. PolNicoYouth survey results indicate that when asked about their recent cigarette and e-cigarette use, more teenagers reported daily use of e-cigarettes than of cigarettes (10.6% vs. 9.2%). In October 2020, a new excise tax on e-cigarettes was introduced. To date, there is no evidence on the impact of e-cigarette taxation on the use of those products.

Research recommendations: *the impacts of e-cigarette and heated tobacco product tax/price policies on the use of those products should be evaluated.*

International research indicates that cigarettes and e-cigarettes are substitutes, which means that if the price of one product increases, the use of the other product would also increase. If this is true, increasing the e-cigarette tax without an accompanying increase in the cigarette tax might result in switching from the less-harmful to the more-harmful product.

Research recommendations: *Future research should investigate the switching behaviors to inform future tax revisions. Specifically, a well-designed policy could ensure that taxes on e-cigarettes*

are being used to raise prices so as to deter e-cigarette initiation by those who have not previously smoked, while concomitantly greater tax increases on regular cigarettes could prevent switching from e-cigarettes to combustible products.

In May 2020, Poland banned sales of flavoured cigarettes, including menthol cigarettes. This was a direct requirement of the EU Tobacco Products Directive. One of the rationales for the ban was frequent youth smoking initiation through the menthol cigarette.

Research recommendations: *the impacts of the menthol ban should be evaluated to understand its effect on smoking behaviors, including tobacco use initiation by youths (including through e-cigarettes) and whether menthol cigarette smoking has been replaced by the use of other tobacco product among former menthol smokers.*



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