



Current perspective on smoking epidemics in Poland – statement the Polish Society of Public Health

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Abstract

Introduction and Objective. Over the past years, due to better education and prevention methods, the number of daily tobacco smokers in developed countries has noticeably declined. However, the rates of tobacco addicts and number of people dying from smoke-related diseases is still alarming and smoking remains the leading cause of premature death. In Poland, despite a significant decrease in mortality, tobacco smoking is still one of the major challenges for public health care. It is expected that the number of smokers will persist on a relatively high level, resulting in a lot of needless deaths, generating high medical care costs, negatively influencing citizens' wellbeing and harming the economy. This literature review aims at describing the current state of tobacco consumption in Poland, with emphasis on public health action for its reduction.

Review Methods. A comprehensive literature review was conducted of extant publications and analysis of statistical data obtained from reports and scientific descriptions in the area of smoking epidemiology.

Brief description of the state of knowledge. Despite comprehensive research confirming smoking as a high-risk factor in the development of many civilization diseases, it remains a significant issue in public health in Poland. There is an urgent need for the development of systemic measures which would help decrease tobacco use in Polish society. The study reviews the current state of tobacco use in Poland, the steps taken to reduce the number of addicted people, available harm reduction solutions and accessible methods of treatment, focusing on the source of the issue, limitations and requirements that remain to be covered in Poland. The study elaborates on national perspectives for reaching a satisfying number of smokers, ultimately leading to the complete elimination of smoking from Polish society.

Key words

Poland, smoking, smoking prevention, smoking related diseases

INTRODUCTION AND OBJECTIVE

Tobacco smoking is one of the most common addictions and constitutes a major threat to public health globally [1]. According to the World Health Organization, tobacco use is an epidemic [2]. It is estimated that at this time about 1.2 billion people smoke worldwide [3], which is equal to 16% of the world's population [4]. As projected by WHO in 2025, this number will increase to 1.6 billion – 19% of the world's population [1]. This literature review aims to present the current epidemic situation and changes taking place in the area of using tobacco products in Poland. In addition, the paper present public health activities in the field of tobacco consumption and its reduction.

Due to exposure to tobacco smoke, every year eight million people die because of tobacco-related diseases [1].

15% of these deaths are consequence of passive smoking. It is estimated that smoking causes almost 90% of lung cancers in men and from 70% – 80% in women. It is also responsible for 140,000 premature deaths annually from cardiovascular disease [5]. Moreover, the predictions for the next two decades estimate that overall, 60% of smokers will die due to smoking-related diseases. What is more, half of the 100,000 new smokers worldwide every day will also die prematurely [6]. In the European Union smoking is associated with 0.7 million deaths, and it is acknowledged that smoking kills more Europeans than any other avoidable factor [7, 8]. Smoking is increasingly linked to conditions such as diabetes, rheumatoid arthritis, age-related macular degeneration of the eye, orofacial clefts and ectopic pregnancy [9].

As the consequences of smoking are alarming and is an ongoing global problem, many governments strive to operate against it. To do so they follow measures advised by organizations such as the WHO and UN, and follow guidelines from NICE and the EU [2, 10, 11, 12]. The main goal of these implementations is to reduce the prevalence

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of tobacco use and exposure to tobacco smoke. Above all, this is achieved by imposing substantial taxes on tobacco products with adequate structure, thus increasing prices. Furthermore, some of the non-price tobacco control policies implemented, ranging from prohibition or restriction of advertisements of tobacco products to laws necessitating the placement of health warnings on tobacco product packages and from different types of anti-smoking campaigns, to laws prohibiting the use of tobacco in certain places. As a result of these implementations, today, nearly one-third of the world's population is covered by at least one type of comprehensive non-price tobacco control policy, and a considerable number of resources is spent to enforce these policies [2, 3, 10, 11, 12].

Overall, steps taken based on these types of programmes have shown some positive effects, although the major decreasing rates of smokers driving the statistics have been recorded only in several high-income countries. At the same time, the prevalence of smoking continues to increase, or does not change in some low- and middle-income countries [4]. It has been suggested that the source of these discrepancies lies in inequalities observed between countries and populations, and implementation of the same methods in all of them [7, 13, 14].

REVIEW METHODS

In June 2021, a literature search was conducted using PubMed and Google Scholar which included articles published between 2007–2021, focusing on articles published between 2014–2021. Combinations of the following key words were used: 'smoking', 'smoking prevention', 'smoking related diseases', 'Poland'. The articles found were in English and Polish. After compilation of a list of potentially relevant articles, a comprehensive selection of relevant articles was performed. This included articles concerning the problem in Poland and containing the latest data. Additionally, as a source of primary data, reports have also been included in the review.

DESCRIPTION OF THE STATE OF KNOWLEDGE

Tobacco smoking in Poland. In Poland within the last 40 years the overall percentage of daily tobacco smokers decreased from 48.5% to 24%–21% (GATS Objectives – Global Adult Tobacco Survey), which is more than double [15, 16]. In 1980, it was estimated that 65% of men and 32% of women were smokers [15, 16, 17]. According to (GATS objectives) in 2009–2010, 33.5% of adult men (5.2 million) and 21% of adult women (3.5 million) smoked tobacco daily, and another 6.6% of the population smoked occasionally [17]. As per WHO data from 2013, 27.9% of men and 18.9% of women in Poland were daily tobacco smokers [18].

Recent numbers indicate that in 2019, one-quarter of Poles were smokers, 26% of males and 17% of females smoked regularly, and an additional 5% and 4%, respectively, smoked occasionally (CBOS) [19]. This currently ranks Poland as the sixth country out of 28 EU countries in terms of the frequency of smoking [17, 20].

In Poland, tobacco abuse is related to 70,000 deaths every year, 43,000 of which are premature deaths [21]. The WHO has assessed that in Poland smoking is a direct cause of 40%

of early deaths in men, with lung cancer being one of the main causes [17]. Annually in Poland, there are 20,000 new cases of lung cancer reported in smoking males [22].

In 2014, study conducted by the National Cancer Registry in Poland revealed that over 156,000 new cases of malignant cancer were recorded. This translates to over 3,600 cases more than the previous year. In the same year, more than 94,000 people died due to cancer, which was slightly less than in 2013. In relative terms, this means that over 400 new smoking-related cancer cases are recorded daily. Furthermore, 60,000 people in Poland live with cancer diagnosed within the previous 10 year [23, 24]. Thus, regardless the common awareness of consequences of smoking, and the reduction of smokers of more than half within last 40 years, it still concerns a high percentage of Polish people and remains one of the main preventable causes of ill-health and early death [20, 23]. Moreover, in comparison with other European countries, Poland still lags behind. For instance, in Scandinavian countries, England and Germany the decrease over the years has been more significant [25]. Currently in these countries, only 15–17% of the population uses tobacco [21].

It is expected that in the following year, without a new solution to fight tobacco use, a plateau in tobacco consumption will be reached. The most recent study presents alarming figures that show that during the three quarters of 2019 in Poland, almost 7% more cigarettes were smoked compared to the previous year [26, 27].

The aforesaid worldwide problem, but especially in Poland, will be explained and elaborated later in this review, emphasizing the source of the problem, focusing on deficiencies in the Polish health system, and related downsides of the Polish economy. Finally, available methods enabling to reach a satisfying number of smokers, ultimately leading to a completely smoke-free society will be discussed.

Characterization of active smokers in the smoking population in Poland. Research shows that in the Polish population smoking is more prevalent among men than women, 29% vs 20% in 2017. As mentioned above, the general descending trend in the number of tobacco users is similar in both groups. Nevertheless, according to research conducted in 2017, of those who smoke regularly, 12% had started smoking within previous year. Among men, this was 11%, while among women, the percentage was higher and reached 13% of the Polish population [28].

Research states that the percentage of people who smoke regularly is the lowest among young people – in the age group: 15–19 years (9% of men and less than every hundredth woman in this age admits to smoking daily). Compared to the 2015 results, a slight decrease in the percentage among young smokers was noted – in 2015, 6% of men and 7% of women at that age admitted to smoking daily. The percentage of men who smoked significantly correlated with age, with the highest percentage is observed among 40-year-olds and was equal to 40%. In women, there is no such a trend and peak percentage of smokers – 31% is observed in the group aged between 30 – 39, constituting the only age group where the percentage of smokers is higher than men – 27%. In the other age groups, there are significantly more smokers among men. The biggest discrepancy – 18% – is seen in age group 40 – 49, where 40% of smokers are men and only 22% of females [28].

Research conducted in 2017 did not indicate any tendencies of smoking addiction to be related with the place of residence. There are no significant differences in the percentage of smokers between people living in small villages, and in cities with a population higher than 500,000. However, interestingly, in all of the five tested conditions – villages, towns up to 20,000 and between 20,000 – 100,000, and cities between 100,000 – 500,000 and above 500,000, the number of men who smoked significantly exceeded number of women who smoked [29].

In relation to educational and professional status, it has been determined that the highest percentage of tobacco users for both men and women is found in the group with national vocational qualification, and equals 40% and 24%, respectively. The higher the educational level, the less the people smoked, on average. The lowest group of smokers regarding education level is seen in woman with a university degree – only 12%. Considering the employment factor, it has been assessed that people with jobs smoke more than those who are unemployed, although the discrepancy equals 3% in men and 2% among women [28].

While focusing only on the employed aspect, according to research conducted by Kantar Millward Brown in July 2017, 23.9% of Poles admitted to smoking at their place of employment during work hours. More detailed statistics reveal that 22.6% of interviewees smoked more than 10 cigarettes, 34.5% from 6 – 10, and 42.9% from 1 – 5 while at work. It has been estimated that smokers therefore contribute daily to a 30.9 PLN million loss in big and small companies [30]. Assessment of the percentage of smokers regarding the financial situation revealed that the worse the financial situation of the person, the higher the possibility of being a regular smoker. The correlation is more apparent among men, but generally holds for both groups. Within the group with high a socio-economic position, the numbers reached 23% for men and 21% for women, whereas in the group with a low position, 53% of men and 41% women claimed to smoke regularly [20]. In the group of occasional smokers, two men (2%) and one woman (1%) in a 100 admitted to smoking from time to time. Between 2009 – 2017, the rates in this group have not changed significantly [30]. In 2017, 18% of the male and 8% of the female population admitted to having smoked regularly in the past. In comparison to previous years, the number of men declaring quitting smoking stays in equilibrium. However, among woman it has been changing over the years and in contrast to 2015 the number of women who quit smoking decreased by 7% [30].

In Poland in 2017, 62% of the population declared never to smoke. In comparison to 2015 this number has increased of 4%. In relation to sex groups, 52% of men and 71% of women claim never to smoke. The descent in comparison to 2015 was 2% and 5% for each group respectively [20, 31].

Passive – second-hand smokers. Second-hand smokers, through being exposed to tobacco toxicity almost at the same rate as active smokers, contribute to 15% of smoke-related deaths worldwide. According to the American Heart Association, passive smoking is an important risk factor for coronary heart disease [31], therefore it is also important to protect non-smokers who should, as much as possible, be included in all government policies.

According to research, the number of Poles passively exposed to tobacco smoke in their household decreases every

year, from 45% of the population in 2013, to 39% through 2015 and 2017. Currently, 12% of interviewees admit that tobacco is smoked in the whole house, without any limitations, 7% state that tobacco is smoked only in designated areas in the house, and in 20% of the houses, people smoke only in open areas, such as balconies and gardens [30].

Regarding the place of work or schools, in 2017, 34% of Poles claimed that smoking is permitted only outside the building and 20% that it is prohibited inside as well as outside; 8% of the examined participants stated that there are special rooms designated for smoking. In total, 7% claimed that smoking is allowed in other rooms besides a smoking room, or is allowed everywhere, with no restrictions. In comparison with results obtained in 2015, no change has been recorded [30]. Conversely, regarding smoking in bars, cafes and restaurants, a significant change was recorded between 2009 – 2017 when it declined from 33% of non-smokers exposed to tobacco smoke in restaurants in 2009, to less than 9% in 2017. A significant improvement has also been recorded when it comes to clubs where the difference between 2009 and 2017 reached a 23% decrease [30]. Another significant improvement was documented for recreational areas, such as public beaches, parks and playgrounds. The percentage of people exposed to tobacco smoke decreased from 15.8% in 2009 to 7.6% in 2017 [30].

Programmes and indications implemented in Poland to reduce tobacco consumption. One of the biggest challenges for public health and lifestyle medicine is defining the most efficient method to reduce tobacco abuse and its effect on the human body. Cessation is effective in reducing the increased risks of developing smoking-related disease. Smokers who successfully quit before the age of 40 avoid nearly all increased mortality risks of continued smoking [32]. As this issue goes far beyond only a health problem, it entails many specialized national and international programmes [29]. At the beginning of the 1990s, anti-nicotine policies were introduced in Poland for the first time. Currently, Poland is involved in many such programmes conducted by the UN, EU and the WHO, which impose variety of restrictions regarding smoking [2, 10, 33].

Sustainable development indication. One of the most essential indications used in Poland is Target 3.4, a part of a broader UN Sustainable Development Goals (SDG) plan, which aims towards reduction of the one-third mortality rate due to non-infectious diseases by year 2030. Target 3.4, one of the main indicators used to assess the success of the programme, is the frequency of tobacco smokers in a population older than 10 years. Unfortunately, due to the scale of the tobacco problem in Poland, the success the programme is very uncertain and among all the SDG health programmes introduced in Poland, this is one of the least successful. At the end of 2017, it had reached only 26% of the goal initially set, and practically speaking, attainment of the final objective might not be achieved in Poland [10].

European Union ordinance. In recent years, the EU ordinance has had a tremendous impact on smoking rates. One programme with a major effect was the Council Recommendation on smoke-free environments of 2009. In 2013, it was assessed that Poland, together with Belgium and Spain, were the only European countries where the adoption

of comprehensive legislation led to very significant drops in tobacco smoke exposure within a short time period [26]. One of the most recent EU ordinances is a complete ban on menthol cigarettes. Although, there is little evidence of possible higher toxicity of these products in comparison to standard cigarettes, it was shown that these types of products attract young people and women, and could be more addictive, hence, harder to quit successfully [20]. As of 20 May 2020, the decision was implemented in Poland and in all other EU countries [34]; therefore, there is no data available that can support the regularity of this decision. However, it is expected that this ordinance could have an especially big impact in Poland, as the menthol cigarettes consumption in recent years had reached one-third of all cigarettes sold [35].

WHO – MPOWER. One of the major WHO programmes aimed at tobacco control is the Framework Convention on Tobacco Control (WHO FCTC), released in 2005, and from the start, it has shown that most countries can implement tobacco control measures. Moreover, in 2008, from a Bloomberg initiative under the name MPOWER, the WHO specified six additional measures that were found to be the most effective in the programme's history. These are M – Monitor tobacco use and prevention policies, P – Protect people from tobacco smoke, O – Offer help to quit tobacco use, W – Warn about the dangers of tobacco, E – Enforce bans on tobacco advertising, promotion and sponsorship, R – Raise taxes on tobacco. The worldwide result of the implementation of this programme is that today five billion people are protected from the harmful effects of tobacco use. To-date, the number of countries with best-practice cessation policies has more than doubled, from 10 to 23. Poland adopted MPOWER measures in 2006. Based on this initiative in Poland, the WHO provides support by taking strong measures to fight tobacco use, that concern providing the necessary tools to implement changes in taxation and pricing, advertising, packaging, warnings, smoking in public places and supporting people who want to quit. In 2013, Poland noted the highest levels of achievement in two out of 6 MPOWER points, which were monitoring of tobacco use and prevention policies – such as advertising, smoking in public areas, and tobacco taxation. However, these still need some improvement, for instance, according to the WHO policies, the minimum of 70% of a retail price of a cigarette should be an excise tax, while in Poland this reaches only 58.09% [4]. Sadly, implementation of the remaining steps is still in its infancy. In Poland the least developed MPOWER points are considered those concerning individual help for people addicted to smoking. The help offered to tobacco smokers remains insufficient and is far behind the standards of other European countries [1].

Education and prevention. Education and prevention are regarded as the basic as well as the most valuable tools that can be used to achieve an addiction-free population. The only downside is that their effects are distant in time and are usually measured in generations rather than years. When it comes to tobacco use, the main objective of prevention and education is a 'Smoke-free Earth' model. In Poland, the mechanisms and tools, such as the above-mentioned MPOWER project, are not fully implemented, and their success is only partial and not satisfactory. Since Poland is a country with very high percentage of people smoking, the

best results in the shortest time are expected to be achieved by focusing time and resources on the implementation of these methods in groups of people who already smoke. This could successfully reduce the number of smokers and lead to a reduction in the harmful effect of tobacco smoke.

Currently, there is no clear focus on any of the targeted groups and the measures taken in the smoking group are not producing the desired effects. Another problem with this approach is that not all methods affect different socio-economic groups in a similar way. As referring to previously, in Poland, the high differences in smokers' rates are explained by different material status; thus, for some methods to work efficiently in all socio-economic groups they should be adjusted [1, 36].

Tobacco dependence treatment. At present in Poland it is plain that education is insufficient to help people quit smoking. Moreover, it is observed that regardless of the awareness of the harmfulness and destructive influence on the body of the smoker, as well as care for the secondhand smokers in their environment, quitting is very hard and sometimes impossible without additional help from professionals. Help should be therefore commonly offered by GPs, in hospitals and psychological clinics. The methods of treatment and their accessibility in Poland and other countries will be discussed later in this review [28].

Treatment course. According to current guidance, the most common intervention method is a simple conversation between GP and addicted patient. Even brief 3–5 minutes conversation in which the GP informs the patient about smoking toxicity and shares tips on how to quit smoking has turned out to be a very valuable for patients. It has proven to significantly increase their willingness to quit smoking and enhance chances for long-term abstinence. Many sources emphasize the importance and need for these direct conversations between patients and doctors. It has also been proven that regardless of person's attitude, offering help to quit smoking in the long-term produces much better effects and results in higher numbers of quitting attempts than helping only people already in a course of withdrawal. At the same time, the need is highlighted of repeating this kind of conversations regularly to achieve better results, as usually a single consultation is not enough.

Minimal counseling (also called short advice) can have a significant impact on public health due to the large number of smokers who consult doctors every year. All healthcare professionals, i.e., family physicians, general practitioners, occupational physicians, specialist physicians, surgeons, nurses and dentists, should therefore be active in this field and offer minimal advice to all tobacco users [4]. From 2019, the following guidelines were introduced for GPs and first contact doctors:

- ask all patients if they smoke;
- advise patients who smoke to quit;
- assess patient's willingness to quit;
- help an attempt to quit smoking by providing behavioural counseling and prescribing smoking cessation medication;
- arrange a visit to continue.

The second level of treatment for tobacco addiction is professional, specialistic therapy. Depending on accessibility, patients are either directed to specialists in a designated

facility or are referred to a trained GP, nurse or psychologist. The treatment is based on a series of meetings where more detailed information about quitting smoking and a variety of possibilities are introduced to the patient. This kind of treatment involves a minimum of 4 – 9 visits, of about 20 – 45 minutes each, spread over 9 – 12 weeks. During the first visit, a treatment course is planned for every individual. At this stage the therapy is often combined with an additional pharmacological therapy (varenicline, bupropion, cytisine, NRT, etc.), as it has been proved that this approach doubles the drop-out rate [4]. Lately, additional methods have been implemented, such as, self-control, hypnosis or acupuncture which have become very popular; however, the effectiveness of these methods has yet to be confirmed. Once the therapy has been completed and the patients have not relapsed, they are again consulted by a specialist. During the visit the side-effects of pharmacotherapy are examined and patient is informed about ways to effectively maintain abstinence and prevent relapse [37]. The plan for the treatments and intensity of the meeting can, of course, vary between places and patients, and it is highlighted that the more contact and support the patient receives, the more effective the therapy. Still, it is expected that only 25% – 40% of patients will quit smoking after one withdrawal attempt.

Another way to help smokers quit smoking are organized telephone counselling and group therapies. The first method is said to be the most popular among young people, as it gives them a sense of anonymity.

Treatment follow-up and case of relapse. As stated previously, relapse of smoking addiction is very common, and depending on the source varies between 20% – 70% of patients. Therefore, for many patients the course of treatment has to be repeated frequently. Additionally, all addicts who successfully quit smoking are susceptible to relapse, especially within the first 3 – 6 months after withdrawal. The highest potential risk of relapse, however, is expected during the first two weeks after the termination of treatment, and decreases gradually in the following weeks [37].

All patients who stopped smoking after the therapy must use the observation period with qualified support to maintain the non-smoking status. In this regard, the doctor will provide them with interventions, such as cognitive behavioural counseling, to maintain abstinence and prevent relapse to smoking. In this part of the treatment, the role of the specialist is also very important, as their responsibility is to monitor patients and prevent relapse. According to the Polish guidelines, the following questions are very important in this aspect:

- Do you still feel the need to smoke?
- How difficult does it seem to refrain from smoking?

In the case where the specialists notices the risk of relapse, patients receive more support, including repeating the therapy. For patients who have stopped smoking and do not feel the desire or withdrawal symptoms, appropriate checks can be carried out in primary care facilities.

Treatment availability, funding, and inequalities in comparison to other countries. According to the latest WHO report on global tobacco epidemic, from 2019, Poland, in comparison to other European countries, is performing very well; however, there is still room for improvement – especially in accessibility to treatment.

In Poland, a free-of-charge quit line is available, and as assessed by the WHO, is one of 32 countries in Europe in which these are advertised in health warnings or the mass media. At the same time, however, this type of help is not advertised in the other 21 European countries [1, 2, 18]. The Polish market offers a variety of nicotine replacement products which are available only at pharmacies, which is the same as in the majority of European countries. In Poland, this method is not cost-covered by the National Health Fund. The NRT methods in Poland are also not included in the list of essential medicines; however, currently it is fully or partially covered in only 11 European countries [1, 2, 18].

Other shortfalls have been revealed by assessment of the smoking cessation support. For instance, support in the above-mentioned primary care facilities is confirmed by the WHO to be partial, and not available in all the care units. Additionally, this help is only partially covered by the public health care budget. The same situation is observed in the offices of health professionals.

According to the WHO there is currently no help offered to hospitalized addicts. Poland is therefore in the 37% of the European countries that do not support nicotine addicts in hospitals [30].

One of the arguable aspects is also the number of specialists currently able to help smokers. There is said to be a constant lack of a sufficient number of doctors and psychologist specialized in the treatment of tobacco dependency, a general lack of specialistic clinics, and a still low contribution of GPs to the treatment [30].

The national health fund budget provided for prevention. Additionally, as assessed for 2017, in Poland the total expenditure on prevention provided per person was 21 USD. At the same time, in comparison to other western Europe countries, such as The Netherlands (149 USD), Germany (165 USD) or Scandinavian countries like Finland (108 USD) or Norway (231 USD), Poland takes the last place. When compared to other countries from Central-East European region, such as Czech Republic (43 USD) or Lithuania (23 USD), Poland is still the last but the discrepancies are not substantial [33, 38].

Burden on the health care system in Poland due to tobacco use. At the beginning of the 2000s, healthcare costs associated with treating smoking-related diseases were estimated at approximately 18 billion PLN. More than half of this budget was allocated for the treatment of chronic obstructive pulmonary disease (COPD). A 2006 report by The World Bank calculated that in countries with high tobacco consumption (such as Poland), healthcare costs related to the impact of smoking can account for about 15% of all healthcare expenditure on an annual scale. In addition to direct medical costs, there are other estimates of costs associated with tobacco use. In 2004 in Poland, these costs, including losses in productivity and employment, were estimated at 15 billion PLN [29, 39, 40].

Harm reduction approach. According to the NICE (National Institute for Health and Care Excellence), only stopping smoking is the step that offers the best chance of lasting success [41]. However, it is unavoidable that sometimes this is challenging and not possible at certain points during therapy. For smokers not yet able or willing to quit, smokers

who need to temporarily abstain from smoking, smokers who are highly dependent on nicotine, and smokers who wish to protect their families from secondhand smoke, the NICE recommends a harm reduction solution [41]. The goal of this method is to reduce the damaging and negative effect of using cigarettes, or gradually preparing an addicted person for a complete withdrawal. This is often used as a bridging therapy in cases where other quitting approaches have failed. The harm reduction solutions offered as a replacement for traditional cigarettes are products that deliver the addicting substance – nicotine, usually at a similar level to normal cigarettes. They cause much less harm to the organism than the substances released in the process of burning a cigarette [42, 43]. Even though the harm reduction method is still a substitute to classical smoking and does not have a major effect on complete abstinence, it is likely to be of substantial benefit to the smokers who cannot quit, and in general for public health leading to lowering the total risk to the population.

According to the recommendation of the Polish Neuropsychiatric Society, 'precedent registrations of products with reduced risk of advert effects (FDA, USA) create conditions to pragmatically replace tobacco products, in which smoking occurs, with other, less harmful products' [44]. Also, recommendations for the management of lower extremity artery disease, developed by the Polish Society of Angiology, the Polish Society for Vascular Surgery and the Cardiovascular Pharmacotherapy Section of the Polish Society of Cardiology, indicate heat-not- burn products as a less harmful alternative for heavy smokers who are unable to quit smoking [45]. Similarly to the Food and Drug Administration (FDA) declaration which states that all harm reduction products can be authorized by the US FDA as a Modified Risk Tobacco Product (MRTP) if the product, as actually used, will (Part A) significantly reduce harm and the risk of tobacco-related disease to individual tobacco users, and (Part B) benefit the health of the population as a whole, taking into account both the users of tobacco products and persons who do not currently use tobacco products [21, 42]. Which means that all MRTPs authorized by the FDA are expected to contribute positively to harm reduction as they have lower undesirable effect compared to the traditional combustible cigarette smoking [46]. Secondly, the benefits of their use are broad and concern both active and second-hand smokers. Nevertheless, it is important to bear in mind that all Modified Risk Tobacco Products are not risk free, meaning that in any case they should not attract non-smokers. It is also important to emphasize the fact that the FDA places stringent marketing restrictions on the products in order to prevent young people having access and exposure to these substances [46].

Furthermore, over the years, the number of alternatives for cigarettes has significantly expanded and the usage of these types of products has gained popularity [25]. Until recently, electronic nicotine delivery systems (ENDS) were one of the most widespread methods, while at present one of the most common and valued harm reduction approaches are the heat-not-burn products (HnB) [47].

Electronic Nicotine Delivery Systems (ENDS). In general, this term describes all battery-operated devices that heat up an 'e-liquid', leading to production of an aerosol that is inhaled by the user [48]. The e-liquid contains substances

such as varying compositions of flavourings, propylene glycol, vegetable glycerin, and other ingredients. Additionally, ENDS often contain nicotine [1]. ENDS are represented by non-combustible tobacco products, such as vapes, vapourizers, vape pens, hookah pens, electronic cigarettes (e-cigarettes or e-cigs) and e-pipes. The majority of ENDS have similar shape to cigarettes, cigars, or pipes. Some resemble pens or USB flash drives or are built as larger devices, such as tank systems or mods, which have little or no resemblance to cigarettes [46].

ENDS – advantages and disadvantages. It is generally believed that all ENDS methods may help lower cravings to reach for a cigarette in those who are trying to quit smoking. However, neither of these methods is approved by FDA as a common quit-aid method. Moreover, there is still a discussion on the balance between advantages and disadvantages brought by ENDS methods. Firstly, their effectiveness for long-term smoking cessation is doubtful. It is also said that people who switched from traditional cigarettes to ENDS may never reach for help when it comes to their nicotine addiction. Hence, it cannot be determined whether ENDS may help most smokers to quit or prevent them from doing so. Moreover, according to a report from the WHO Framework Convention on Tobacco Control (FCTC) conference from 2016, Poland has recorded a rapid increase in the use of ENDS by non-smoking youth, which has increased by a factor of eight in three years, reaching a 13% prevalence among this group [49].

Secondly, the safety of e-cigarettes and health effects have not been thoroughly studied and there is growing evidence that e-cigarettes can pose serious health risks, as the 'e-liquid' contains many toxic substances that can result in a range of significant pathological changes [50]. Additionally, although the number and level of known toxicants generated by the typical use of ENDS, on average, is lower or much lower than in cigarette smoke, the levels of toxicants can vary enormously depending on brands, sometimes reaching higher levels than in tobacco smoke [49].

Heat-not-burn products. The HnB products work by heating instead of burning the tobacco. It is believed that in this way smokers can avoid the destructive effect of the by-products released during cigarette combustion, while, at the same time providing the body with the desired dose of nicotine. The background for the generation of this type of harm-reducing products is that in high -burning temperatures reaching up to 800°C, tobacco forms smoke containing a mixture of over 6,000–7,000 chemical substances. Within those elements the National Cancer Institute have classified around 250 as harmful and possible triggers of smoking-related diseases, such as lung cancer, heart diseases and emphysema [49, 51, 52]. The alternative proposed by HnB products is an effective way of delivery of nicotine, flavour and sensory experience, comparable to normal cigarettes, while at the same time substantially minimizing the exposure of smokers by 75–95%, compared to tobacco smoke [49, 51, 52]. The reduction in number of harmful substances being released while using this product is achieved by heating the tobacco in a specially designed chargeable element. One of the most common heating-not-burning products available on the market and authorized by FDA, is the IQOS® system offered by the large tobacco company, Philip Morris

International. Since the release of their product in 2014 and its FDA marketing authorization in 2019, to-date IQOS have been introduced in over 50 countries [51, 52].

IQOS – advantages and disadvantages. It is claimed that HnB solutions are significantly less harmful than tobacco smoking and is currently recognized as the most extensively researched tobacco harm reduction method available on the market. Nevertheless, since this product is available on the market only for a short period, there is a limited number of long-term clinical trials assessing IQOS and its influence on health. Also, the relatively short observation time does not allow for proper assessment of the effect of IQOS on tobacco-related diseases, such as cancer or chronic airways diseases.

It has been challenged that the HnB products are as safe as the producers claim them to be. By assessing the temperature at which IQOS are heated up, which reaches around 300°C, researchers note that there is still a certain amount of harmful substances in the aerosol [53].

Additionally, it is important to realize that IQOS users do not inhale only pure nicotine. New substances present in IQOS aerosol are being identified, but most of them are not recognized by the FDA as harmful. However, a method developed by Slob et al. that measures change in cumulative exposure of emitted carcinogenic compounds (CCE) was estimated to be 10- to 25-fold lower when using heated tobacco product instead of cigarettes [54]. In a review published by Ratajczak et al, the authors summarized the impact of the introduction of the HnB products to the market, its availability and popularity [55]. According to the review, there are significant advantages and disadvantages of these types of products. Firstly, it showed that more young adult smokers were aware of the availability of this replacement, and were interested in trying or have already tried the HnB products. The same study revealed that HnB products also appeal to young people who have never tried cigarettes, which makes this group prone to trying HnB products. Nevertheless, a study conducted in Poland by the National Institute of Public Health – National Institute of Hygiene on a large group of young people (N = 10,385) showed that HnB products do not initiate tobacco addiction among adolescents. Only 0.2% of the respondents confirmed that they had used an HnB as their first nicotine product [56].

As seen in the actions of governments in the UK, France, and the majority of the EU, foreign countries have not yet decided on taking sides, leaving open the decision about actual benefits of HnB products [49]. Recently, the FDA authorized the marketing of IQOS as a modified risk tobacco product, ensured that ‘information directed at consumers about reduced risk or reduced exposure from using a tobacco product is supported by scientific evidence and is understandable’ [46].

Success of harm reduction methods. There are many factors influencing the success of harm reduction methods. One of the most crucial elements in effective governing of this approach is the price range of the tobacco substitutes comparison with the traditional tobacco products. Research shows that this aspect plays an especially important role in countries with a lower economic status. The price is therefore a critical factor for the regulation of product availability. Thus, it is important to create a market where the prices of cigarettes are much higher in comparison to all tested, reduced risk, tobacco

products. This can be best administered with correct excise and tax regulation and aligns with the recommendation proposed by the WHO's International Agency for Research on Cancer [1], recognizing the continuum of risk of various nicotine-containing products. With all the above-mentioned aspects shaping the tobacco market in Poland, it seems to be a reasonable approach, with the potential for a successful outcome. However, as mentioned before, Poland is currently preparing for the taxation of heated tobacco products and e-cigarettes liquids, what could cause a significant increase in the price of tobacco alternative products. Therefore, it is important to draw attention to maintain the present tax difference between conventional cigarettes and IQOS® products available currently on the Polish market.

The Polish tobacco sector. There are two sides to the tobacco problem in Poland. The undoubted drawbacks of tobacco consumption have already been enumerated above and are the main concern of this review. Contrarywise, the tobacco market constitutes one of the main economic sectors in Poland. As these two contradict one another, it is very difficult to correctly assess the available statistics; however, this needs to be taken into consideration while interpreting the numbers. It is essential to realize that reduction in smoking rates would inevitably negatively influence the Polish economy. Moreover, the implementation of the above-mentioned programmes aimed at reducing tobacco use, besides the advantages seen in decreasing the numbers of active smokers, also has many drawbacks, with an increase in the ‘shadow’ economy being a major issue [27, 29].

Cigarette production. Poland is one of the biggest tobacco manufacturers in the EU by value. After Germany, which contributes 26% of this value, Poland shares 17% of all European tobacco products. In 2016, Polish tobacco production reached 158,000 tons and contributed 33–35 billion PLN to the GDP, and to 1.1% of the country's economy. Interestingly, between 2002 – 2015, the investment outlays in the tobacco product manufacturing sector grew from 260.7 million PLN to 887.3 million PLN (per year) [57]. From 2014 – 2018, investment outlays in the tobacco sector grew by 124%, which corresponds to a growth from 600 million PLN to 1.4 billion PLN. In 2019, the estimated value of tobacco products manufactured in Poland was 45.9 billion PLN [58].

Workforce in the tobacco sector. It is estimated that the workforce in the Polish tobacco industry is equivalent to 33,000 full-time positions. Additionally, in 2016, in comparison with 2012, there had been an increase in both the number of people employed in the business chain and the share in the total number of workers, of 60,000 and 0.17%, respectively. In 2019, the number of people with jobs connected to tobacco cultivation, manufacturing, and distribution of tobacco products, exceeded 600,000 [57].

Taxes on tobacco products in Poland. In 2016, the production and consumption of tobacco products has brought Poland a total of about 24.4 billion PLN in tax revenue, which equals 8.9% of the total tax revenue. This was divided by 18.5 billion PLN from excise, 5.5 billion PLN from VAT, 124 million PLN from personal income tax, and 250 million PLN from corporate income tax. Revenues from indirect taxes on tobacco products in 2016 constituted 7.6%

of total budget revenues and 8.9% of total tax revenue. By comparison, in Germany these revenues are about 2.6% of the total budget revenue; whereas a high value for this indicator can be observed in countries with a low GDP, e.g. in Bulgaria, where it was 7.9% in 2013.

Increasing the average excise tax to 9.76 PLN per packet of cigarettes in Poland would result in 618,000 adults quitting smoking and would discourage 215,000 young people from smoking, which would mean a 7.2% reduction in premature deaths in the Polish population. Moreover, it would increase excise tax revenues by 7.1 billion PLN. An important issue which has not yet been addressed in the Polish excise tax system is the correlation between the level of proven toxicity of the product, and the excise. This has been advised by the WHO but has not yet been implemented in Poland [59].

Cigarettes sold in Poland. There is a discrepancy between the number of smokers and the number of cigarettes sold. Despite the decrease in the number of smokers in Poland over the last decade, it is surprising that the number of cigarettes sold continues to increase. One of the main reasons could be the migration rate.

Immigration

The above-mentioned discrepancies can be explained by looking at immigrants living in Poland. The number of immigrants living in Poland who smoke is high; nevertheless, they are not included in any of the health statistics. Hence, the actual number of people smoking daily in Poland cannot be properly assessed. On the other hand, immigrants can also be a source of illegal importation of cigarettes.

Emigration

In the case of emigration, it is possible that emigrants visiting Poland (Polish or other nationalities) purchase cigarettes in Poland because of the low price, but eventually use them in their country of origin. In the three European countries in which the number of Polish emigrants is the highest, the United Kingdom, Germany and France, prices of cigarettes reach 12.26€, 6.4€, 10€, respectively, whereas in Poland the price is estimated to be 3.71€, with Poland being the 28th out of 38 European countries with the lowest cigarette prices [60].

Attractive cigarette prices in Poland compared to world prices. The prices of cigarettes in Poland continue to be very low. It has been assessed that in 2010 the number of packs of cigarettes that could be purchased with net average income was 255, even though over the years this number has had a decreasing tendency, in 2015 reaching 215, and currently this number remains in the same range. According to the above-mentioned costs of a pack of cigarette in other countries, Poland, compared with other Western Europe countries, is in the last 10 [57].

Illegal market. Although it is difficult to precisely define the size of the illegal tobacco market in Poland, it is estimated that annually around 10 billion cigarettes are the result of smuggling, additionally, the national illegal production is estimated to reach 0.3 billion cigarettes. In comparison, Poland produces 175 billion cigarettes every year. Furthermore, one of the main tobacco control methods is tax manipulation [61].

Recently, an important issue was raised regarding the black market. In 2020, two big changes in the tobacco market were introduced in Poland. Firstly, an increase in excise duty on tobacco products as of 1 January 2020, as a result of which the price of a packet of cigarettes should have increased by 1.10 PLN and a kilogram of dried tobacco – 20 PLN. However, due to the high *ad-valorem* rate and low specific component of excise, only 10% of the cigarette market increased prices as expected. Producers of cheap cigarettes, due to inadequate excise structure, increased their prices by only 0.60 PLN. Additionally, the price of all e-cigarette liquids, which until end of September 2020 had a zero-tax rate, is predicted to increase by up to 150–200%. Secondly, according to the EU ordinances, as of May, all menthol tobacco products were banned. In Poland, this market reached almost one-third of all tobacco products. Therefore, some experts expected that the simultaneous elimination of a significant part of the market and price increases determined by the tax increase, may direct consumers to the ‘grey’ economy [34]. Furthermore, it is feared that the illegal market will expand even more if Poland aligns with price recommendations from the WHO and EU (high increase)[58]. The reality appears to be totally different, i.e., the legal market in cigarettes a maintained level similar to the previous year while the ‘grey’ zone decreased. Market outcomes confirmed that there is still place for an increase in excise tax for traditional tobacco products, in particular for cigarettes. Moreover, there is still a need to change the excise tax structure by increasing specific components and decreasing the *ad valorem* rate to adequately impact on cheap cigarettes price policy. Such a change will comprehensively implement the recommendations of the guidelines for implementation of Article 6 of the WHO FCTC. In accordance with the guidelines considerations, ‘Uniform specific taxes compared to *ad valorem* taxes may reduce incentives for consumers to switch to lower-priced brands because they generate smaller price differences between lower- and higher-priced brands’ [21].

SUMMARY

The battle with smoking addiction worldwide and in Poland, although it is on a right path, it is slowly reaching a plateau, and the percentage of the population still smoking has reached an equilibrium. This review confirms that in order to improve this situation it will take a consolidated effort from the aspects of finance, health and social politics. The lack of such a partnership across these three governing branches is reflected in the alarming state of health of Poles, which is reflected in the number of cases of cancer, chronic diseases, obstructive pulmonary disease, and coronary heart disease in various forms). At the same time, the smoking problem has huge economic consequences.

In many places in this review, it can be deduced that although there is visible progress, some of the methods might not be those best suited for the whole of Polish society. As mentioned at the beginning, the number of Poles smoking correlates negatively with social status, yet there are not many measures aimed particularly at the poorest group. It is of the highest priority to efface these discrepancies by inculcating new and more suitable plans, including tax policy changes, starting from the excise tax structure based mainly on the specific, not *ad valorem*, component of excise.

Prevention measures should therefore address the specific pattern of smoking inequality observed within a population, as it is not possible to make specific policy recommendations that will work in every country in Europe. National population-based tobacco control policies are important, but are unlikely to significantly reduce inequities without additional measures. When developing tobacco control policies at European, national and local levels, it is essential to consider the equity implications with the best available evidence. This is important smoking-related harm [7].

Because the number of Poles still smoking remains very high, the of the most essential aspects in the process of tobacco eradication in Poland is efficient medical help. Hence, physicians should routinely identify a patient's smoking status, readiness to quit, advise and assist smokers to quit, and offer pharmacotherapy to help them quit. Currently, with number of nicotine replacement products it can be even simpler. For physicians and health care systems alike the only challenge is implementing effective treatment in routine medical practice.

In conclusion, it is noticeable in Poland that tobacco use is still a substantial problem. It not only has its consequences in the health care sector because of the number of people suffering from diseases related to smoke exposure is very high, and therefore also medical costs, as well as in many other important aspects of society. Hence, more methods and improvements need to be urgently implemented in Poland.

As Poland, compared to other European countries, is still lagging behind, in order to achieve the established goals and satisfying results still more steps and measures need to be implemented. Poland must reassess and focus on strengthening early health education, introducing acceptable substitution and harm-reduction (HR) techniques, expanding treatment possibilities, and improving education and prevention as well as implementing more decisive market activities, including control of legal and illegal production and evaluating possibilities to limit smuggling.

The authors agree that all 'nicotine providers', including HnB, e-cigarettes, NRT, nicotine pouches, etc., fall within the category Harm Reduction. The problem is that there is no definition of the category and different countries have classified these product differently. It would therefore be helpful if, on an international basis, it could be has been agreed on what exactly an HR product is. This would make introducing them into markets, or designing special, even preferable tax rates, more transparent.

With this said, our goal is to ensure greater consistency in smoking prevention measures and to promote a comprehensive tobacco control policy at national level. Ultimately, total eradication of tobacco smoking should be one of the basic, long-term tasks of public health. However, in the short-term, reduction in tobacco use or harm-reduction through the introduction of alternative products, while addressing more rigidly regulations regarding the most harmful forms of nicotine consumption – cigarette smoking – can be considered an advantageous solution.

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