SAVING LIVES LIKE SWEDEN

SMOKE FREE SWEDEN 2023

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3. Calculating the 'Size of the Prize' for Public Health

APPENDIX A

> **Judge a man not on his answers, but by his questions**
>
> **Voltaire**

SMOKE FREE SWEDEN 2023

About the Report

Even after decades of tobacco control, an estimated 1.3 billion people still use tobacco. Tobacco kills up to half of its users, with nearly 8 million people dying worldwide each year due to tobacco-related causes, and 200 million years of life are lost.

Global public health has set as a goal a 'smoke free' future by 2040, where 5% or less of the adult population smoke in any given country. Most countries fall woefully short of this target. Since the establishment of the World Health Organization (WHO) Framework Convention on Tobacco Control (WHO-FCTC) treaty 18 years ago, tobacco demand has declined, but far too slowly and, in some low- and middle-income countries (LMICs), not at all.

There is one exception, the country of Sweden. The precursor report to this edition, called the "The Swedish Experience, a Roadmap to a Smoke free World" (see link), explains how the Swedes have succeeded where others have fallen short. Thanks to the Swedish way of making alternative smoke-free nicotine products widely accessible, acceptable, and affordable, this country's smoking prevalence has fallen to 5.6%. In short, Sweden has been able to successfully combine tobacco control and harm reduction strategies.

This is exactly what is called for in the WHO-FCTC, where Article 1(d) calls for: 'tobacco control' which means a range of supply, demand and harm reduction strategies that aim to improve the health of a population by eliminating or reducing their consumption of tobacco products and exposure to tobacco smoke.

This follow-up report is a call to the WHO and global public health to study the harm reduction strategies so successfully employed by Sweden. More importantly, to develop updated databases of tobacco-attributable deaths and epidemiologically sound methods to calculate the 'size of the prize' for public health.

This report offers facts, analysis, and calculations of the number of deaths and disability-adjusted life years averted in Sweden and life years saved. There are significant limitations in doing these calculations, not least because WHO data on tobacco-attributable deaths is outdated and several assumptions need to be made to determine the best estimate for key health metrics in Sweden and comparisons with other countries. Therefore, this report invites critique of methodology and encourages debate and development of more accurate databases and methods.

What is not contested, is that Sweden is about to become the first WHO member state to become 'smoke free' and its tobacco control and harm reduction strategies deserve to be studied and replicated. This compelling strategy has the potential to dramatically alter the future for countless smokers, potentially saving millions of lives around the world.

Acknowledgements

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Abbreviations

ANP	Alternative Nicotine Products
COP10	10th session of the conference of parties to the FCTC
WHO-FCTC	World Health Organization Framework Convention on Tobacco Control
MPOWER	Monitoring tobacco use, Protecting people from tobacco smoke, Quitting tobacco, Warning about the dangers of tobacco, Enforcing tobacco advertising bans, Raising taxes on tobacco
LMICs	Low- and middle-income countries
DALYs	Disability-adjusted life-years
YLLs	Years of life lost
YLDs	Years lived with disability
HDI	Human Development Index
UNDP	United Nations Development Programme
COPD	Chronic obstructive pulmonary disease
NCD	Non-communicable disease
IHME	Institute for Health Metrics and Evaluation
GBD	Global Burden of Disease Study
CDC	Centers for Disease Control and Prevention
EU	European Union
ENDS	Electronic nicotine delivery systems
HRPs	Harm Reduction Products
THR	Tobacco harm reduction
NRT	Nicotine-replacement therapy
HNB	Heat-not-burn
SLT	Smokeless tobacco
SAVM	Smoking and Vaping Model
THP	Tobacco heating product
HTP	Heated tobacco products
PPPs	Public-Private Partnerships
QALYS	Quality-adjusted life years
SAMRC	South African Medical Research Council

Executive Summary

This report is a call to the WHO and global public health to study the harm reduction strategies so successfully employed by Sweden. More importantly, to develop updated databases on tobacco-attributable deaths and develop epidemiologically sound methods to calculate the 'size of the prize' for public health.

The report examines the tobacco control objective of 'smoke free' and the current methods employed to achieve this goal. It further identifies relevant sources of data and the public health metrics needed to measure success. Sweden's blend of tobacco control and harm reduction strategies are examined and compared to the EU's tobacco control performance and selected other countries.

Current simulation modelling frameworks are analysed and their application to various countries is noted. Lastly, a recent consumer perception study in Sweden is highlighted, to show the importance of a whole-of-society approach and a deep understanding of consumer behaviour, to successfully address the challenge of the tobacco epidemic.

AN INTERNATIONAL PUSH TOWARDS 'SMOKE FREE': 'Smoke free' is broadly defined as an adult smoking prevalence of <5% and is part of the tobacco control 'end game' strategies of WHO and several countries, including the EU, USA, United Kingdom, New Zealand and Sweden. Smoking cessation efforts worldwide have largely stalled or proven less effective, with smoking persisting in many low- and middle-income countries (LMICs) and within the most vulnerable groups in higher-income countries.

TOBACCO HARM REDUCTION AS PROOF OF CONCEPT: As harm reduction products (HRPs) have now been available for more than two decades, there is proof of concept regarding their ability to displace cigarettes and reduce harm to individual users. Whilst article 1(d) of the WHO's FCTC[4] affirms the inclusion of 'harm reduction strategies' as part of an integrated approach to tobacco control, policy discourse related to HRPs remains contentious.

SWEDEN'S SUCCESSFUL BLEND OF TOBACCO CONTROL AND HARM REDUCTION STRATEGIES: In Europe, Sweden is leading the way in adopting an integrated approach to tobacco control, complemented by harm reduction strategies. Whilst its prevalence of nicotine use is similar to the EU average, the vast majority of this intake is via safer, non-combustible alternatives. Sweden's smoking prevalence (5.6%) is nearly five times lower than the EU average (23%). Consequently, Sweden has the lowest tobacco-related disease and mortality rates in the EU.

RECOMMENDATION #1

As in Sweden, recognise the fundamental differentiation between combustible and non-combustible forms of tobacco and nicotine. Advocate for risk-proportionate regulations to incentivise adult smokers to quit or switch to less harmful smoke-free products.

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TOBACCO-RELATED DISEASE AND PREMATURE DEATH: COMPARATIVE ANALYSIS OF KEY PUBLIC HEALTH METRICS BETWEEN SWEDEN VERSUS THE EUROPEAN UNION AND SELECTED OTHER COUNTRIES: Using data from the WHO Global Report on Mortality Attributable to Tobacco and the Global Burden of Disease Study by the Institute of Health Metrics and Evaluation (IHME), best estimate quantifications and comparisons are made regarding smoking-related disease and premature death across different countries.

DEATHS AND DALYS: By comparing the rates of death and Disability-Adjusted Life Years (DALYs), differences in countries' populations are accounted for when comparing their smoking-attributed mortality and morbidity. A DALY is a universal metric that equals the sum of years of life lost (YLLs) and years lived with disability (YLDs). One DALY is equivalent to one lost year of healthy life.

SWEDEN'S TOBACCO CONTROL PERFORMANCE COMPARED TO THE EUROPEAN UNION (EU): Examining 'all causes of death', if the European Union had the same smoking-attributable death rate as Sweden during the years 2000-2019, potentially 2.9 million deaths could have been averted. At the same time, examining 'all causes' of lost DALYs; if the European Union had the same smoking-attributable rate of DALYs lost as Sweden during the years 2000-2019, 108 million DALYs lost could have been averted.

RECOMMENDATION #2

As an elaboration of harm reduction strategies referred to in the FCTC Article 1(d), advocate for Sweden to be the subject of a country case study by WHO and Member States. Where appropriate, replicate Sweden's integrated approach to tobacco control, complemented by harm reduction strategies and products.

PREVENTING TOBACCO-RELATED DISEASE AND DEATH IN SWEDEN: Sweden's incidence of cancer is 41% lower than the rest of its European counterparts, corresponding to a 38% lower level of total cancer deaths. 24 of the other 27 EU Member States have a tobacco-related mortality rate twice as high than Sweden, relative to population size. Sweden has a 39.6% lower rate of death of all tobacco-related diseases compared to the EU average and has the lowest number of deaths attributed to lung cancer.

RECOMMENDATION #3

Develop sources of data and mechanisms to assess the health impact of risk-proportionate policies, such as those employed in Sweden. Those mechanisms should include measuring the effectiveness of policies applicable to pricing, labelling, taxation, flavours, nicotine levels, and health messaging.

SELECTED COUNTRY CASE STUDY IN TOBACCO CONTROL - SWEDEN VERSUS BELGIUM: Recently, Belgium banned the category of oral nicotine pouches, one of the harm-reduced products used by Swedish consumers. This seems a most inappropriate measure, given that the most harmful product, cigarettes, are still freely available. If Belgium had the same rate of smoking-related deaths and DALYs as Sweden between 2000-2019, potentially 90,570 deaths and 2.5 million DALYs could have been averted.

CONSIDERING LMICS AND THE INTERACTION BETWEEN SMOKING AND TUBERCULOSIS: Smoking is the leading preventable cause of death worldwide, and it inflicts disproportionately greater harm to poor, vulnerable, and marginalised population groups; over 80% of smokers live in low- and middle-income countries (LMICs). Given the need for access, affordability, and acceptance of smoke free nicotine alternatives, the Swedish model should be considered as an aid to tobacco control in LMICs.

RECOMMENDATION #4

Consider funded research in LMICs, to identify optimal policy responses, including the Swedish model, to support cessation and improved access, affordability and acceptance of tobacco harm reduction products.

PROSPECTIVE MODELLING - SIMULATION MODELLING TO CALCULATE POTENTIAL TOBACCO-RELATED DEATHS AVERTED, LIFE YEARS GAINED: Models proposed by Levy et al, Warner et al, Ramström and Yach were noted. The Smoking and Vaping Model (SAVM) of Levy et al projects that according to current patterns of smoking and vaping prevalence in the **United States**, between 2013 and 2060, the net outcome of smokers switching to nicotine vaping products will translate into:

- **1.8 million fewer smoking-related premature deaths**
- **38.9 million life years gained**

In **Canada**, between 2012 and 2052, this would translate into:

- **130 000 deaths avoided**
- **3.5 million life years saved**

In **Germany**, between 2013 and 2060, this would translate into:

- **300 000 deaths avoided**
- **4.7 million life years saved**

In **England**, between 2012 and 2052, this would translate into:

- **200 000 deaths avoided**
- **5 million life years avoided**

Derek Yach projected how the widespread adoption of HRPs would drastically reduce tobacco-related deaths by 2060. According to Yach's estimates, the potential public health benefit is 3 to 4 million fewer annual tobacco-related deaths within four decades. "In his words: there is no other public health issue where the potential gains approach that order of magnitude".

Warner and Mendez proposed a model, where the authors projected that the US population would gain almost 3.3 million life years by 2070 thanks to smokers switching to e-cigarettes. They concluded: "The benefits of the public's health will exceed the potential costs of vaping-induced new smokers."

Using the WHO Global Report on Mortality Attributable to Tobacco, **Lars Ramström** projected that in men over the age of thirty, in the EU 355,000 lives per year could have been saved if the other EU countries had matched Sweden's tobacco-related mortality rate.

RETROSPECTIVE MODELLING:

- **Saving lives:** A comparison of tobacco-attributed mortality between 2000-2019 in Sweden versus the European Union (EU), using data from the IHMA's Global Burden of Disease Study, showed that potentially 2.9 million premature deaths could have been averted.
- **Averting disability-adjusted life years (DALYs):** Moreover, the Swedish model could have an even greater impact on averting Disability-Adjusted Life Years (DALYs). If the EU were to have employed the Swedish model, potentially 108 million DALYs would have been averted in the EU. In short, the EU adult smoker population could have led healthier and more productive lives, as in Sweden.

RECOMMENDATION #5

Undertake prospective and retrospective simulation modelling on a multi-national, multi-disciplinary basis, to estimate and better understand the benefits of harm reduction strategies in terms of life years saved, and avoidance of premature tobacco-related deaths and disability-adjusted life years. This is a galvanising force in public health, as was shown during the Covid pandemic.

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CONSUMER INSIGHTS

- **Consumer research:** Consumer choice can drive change, as has been proven in Sweden. The Ipsos 2023 study showed that acceptability, affordability and accessibility are key drivers of consumer migration from the most harmful form of tobacco (cigarettes) towards quitting or less harmful forms of nicotine.
- **Health reasons** weigh significantly heavier with age, for Swedes to switch from cigarettes to smoke free nicotine alternatives.

RECOMMENDATION #6

In support of the FCTC COP 10, promote engagement with consumers and a whole-of-society approach to address the tobacco epidemic, including conducting consumer behaviour studies. Leverage Swedish consumer insights to support bringing an end to smoking in other countries.

RECOMMENDATION #7

Calling on all stakeholders in tobacco control and harm reduction to affirm and support the United Nations Political Declaration of the High-Level Meeting of the General Assembly on the Prevention and Control of Non-Communicable Diseases (2011) calling for a 'whole-of-government' and 'whole-of-society' effort. In addition, to "recognize that the rising prevalence, morbidity and mortality of non-communicable diseases worldwide can be largely prevented and controlled through collective and multisectoral action by all Member States and other relevant stakeholders at local, national, regional, and global levels, and by raising the priority accorded to non-communicable diseases in development cooperation by enhancing such cooperation in this regard".

Table 1:

Using Sweden as a benchmark, the table below showcases the transformative impact that lower smoking prevalence can have on a nation's health - from deaths averted and life years gained. Detailed and expanded data available in Annex 1.

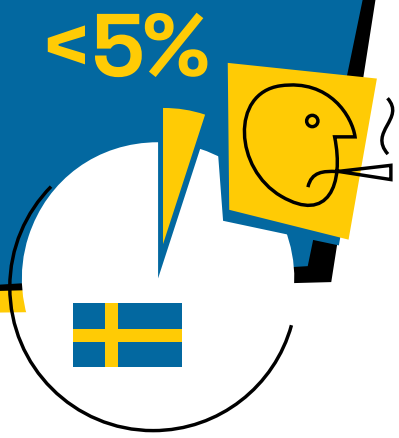
Country	Potential Deaths Averted	Potential Life Years Gained	Potential DALY's Averted
Denmark	116 284	2 125 295	2 470 455
Netherlands	125 151	3 178 308	3 572 180
Italy	124 750	4 263 002	4 369 863
France	90 570	2 303 844	2 511 439
Germany	454 366	15 504 344	17 981 109
United Kingdom	680 808	13 477 253	15 856 067
Spain	30 865	3 900 229	3 352 663
Poland	442 020	16 829 681	17 498 524
Romania	251 205	10 530 736	10 479 915
Greece	169 522	4 040 339	4 511 619
Bulgaria	249 280	7 660 410	8 109 450
Hungary	251 124	7 942 192	8 494 164
EU	**2 890 004**	**103 436 746**	**107 978 932**

CHAPTER 1

Introduction:

WHAT DOES 'SMOKE FREE' MEAN?

The Quest towards 'Smoke Free' – why and how Global Public Health have established the aspirational goal of 5% Smoking Prevalence as the 'End Game' for Tobacco Control



1.1 A Public Health Policy Priority - 'Smoke Free'

A policy priority

On 3 February 2021, the European Commission launched its eagerly-anticipated 'Europe's Beating Cancer Plan'[1, 2] – an initiative led by the EU Parliament's Special Committee on Beating Cancer (BECA). With a €4 billion budget, the Plan is structured around four key pillars to tackle cancer: (1) prevention; (2) early detection; (3) diagnosis and treatment; (4) and quality of life of cancer patients and survivors[4]. A priority action area under the first pillar of prevention is 'achieving a tobacco-free Europe'[2], since tobacco consumption continues to be the leading cause of preventable cancer (accounting for 27% of all cancers)[3].

The meaning of 'tobacco-free'

Practically speaking, what does it mean to be 'tobacco-free'? The answer depends partly on each country's stance on harm reduction products (HRPs), such as electronic nicotine delivery systems (ENDS), oral nicotine pouches, heated tobacco products (HTPs), and snus. Whilst article 1(d) of the WHO's FCTC[4] affirms the inclusion of 'harm reduction strategies' as part of an integrated approach to tobacco control, policy discourse related to HRPs remains heterogeneous[5]. For example, whilst Sweden has successfully pioneered snus as a less harmful alternative to combustible cigarettes, Belgium issued a decree in 2022 prohibiting the sale of nicotine pouches[6].

Nevertheless, the WHO-endorsed notion of a 'tobacco-free generation' (TGN) pervades across most nations as a goal worth striving for; it is defined as an adult smoking prevalence of <5%, coupled with legislation that precludes the sale of tobacco products to people born after a certain date[7] – e.g. in Singapore tobacco sales are denied to: 'a person below the age of 18 years or a citizen born on or after 1 January 2000'[8].

An international push towards 'Smoke Free'

Since Michael Russell's observation in 1976 that "people smoke for nicotine but die from the tar"[9], a growing body of evidence (see part 1 of this report) has conclusively demonstrated that non-combustible HRPs are significantly less harmful than combustible cigarettes[10–13]. As such, an alternative term to 'tobacco-free' has emerged, which apportions due recognition to the role that HRPs play in displacing combustible cigarettes, in addition to the traditional MPOWER tobacco control measures[14]. The term is 'smoke free', which is defined as an adult smoking prevalence of <5%, with the implication that HRPs are a key ingredient to accelerating towards the goal of a combustible cigarette 'end game'[5]. Examples of policies chasing 'smoke free' status (with target year) include:

- EU: The EU Beating Cancer Plan (2040)[2]
- USA: Healthy People (2030)[15]
- New Zealand: Smoke-Free Aotearoa (2025)[16]
- England: The Smoke-Free 2030 Ambition for England (2030)[17]
- Sweden: Tobacco End game - Smoke free Sweden (2025)[18]

1.2 Why aspire towards smoke free?

The harms of smoking to individuals and society

There are over 7000 chemicals in tobacco smoke, of which 250 are known to be harmful, including 70 carcinogens[19]. Of the 1.3 billion people who smoke worldwide, more than half will die prematurely as a result; annually, there are over 8 million premature deaths attributable to smoking[20]. Moreover, for every 1 premature death, 30 people live with a serious smoking-related illness that limits their quality of life[21]. These figures provide a bleak overview of the individual and societal harms caused by combustible cigarettes.

Table 2: Selected push factors to move away from the individual and societal harms of combustible tobacco.

Individual	Consi-deration	Societal
The ill effects of smoking on health are extensively documented; globally, it is the leading preventable cause of death. For example, people who smoke are up to 30x more likely to get lung cancer[22]; the risk of all-cause premature mortality is more than double in those who smoke[23]. Smoking's deleterious impact on quality of life is also well-established, with a dose-response relationship between smoking and loss of independence in activities of daily living. Xu et al recently demonstrated an average loss of 8.1 quality-adjusted life years (QALYs) among people who smoke[24].	Health	Whilst smoking is often perceived as a social activity, and a common reason for initiation, recent findings from the nationally representative English Longitudinal Study of Ageing indicate that sustained smoking increases social isolation and loneliness. Even after adjusting for age, sex, and socioeconomic status, people who smoked had less frequent social interactions with family and friends; less frequent engagement with community and cultural activities; and were more likely to live alone[25]. Given global trends towards a growing ageing population, this provides further cause to become smoke-free.
In a 2017 meta-analysis of the association between smoking prevalence and income level, Casetta et al found that lower income was consistently associated with higher smoking prevalence (OR 1.45; 95% CI 1.35-1.56)[26]. Furthermore, as smoking is concentrated among the poor and vulnerable groups, there is a vicious cycle of cigarette dependence and poverty[27].	Economy	Globally, tobacco use burdens economies with more than US$ 1 trillion in healthcare costs and lost productivity every year. This economic burden disproportionately affects LMICs, as 80% of people who smoke live in LMICs[27]. The net result is that socioeconomic inequality is exacerbated, economic productivity is hampered, and GDP growth is constrained[28].
Two examples of environmental harms to individuals from combustible cigarettes are: (i) home fires: Despite the development of so-called 'fire safe' cigarettes, they remain the top cause of fatal home fires[29,30], even in countries where smoking prevalence has decreased in recent years[31]; (ii) Third-hand smoke pollution: refers to the long-lasting smoke residue that lingers on surfaces indoors. The accumulation of toxic constituents of smoke pollutes the indoor environment, and infants are especially vulnerable to this as they spend a long time indoors[32].	Environment	Cigarette butts are the most abundant form of plastic pollution in the world. 5.6 trillion cigarettes are smoked annually, two-thirds of which are improperly disposed of[33]. This manifests as 766.6 million kilograms of toxic trash every year; it is the most common plastic litter found in beach clean-ups[34]. The environmental harms are clear: e.g., microplastic leakages into the marine ecosystem, and accumulation of microplastics in the food web. The WHO and UNEP have partnered to tackle this urgent issue through the Clean Seas Campaign[34].
The direct harms to the individual of second-hand smoke are indisputable. A meta-analysis (compiling evidence from 24 studies) revealed a significantly increased risk of disease for those exposed to second-hand smoke: 66% for COPD, 35% for stroke, and 27% for ischaemic heart disease[35]. Babies and infants are particularly vulnerable to the ill effects of second-hand smoke, which is implicated in 60% of sudden infant deaths (also known as cot death)[36].	Youth	To achieve the ambition of a smoke free 'end game', society needs to phase out the consumption of combustible cigarettes with each generation. Evidence shows that parental smoking is among the top reasons for youth smoking initiation; children whose parents smoke are 4x more likely to take up smoking themselves[37]. Interestingly, children of parents who had quit smoking appear to be no more likely to smoke than children whose parents never smoked[38].

1.3 Harm Reduction Products (HRPs): A fire escape for smokers struggling to quit

The appetite to move away from the harms of combustible cigarettes is significant amongst policymakers and consumers alike. Seven out of ten adults who smoke want to quit, and three quarters regret ever having started[39]. Of the 44% who attempt to quit, only 4 to 7% succeed[20]... the average number of quit attempts before succeeding is 30[40].

Harm reduction products (HRPs) provide a fire escape. By removing the element of combustion, these smoke free alternatives are demonstrably less harmful than cigarettes and provide means to deliver nicotine without the tar. Sadly, nicotine itself remains a widely misunderstood molecule; in a recent US study of 1058 doctors, the vast majority of them "strongly agreed" that nicotine directly contributes to the development of cardiovascular disease (83%), COPD (81%), and cancer (81%)[41]. These nonfactual misperceptions are reflected in the consumer population – in 2020, Rajkumar et al. conducted an international study of adults (n=54,627) who smoke, use HRPs, or have previously smoked or used HRPs in the last five years. They found that 89% of current consumers believe nicotine is harmful, and up to 78% believe it to be the primary cause of tobacco-related cancer[42].

THE TRUTH ABOUT NICOTINE & SAFER ALTERNATIVES

World-renowned physician and pre-eminent expert on nicotine pharmacology, Prof Dr Neal L. Benowitz, has stated: "Nicotine plays a minor role, if any, in causing smoking-induced diseases"[20]. Another physician who is passionate about dispelling myths about nicotine, and helping smokers quit cigarettes is Dr Colin Mendelsohn. In a chapter entitled 'Busting the Myths about Nicotine' of his recently published book, Dr Mendelsohn synthesises a sound body of evidence demonstrating that nicotine does not cause cancer, lung disease, or heart disease[43]. Therefore, by switching from combustible cigarettes to smoke free nicotine alternatives, the potential public health gains are remarkable. As the Royal College of Physicians stated in its landmark report 'Nicotine Without the Smoke'[44]: "(...) nicotine itself is not especially hazardous. If nicotine could be provided in a form that is acceptable and effective as a cigarette substitute, millions of lives could be saved".

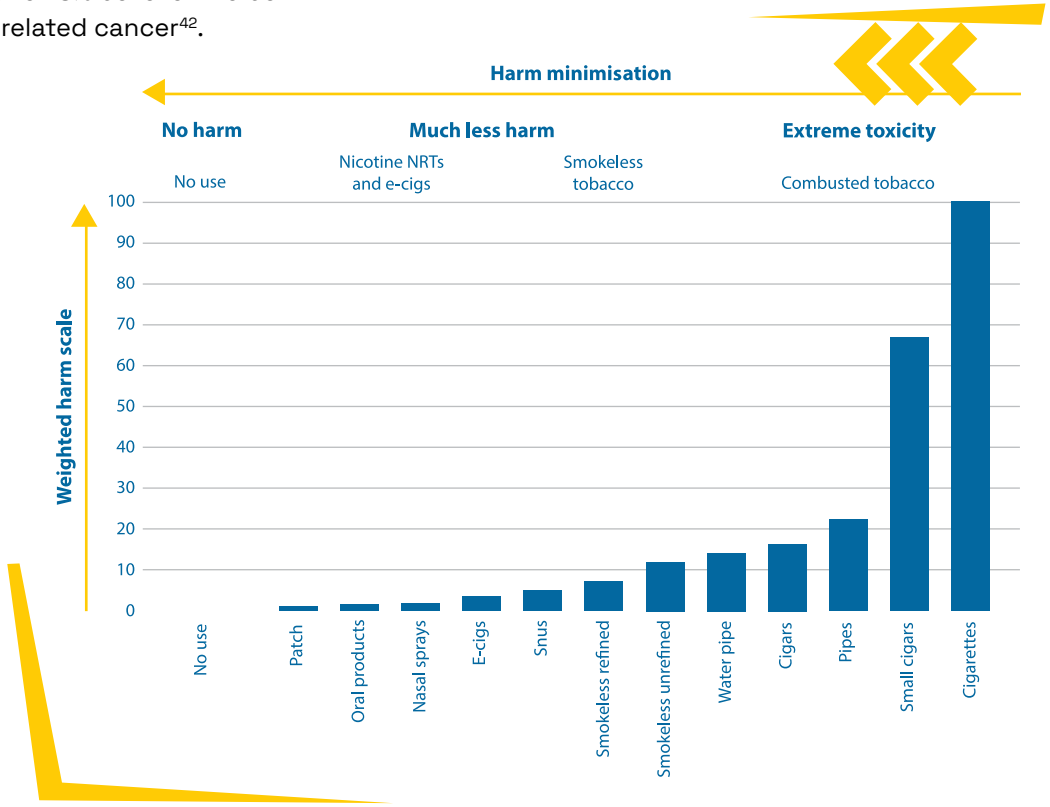


Figure 1: The weighted harm of combustible tobacco compared to non-combustible alternatives placed along the 'harm minimisation continuum' by Abrams et al[45]

1.4 How can a 'Smoke free' status be achieved?

VARIOUS APPROACHES TO THE 'END GAME'

Since the adoption of the Framework Convention on Tobacco Control (FCTC) by the WHO in 2003[46], various 'end game' strategies have been proposed to phase out tobacco consumption[47]. These can broadly be categorised in three ways:

- **The FCTC's MPOWER measures:** these include smoke free public spaces, cessation support, warning labels, plain packaging, bans on advertising, public health campaigns, and increased taxation of tobacco products[14].
- **The 'Tobacco-Free Generation' (TFG) proposal:** This precludes the sale of tobacco products to people born after a certain date, e.g., in Singapore, citizens born on or after 1 January 2000[8].
- **Harm reduction via alternative nicotine products:** For smokers who are struggling to quit, provide access to less harmful alternatives (HRPs), e.g., e-cigarettes, oral nicotine pouches, snus, and heated tobacco products. This approach is currently not embraced by the WHO FCTC, despite being enshrined in Article 1(d) of the original treaty[4].

All the above approaches agree on the premise that tobacco-related harm remains unacceptable. Whilst the MPOWER measures have been successful in reducing smoking rates, many of the developed countries where they were implemented now stall at a smoking prevalence plateau of 15-25%[47] - far from the smoke free ambition of <5%. Indeed, as Bonita and Beaglehole recently commented: "tobacco control is not working for most of the world. (...) The missing strategy in the WHO and FCTC policies is harm reduction"[48].

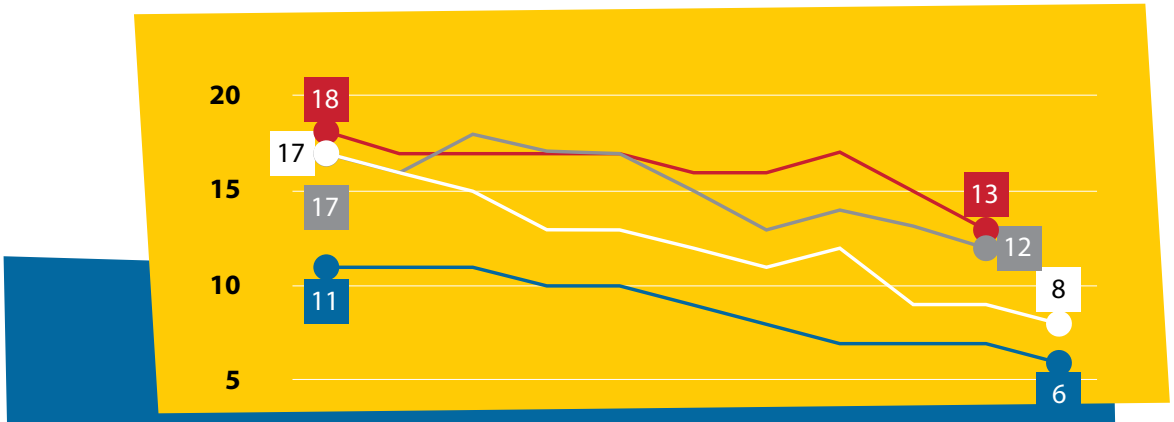
ACCELERATING AN END TO SMOKING

Dr Derek Yach, former Executive Director of Non-Communicable Disease at the WHO, who was central to the development of the FCTC, has also called for a change to the status quo. In a paper entitled 'accelerating an end to smoking'[5], Yach notes the subpar implementation of MPOWER measures – for example, that only 23 countries in the world provide cessation services at best-practice levels. Yach's call to action resonates with Bonita and Beaglehole: 'To cut death and disease rates within two decades, we must consider new strategies for accelerating adult cessation. In particular, we must embrace empathetic tactics that encourage individual smokers to quit or switch – including the use of harm reduction products (HRPs)'[5].

TOBACCO HARM REDUCTION: PROOF OF CONCEPT

As HRPs have now been available for more than two decades, there is proof of concept regarding their ability to displace cigarettes and reduce harm to individual users. In a recently published review by Dr Karl Fagerström, smoking prevalence in countries with relatively high adoption of HRPs was compared to neighbouring countries where HRPs are less prevalent: 'The data indicate that countries with high adoption of alternative nicotine products have been able to achieve lower smoking rates'[49] To use the Nordics as an example, Sweden and Norway (where snus and oral nicotine are available) are far ahead of their neighbours Denmark and Finland (where these HRPs are prohibited) in achieving a smoke free society[49]:

Figure 2: Daily smoking prevalence in Sweden & Norway (where snus is available) vs in Denmark & Finland (where snus is prohibited)[49]



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Sweden (16-84)	11	11	11	10	10	9	9	7	7	7	6
Norway (16-74)	17	16	15	13	13	12	11	12	9	9	8
Denmark (16-74)	18	17	17	17	17	16	16	17		13	
Finland (20-64)	17	16	18	17	17	15	13	14	13	12	

1.5 Call for an integrated 'Smoke Free' & End game strategy

The ultimate goal of any end game strategy should be to minimise tobacco-related disease and premature death. Each of the three approaches (traditional MPOWER tobacco control policies, a tobacco-free generation, and harm reduction) have their merits and limitations in achieving the smoke free target of <5% smoking prevalence. In isolation, they are unlikely to achieve this target. However, by integrating ideas from each of these strategies, a pragmatic and realistic roadmap to the 'smoking end game' is in sight[5, 47–49].

A science-based, consumer-driven revolution is needed to accelerate the end of smoking. By combining strong MPOWER measures for combustible tobacco with a regulatory and fiscal framework that incentivises smokers to switch to safer nicotine alternatives, the ambition of becoming smoke free is entirely achievable.

In Europe, Sweden is leading the way in adopting this integrated approach. Whilst its prevalence of nicotine use is like the EU average, the vast majority of this intake is via safer, non-combustible alternatives[50]; Sweden's smoking prevalence (5.6%) is nearly five times lower than the EU average (23%)[51]. Consequently, Sweden has the lowest tobacco-related disease and mortality rates in the EU[52].

CHAPTER 2

TOBACCO-RELATED DISEASE AND PREMATURE DEATH:

Comparative Analysis of Key Public Health Metrics between Sweden Versus the European Union and selected other countries

2.1 Key public health databases and metrics related to smoking

2.1.1 Sources of data

To quantify and compare smoking-related disease and premature death across different countries, nationally representative data from reputable sources must be used. The two main sources of data for this chapter are:

a) The WHO Global Report on Mortality Attributable to Tobacco[53]: Although this report was published in 2012, it cites data collected in 2004. It is the WHO's most recent report of this nature.

b) The Global Burden of Disease (GBD) Study by the Institute for Health Metrics and Evaluation (IHME) [54]: Boasting more than 1 billion data points in over 200 countries, this collaborative research project led by the University of Washington is the largest and most detailed scientific effort to compile health metrics observational data. It is highly respected by the scientific and policymaking communities; there have been over 400 peer-reviewed publications since 2010 using IHME data. To this chapter, GBD has the added advantage of compiling more recent data (from 1990 to 2019) than the aforementioned WHO report.

2.1.2 Key Public Health Metrics

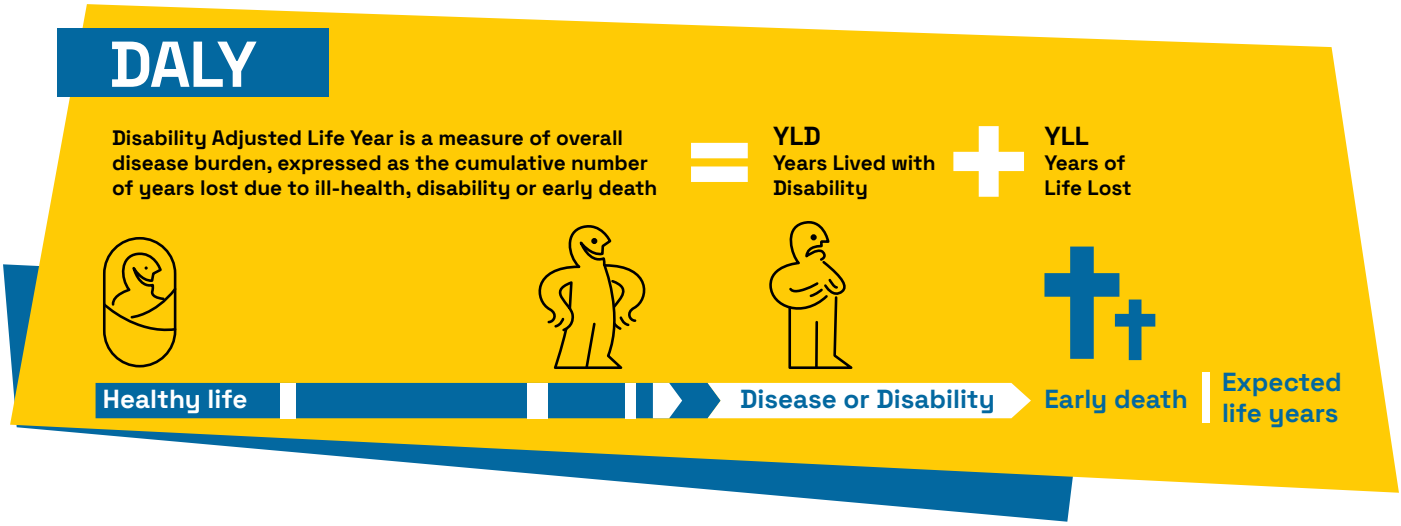
The key health metrics cited in this chapter are smoking-attributed deaths and disability-adjusted life years (DALYs) due to:

- All causes
- Non-communicable disease (NCD)
- All cancers
- Respiratory tract cancers (tracheal, bronchial, lung)
- Chronic obstructive pulmonary disease (COPD)
- Cardiovascular disease
- Lower respiratory tract infections

Deaths and DALYs

By comparing the rates of death and DALYs, differences in countries' populations are accounted for when comparing their smoking-attributed mortality and morbidity. A DALY is a universal metric that equals the sum of years of life lost (YLLs) and years lived with disability (YLDs). One DALY is equivalent to one lost year of healthy life[54].

Figure 3: Schematic explanation of Disability Adjusted Life Year (DALY)[55]

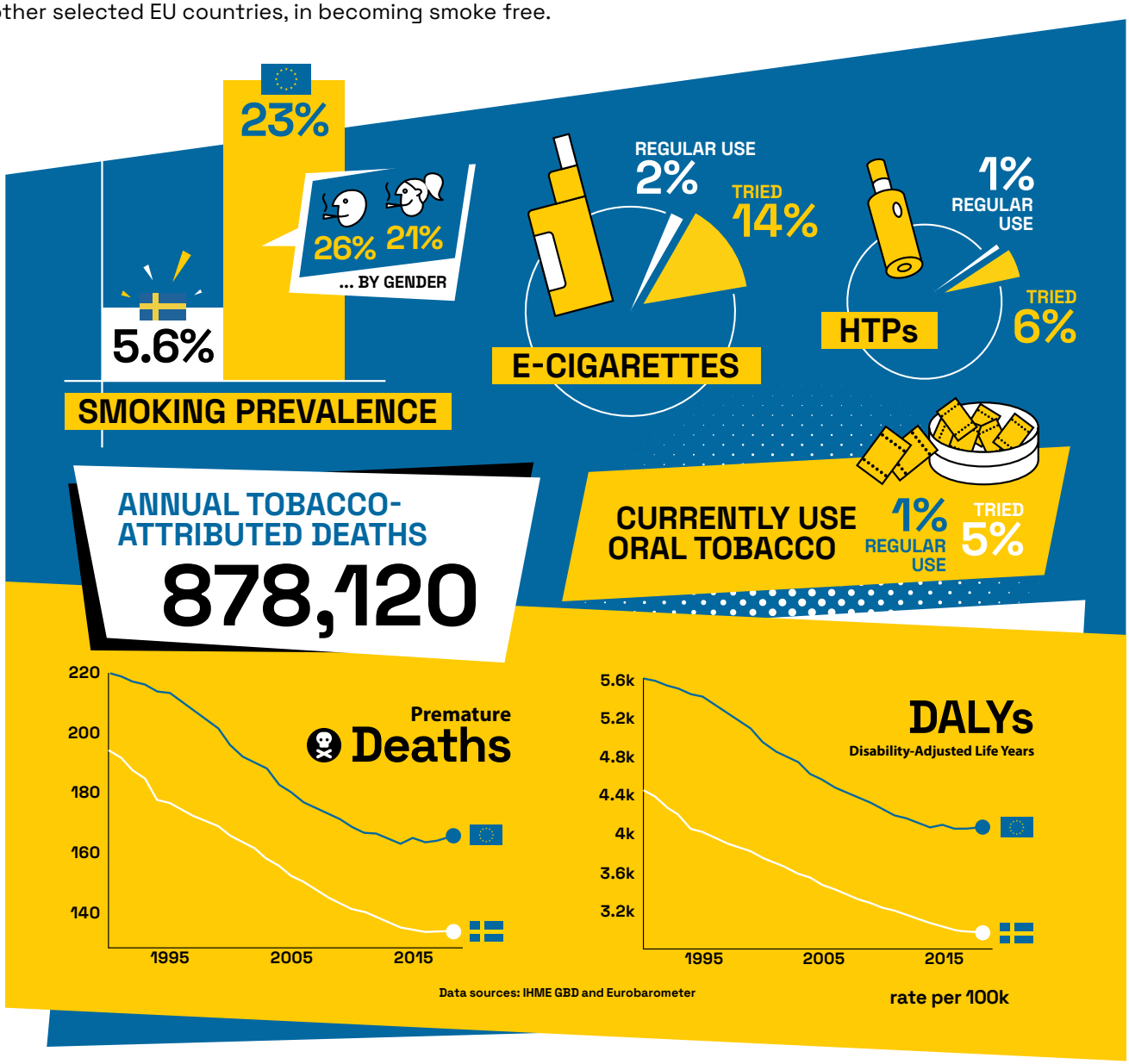


The economic cost per DALY was recently calculated by Daroudi et al[56] using IHME data for countries with different levels of Human Development Index (HDI). The estimated cost per DALY averted was US$998, US$6522, US$23,782, and US$69,499 in low HDI, medium HDI, high HDI, and very high HDI countries. In the future, it will therefore be possible to quantify and compare the potential human and economic costs of smoking between countries. Of the 27 EU countries, 26 are classed as 'very high HDI', and one (Bulgaria) as 'high HDI'[57].

SAVING LIVES LIKE SWEDEN

2.2 Sweden's tobacco control performance compared to the European Union (EU)

Firstly, Sweden's performance will be compared to the European Union's average performance in the 20 years between 2000-2019[54]. This way, one can calculate the potential deaths, DALYs, and economic costs that could have been averted. This will be followed by visual representations of health data that reflect Sweden's success, relative to other selected EU countries, in becoming smoke free.



IF THE EUROPEAN UNION HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

POTENTIAL DEATHS AVERTED	POTENTIAL LIFE YEARS GAINED	POTENTIAL DALYS AVERTED
2,890,004	103,436,746	107,978,932

Figure 4: Graphic presentation: potential deaths and DALYs averted if the EU had the same rate of tobacco-attributed mortality and morbidity as SWEDEN between 2000-2019.[54]

Table 3: Comparison of tobacco-attributed morbidity between 2000-2019 in Sweden versus the EU using data from the IHME GBD.[54] The column in blue "EU (if rated like Sweden)" is a hypothetical figure calculated by the following equation: (EU actual DALYs lost/EU rate of DALYs lost) multiplied by Sweden's rate of DALYs lost. Looking at "all causes", if the EU had the same smoking-attributable rate of DALYs lost as Sweden during these 20 years, 108 million DALYs lost could have been averted.

Smoking-attributable deaths: Sweden vs EU (2000-2019)

Cause of death	Smoking-attributable deaths, rate per 100k (2000-2019)		Smoking-attributable deaths, number (2000-2019)		Deaths that could have been averted, number
	Sweden	EU	EU (actual)	EU (if rated like Sweden)	
Non-communicable disease (NCD)	139.9	167.6	16,870,287	14,082,789	2,787,499
All cancers	56.0	79.6	8,020,071	5,637,051	2,383,020
Respiratory tract cancers	28.4	44.0	4,434,576	2,858,811	1,575,765
COPD	18.9	23.2	2,336,499	1,906,782	429,717
Cardiovascular disease	52.7	55.2	5,541,923	5,294,089	247,834
Lower respiratory tract infections	5.0	5.9	595,510	503,637	91,873
All causes	145.8	174.5	17,562,390	14,672,386	2,890,004

Smoking-Attributable Death Rates by Cause: Sweden vs EU (2000-2019)

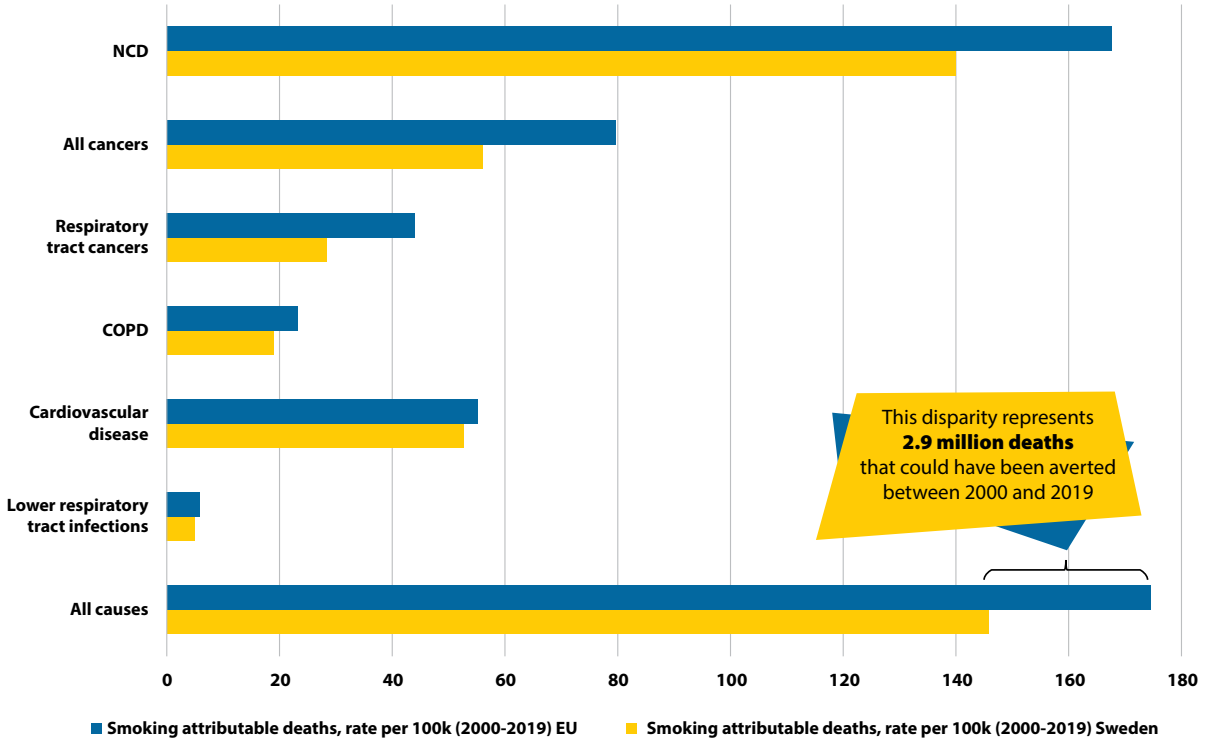


Figure 5: Stacked bar chart representing the data from Table 3. All data are used with permission from the IHME GBD.[54]

Smoking-attributable DALYs lost: Sweden vs EU (2000-2019)

Cause of lost DALY	Smoking-attributable DALYs, rate per 100k (2000-2019)		Smoking-attributable DALYs, number (2000-2019)		DALYs lost that could have been averted
	Sweden	EU	EU (actual)	EU (if rated like Sweden)	
NCD	3,211.7	4,238.6	426,581,452	323,185,122	103,396,330
All cancers	1,093.1	1,749.8	176,247,374	110,085,240	66,162,134
Respiratory tract cancers	558.1	961.2	96,833,104	56,220,730	40,612,374
COPD	485.5	527.1	53,109,026	48,925,974	4,183,052
Cardiovascular disease	1,032.8	1,275.2	128,079,066	103,732,113	24,346,954
Lower respiratory tract infections	64.3	99.4	9,997,373	6,459,388	3,537,985
All causes	3,307.2	4,379.6	440,763,826	332,836,144	107,927,682

Table 4: Comparison of tobacco-attributed morbidity between 2000-2019 in Sweden versus the EU using data from the IHME's Global Burden of Disease Study[53]. The column in blue 'EU (if rated like Sweden' is a hypothetical figure calculated by the following equation: (EU actual DALYs lost / EU rate of DALYs lost) multiplied by Sweden's rate of DALYs lost. Looking at 'all causes', if the European Union had the same smoking-attributable rate of DALYs lost as Sweden during these 20 years, 108 million DALYs lost could have been averted.

Smoking-Attributable DALYs lost by Cause: Sweden vs EU (2000-2019)

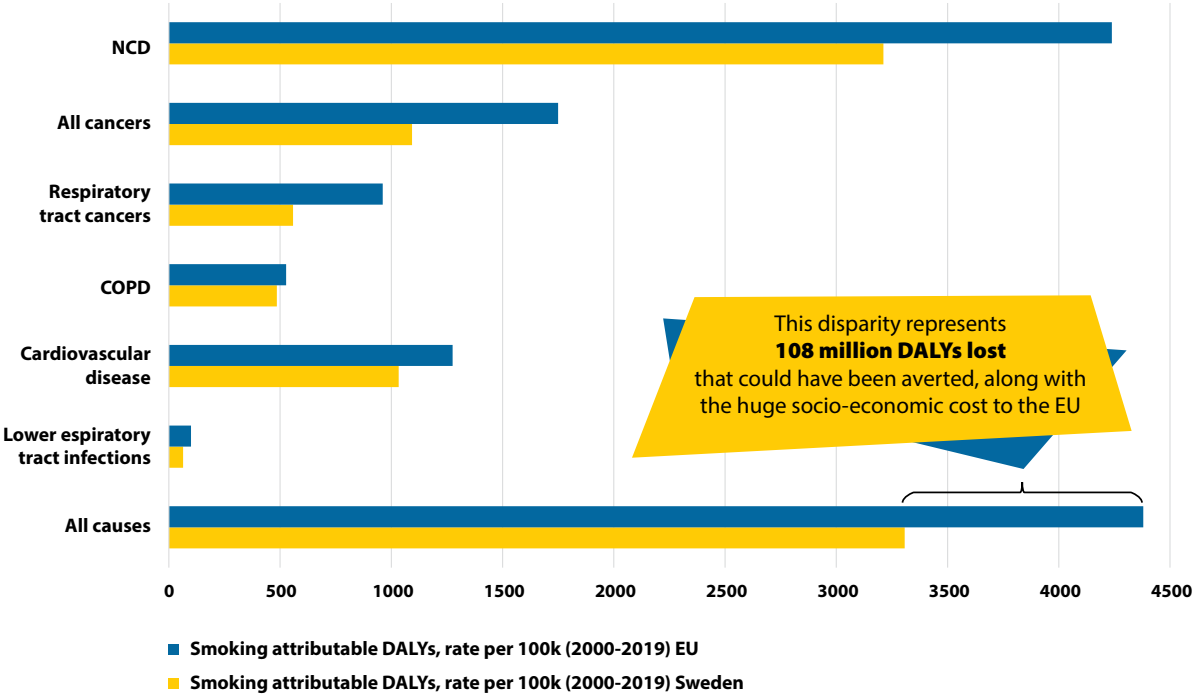


Figure 6: Stacked bar chart representing the data from Table 4. All data are used with permission from the IHME GBD.[54]

2.3 Sweden's tobacco control performance compared to selected EU countries (Based on WHO Data)

WHO and OECD data corroborate IHME data

The IHME data (Figures 3 and 4) is corroborated by WHO data, showing a similar trend among European nations in smoking-related morbidity and mortality. Consider the graphs below produced by the Snus Commission[58] using data from OECD[59] and WHO's 2012 Global Report on Mortality Attributable to Tobacco[53]. The left (Figure 7) shows the percentage of men aged >30 who smoke daily. The right (Figure 8) shows the death rate in men aged >30 attributable to tobacco. Note that Sweden outperforms all the other EU nations on these metrics, with smoking rates and smoking-attributable death rates more than half the EU average:

Sweden has the lowest cancer rates in the EU

Further to the above data from WHO's 2012 report, more recent data from the WHO International Agency for Research on Cancer (IARC) demonstrate that Sweden has the lowest mortality rate among men across all cancers – see Figure 9 below. More specifically, it has the lowest lung cancer incidence in Europe across both sexes (17.7 per 100,000). This translates to a lung cancer mortality rate in Sweden (14.4 deaths per 100,000), the lowest in the European Union[60].

SAVING LIVES LIKE SWEDEN

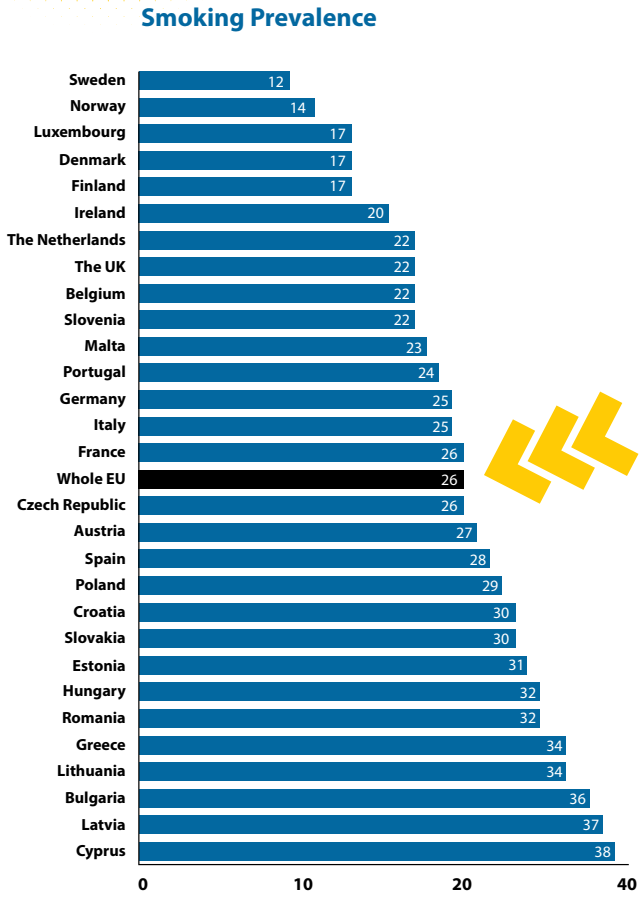


Figure 7: Percentage of men aged >30 who smoke on a daily basis[58].

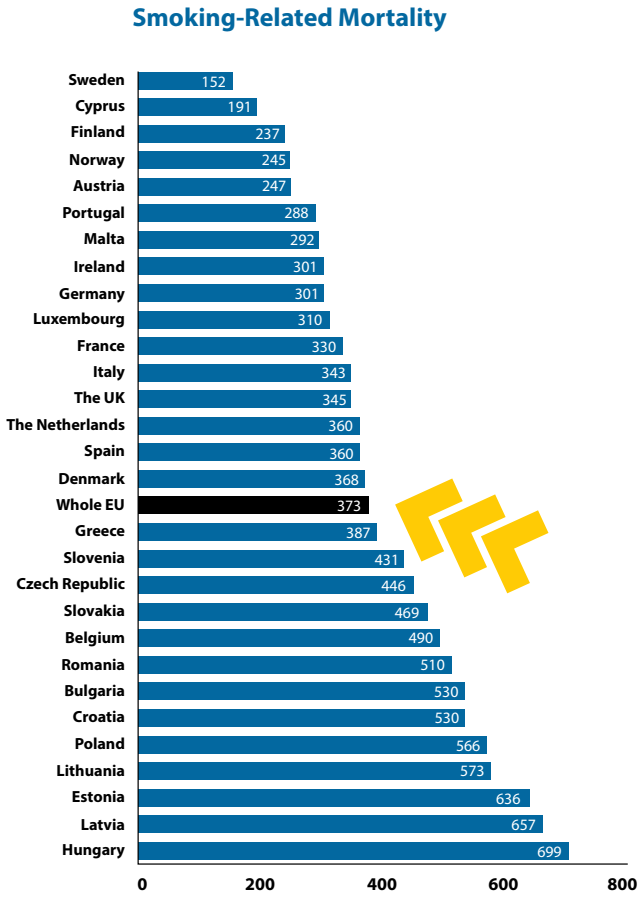


Figure 8: Death rate attributable to tobacco in men aged >30 per 100,000 inhabitants[53].

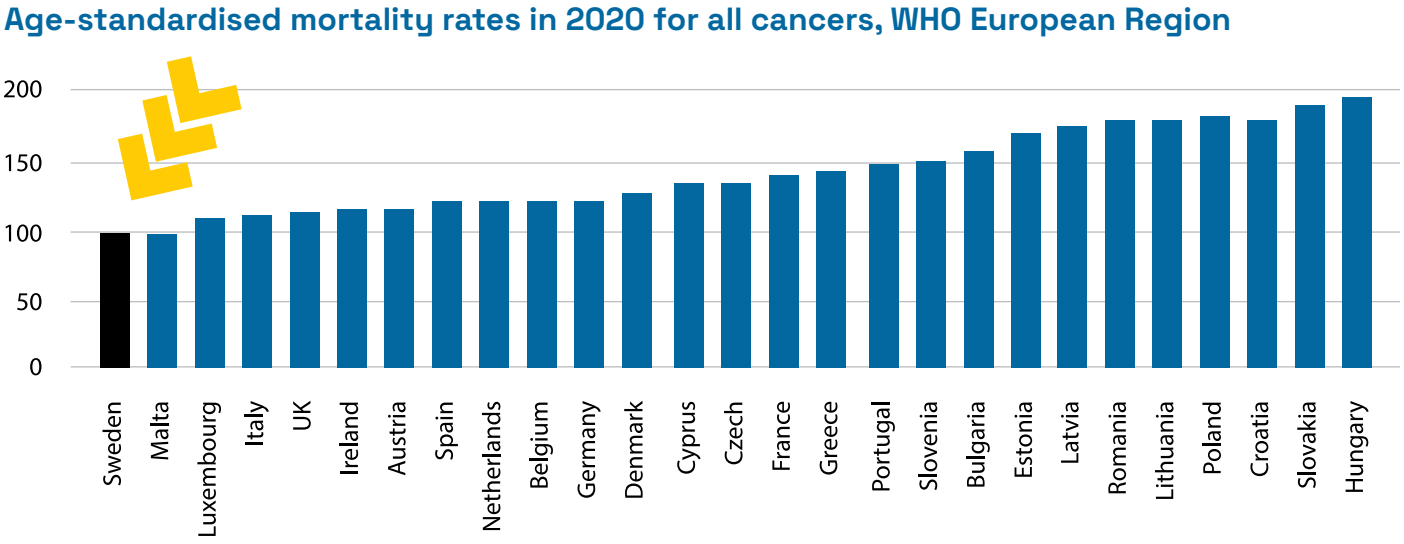


Figure 9: According to WHO IARC 2020 data, Sweden has the lowest mortality rate among men across all cancers in Europe[60].

2.4 Selected country case study in tobacco control: Sweden versus Belgium

Recently, the Belgian Health Minister Frank Vandenbroucke called for a ban on nicotine pouches, saying: "Nicotine pouches, like electronic cigarettes and vaping, can be a stepping stone to smoking at an early age. That is why we are resolutely opting for a ban on them"[61]. This approach lies in stark contrast to the Swedish model of embracing harm-reduction products as a diversion away from much more harmful combustibles.

Often, disparities between countries in smoking prevalence and smoking-related disease are justifiably explained by socioeconomic differences. However, Sweden and Belgium have much in common:

- **Income:** Both classed as 'High Income' countries by the World Bank[62].
- **Age structure:** Very similar population pyramids[63].
- **Equality:** Near-identical Gini indexes: Belgium 0.26, Sweden 0.27[64,65].
- **Government expenditure:** Both are in the top 5 OECD countries for government expenditure as a percentage of GDP – Belgium is third with 52%, and Sweden is fifth with 49%.
- **Population Size:** Belgium 11.6 million, Sweden 10.4 million[63].
- **GDP:** Similar – Belgium 594 billion US$, Sweden 636 billion US$[64,65].
- **Political/historical context:** Sweden and Belgium are both constitutional monarchies with a parliamentary government[66].

The above similarities make Sweden and Belgium ideal candidates for comparison with regard to the issue of smoking-related harm. So, based on the evidence, how do they compare?

Smoking prevalence: According to Eurobarometer data, Sweden is considerably outperforming Belgium in the pursuit of becoming smoke free. In 2020, Belgium (21%) had triple the smoking prevalence of Sweden (7%)[67]. Consequently, smoking-related mortality and morbidity rates are inevitably higher in Belgium, as shown by IHME data (Figure 10).

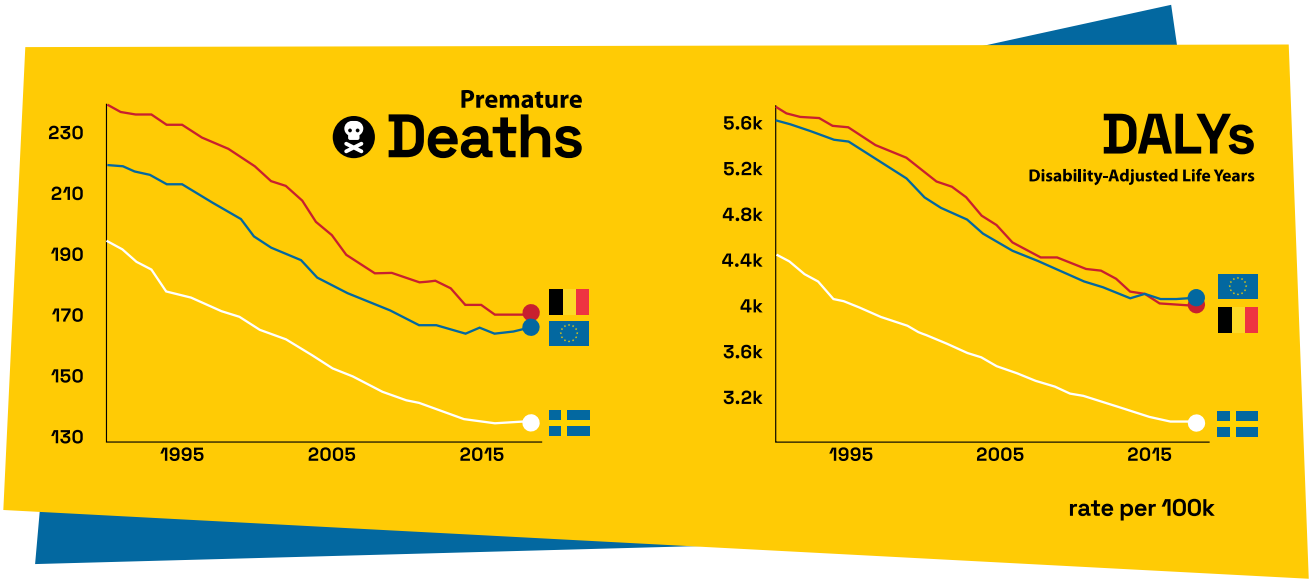


Figure 10: Comparing Sweden vs Belgium vs EU smoking-related deaths and DALYs using IHME GBD data[54]. If Belgium had the same rate of smoking-related deaths and DALYs as Sweden between 2000-2019, potentially 90,570 deaths and 2.5 million DALYs could have been averted.

SAVING LIVES LIKE SWEDEN

With the mounting evidence backing Sweden's approach to becoming smoke-free, respected Members of the EU Parliament (MEPs) have been advocating for its adoption throughout the rest of the bloc in their public addresses to the European Parliament in December 2022:

- **Member of the European Parliament (MEP), elected in 2022, representing the Sweden Democrats Party:** "To promote public health and address tobacco-related health problems in the long term, the National Health Service in the UK has encouraged people to use e-cigarettes instead of traditional tobacco products. This is part of a long-standing government health campaign, the aim of which is for the country to be entirely smoke-free by 2030. We are seeing a similar trend in Sweden. Nicotine pouches are popular, and, together with snus, they have led to a marked reduction in the number of smokers. Sweden has the lowest proportion of smokers in the EU, with only around 6% of people smoking daily. The EU average is around 18%. A smoke-free Sweden would therefore appear to be an increasingly realistic prospect. In the light of the foregoing:
  - Has the Commission studied developments in the UK and Sweden?
  - Has the Commission considered the risk of the number of smokers in Europe increasing if the tax on nicotine pouches and e-cigarettes is raised?

  Does the Commission have any plans to promote alternatives to cigarettes, such as nicotine pouches and e-cigarettes, with a view to curbing tobacco use in Europe?"[68]

- **Member of the European Parliament (MEP), elected 2019 and representing the Christian Democratic Party, Sweden:** "With only 5.6% of the population being daily smokers, Sweden has the lowest proportion of cigarette smokers in Europe by a significant margin. Moreover, the proportion of smokers in Sweden is continuing to decrease and the use of nicotine pouches has played a significant role in this development. Other countries have chosen a different path. For example, Belgium is moving forward with a plan to ban nicotine pouches. They informed the Commission of their intentions in the summer of 2022 and stated that they wanted to ban these products until there is proof that they are a useful instrument in lowering smoking rates.
  - Does the Commission consider it to be a problem for the single market that Member States are adopting different regulations on new nicotine products, such as nicotine pouches?
  - What should Member States take into consideration when imposing new regulation on nicotine products?"[69]

2.5 Difficulties in comparing Sweden's tobacco control with Lower- and Middle- Income Countries (LMICs), e.g., South Africa

In comparing Sweden with LMICs, there are variables that make comparisons with the Swedish model difficult. As an example, the interaction between smoking and tuberculosis. Tuberculosis is still rampant in South Africa, with approximately 852 cases per 100 000 people[70], as opposed to Sweden with 4 per 100 000 people[71]. This has a significant effect on any tobacco-related metrics, as outlined below.

CONSIDERING LMICS: THE INTERACTION BETWEEN SMOKING AND TUBERCULOSIS

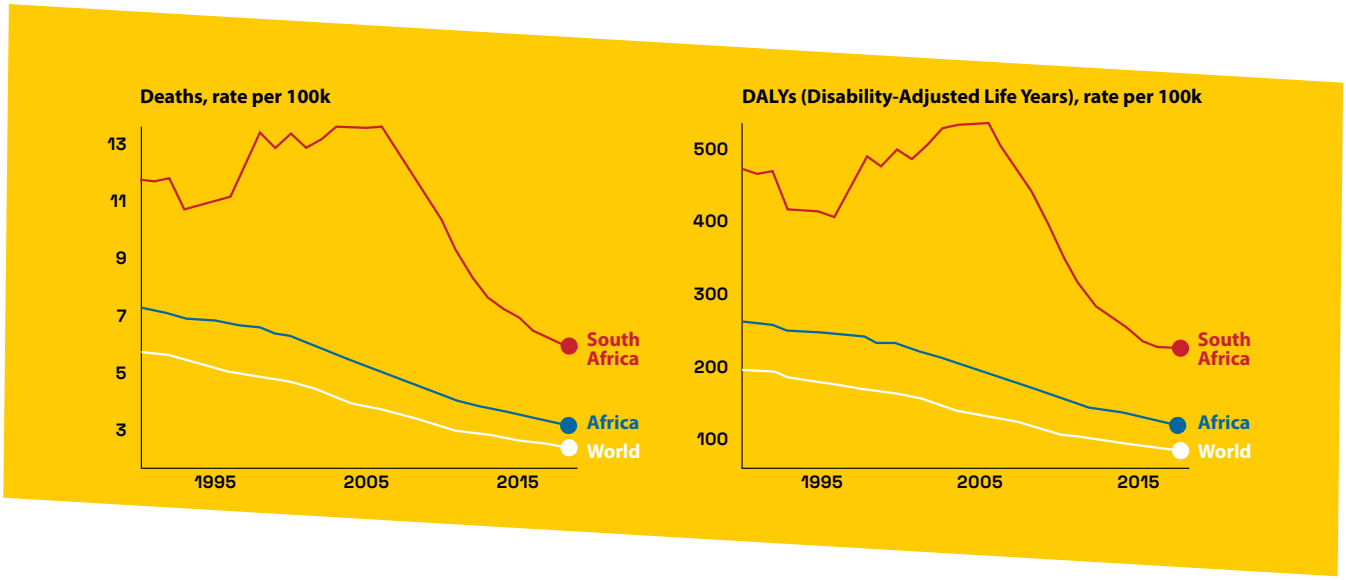
Smoking is the leading preventable cause of death worldwide, and it inflicts disproportionately greater harm to poor, vulnerable, and marginalised population groups; over 80% of smokers live in low- and middle-income countries (LMICs)[72]. Similarly, the leading cause of death from a single infectious disease globally is tuberculosis (TB), and over 95% of TB cases and deaths occur in LMICs[73]. The harmful synergy between smoking and TB is well-documented:

- Smoking increases your risk of contracting TB by 4.5x[74].
- TB treatment is 24% less effective in smokers[75].
- Children exposed to second-hand smoke are 2x more likely to contract TB[76].

SMOKING AND TB IN SOUTH AFRICA

Given the above evidence, South Africa is an interesting country to study because 60% of its people living with TB are smokers, and the country ranks third glob-

The Human Cost of Smoking on Tuberculosis in South Africa



If South Africa had the same rate of smoking-attributed tuberculosis deaths and DALYs as the African average, potentially 80,000 deaths and 3 million DALYs could have been prevented between 1990-2019

Figure 11: Graphs showing smoking-attributed tuberculosis deaths and DALYs in South Africa vs the African and World averages. All data used with permission from IHME's GBD[54].

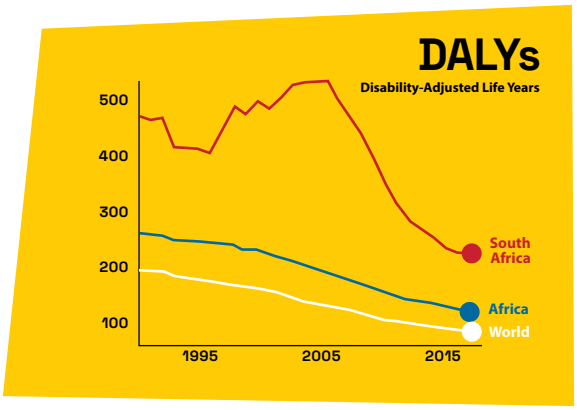
ally after India and China in terms of annual incident cases of TB[77]. The Global Adult Tobacco Survey (GATS) was recently implemented in 2021 by the South African Medical Research Council (SAMRC); it showed significant tobacco-attributed health and economic burden. It showed an overall smoking prevalence of 25.8% (41.2% of men, and 11.5% of women), with high expenditure on manufactured cigarettes despite high levels of poverty[78]. Interestingly, there was good awareness about the harms of smoking, and over two-thirds of current smokers planned to or were thinking of quitting smoking. So, using IHME data, what are the potential human and economic costs of smoking and TB in South Africa (Figures 11 and 12)?

The Potential Economic Cost of Smoking on Tuberculosis in South Africa

According to UN, South Africa has a Human Development Index (HDI) of **0.713**, which is classed as «high».

Using IHME data, Daroudi et al calculated the cost per DALY avered for «high HDI» countries as **$23,782.**

3 million smoking-attributed TB DALYs could have been averted between 1990-2019.
3 million x $23,782 = **$71 billion**
(= $2,4 billion per annum).



If South Africa had the same rate of smoking-attributed TB DALYs as the African average, potentially 3 million DALYs could have been prevented between 1990-2019

$2.4 billion every year = 44 billion ZAR

Figure 12: South Africa is classed as 'high HDI' by the UN[57]. Assuming the cost of each DALY lost is $23,782 as per Daroudi et al's findings[56], smoking is potentially costing South Africa an extra $2.4 billion every year in its battle against TB, compared to the African average. DALY data from IHME GBD[54].

CHAPTER 3

CALCULATING THE 'SIZE OF THE PRIZE' FOR PUBLIC HEALTH

Currently Available Models to Predict the Public Health Benefits of Adopting Tobacco Harm Reduction Strategies at a Population Level

3.1 Retrospective Analysis vs Prospective Modelling

This report analyses key health metrics to draw comparisons between Sweden, the EU and selected other countries. This was mainly done by retrospectively analysing IHME data from 2000-2019. But what if it were possible to prospectively predict the effects of adopting THR strategies at a population level?

Since the worldwide popularity of smoke-free nicotine products has increased in the last two decades, numerous models have been proposed. This chapter summarise four peer-reviewed models based on real-world data.

3.2 Prospective Modelling

3.2.1 Smoking and Vaping Model (SAVM) – Levy et al (2021)

Professor David Levy is a professor of oncology at Georgetown University's School of Medicine, specialising in population health. With over 200 peer-reviewed publications to his name, he has developed tobacco policy simulation models for over 40 countries[79]. One of his most recent is the Smoking and Vaping Model (SAVM), which simulates the future public health implications of introducing nicotine vaping products (NVPs) at a population level. Whilst this model has been applied to multiple countries, the ini-

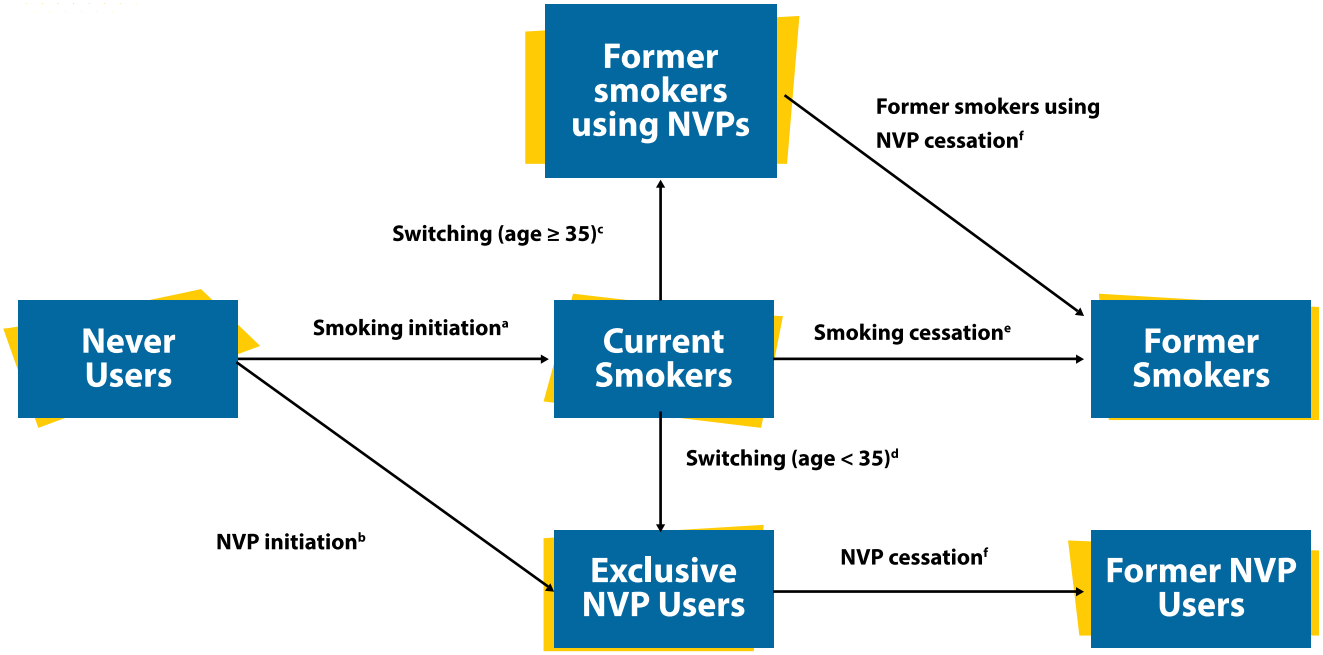


Figure 13: Graphic reproduced from Levy et al[80] depicting the transition states between users of product categories in their journey to smoking and/or NVP cessation.

tial publication pertains to the USA[80], while the same model has also been applied to other countries such as Canada, England, Germany and Australia.

a) Validated parameters and results

The SAVM model simulates what would happen if a nation's smokers switched to less harmful nicotine vaping products. It assesses smoking and vaping prevalence over time, smoking cessation rates with and without the help of NVPs, and smoking- and vaping-attributable deaths and life years lost (LYLs). The model was first validated over the years 2013 to 2018 by comparing model predictions of current smoking prevalence to future smoking prevalence rates from the USA's National Health Interview Survey (NHIS). Extensive sensitivity analyses revealed a robust and reliable model to predict how smoking-attributable deaths and YLLs might be affected by NVPs in the future.[80]

b) A publicly available model

A major benefit to the SAVM model is that its methodology is transparent, and it is publicly available from Georgetown University's website, along with a SAVM User Guide[81]. As such, this validated model can be applied to other countries' datasets by experienced users.

c) Modelling public health implications of nicotine vapes for 2013-2060

The SAVM projects that according to current patterns of smoking and vaping prevalence in the United States, the net outcome of smokers switching to nicotine vaping products will translate into:[80]

- **1.8 million fewer smoking-related premature deaths**
- **38.9 million life years gained**

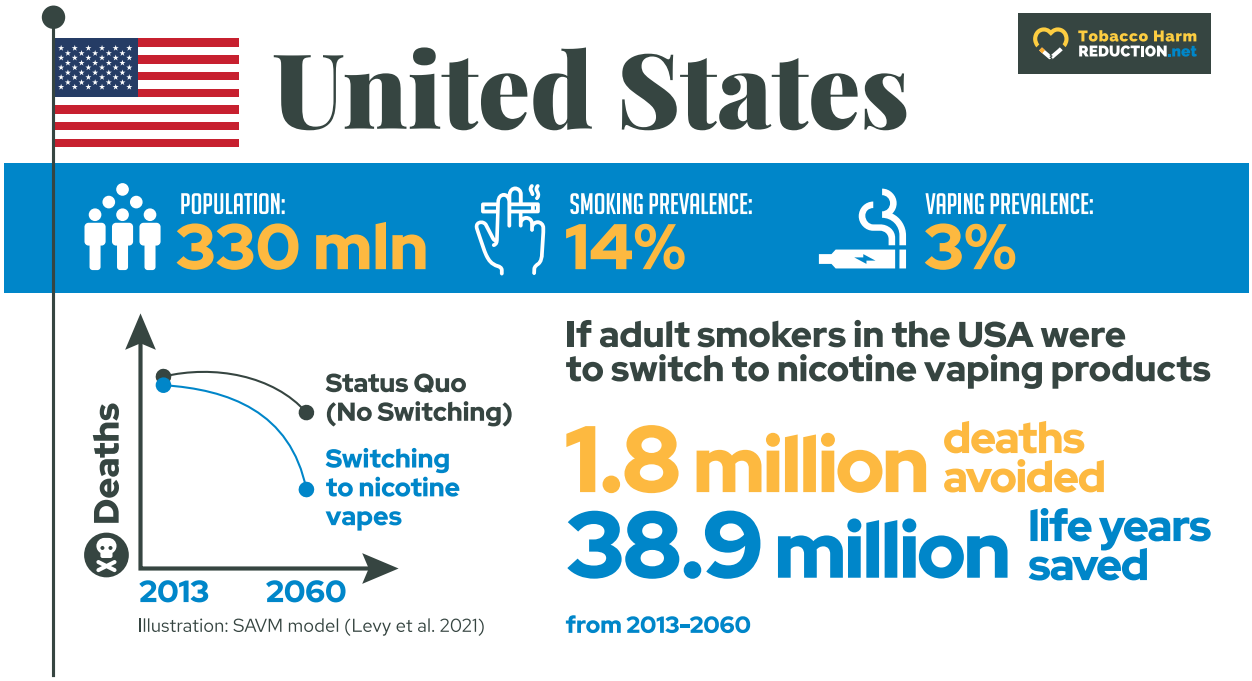


Figure 14: What would happen if adult smokers in the USA switched to nicotine vaping products? According to Levy et al's SAVM model[80], 1.8 million deaths would be avoided, and 38.9 million life years gained.

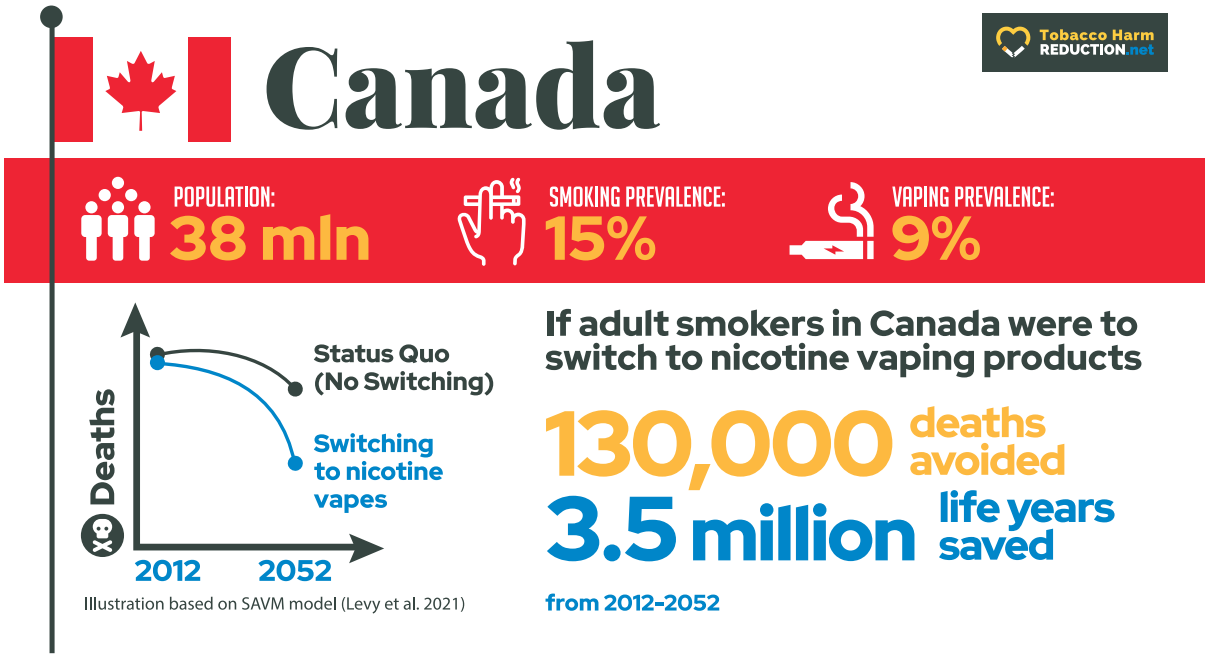


Figure 15: What would happen if adult smokers in Canada switched to nicotine vaping products? According to Levy et al's SAVM model[80], 130,000 deaths would be avoided, and 3.5 million life years gained.

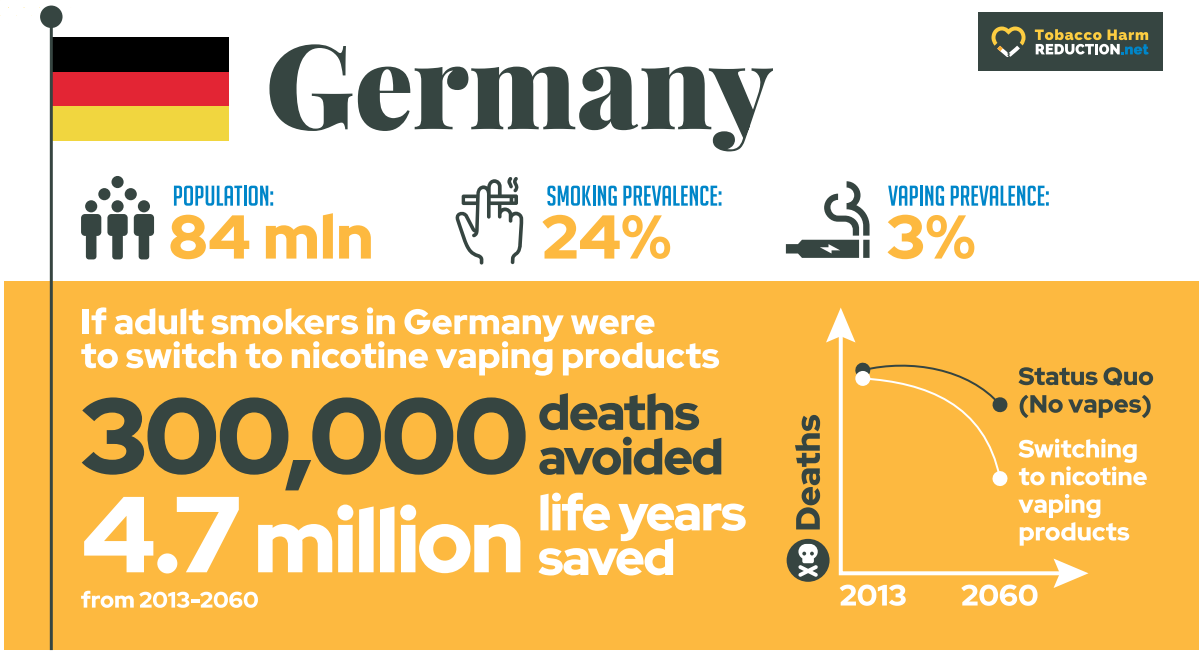


Figure 16: What would happen if adult smokers in Germany switched to nicotine vaping products? According to Levy et al's SAVM model[80], 300,000 deaths would be avoided, and 4.7 million life years gained.

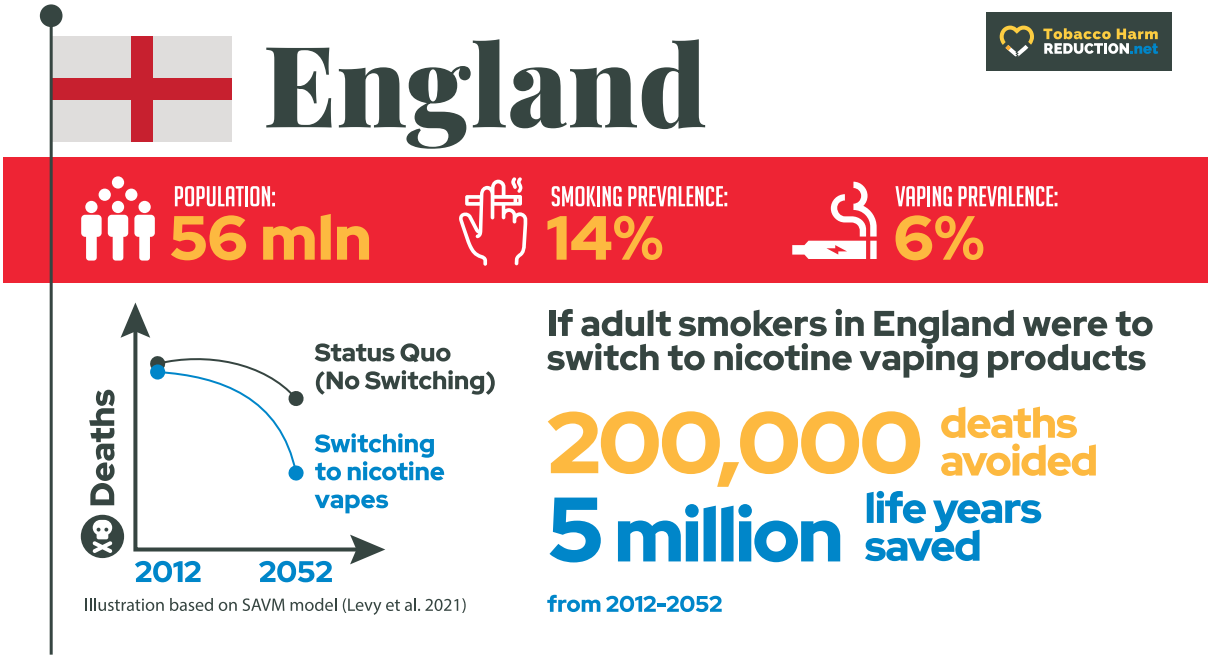


Figure 17: What would happen if adult smokers in England switched to nicotine vaping products? According to Levy et al's SAVM model[80], 200,000 deaths would be avoided, and 5 million life years gained.

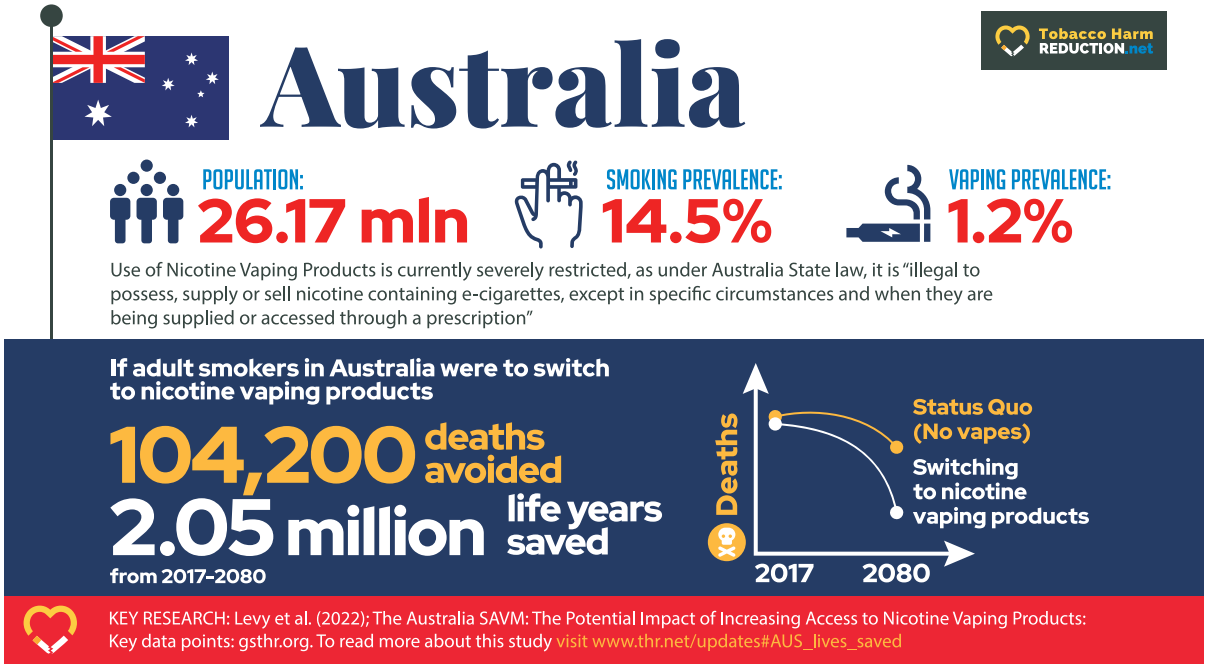


Figure 18: What would happen if adult smokers in Australia switched to nicotine vaping products? According to Levy et al's SAVM model[80], 104,200 deaths would be avoided, and 2.05 million life years gained.

3.2.2 Accelerating an end to smoking – Yach (2020)

Dr Derek Yach is a former Executive Director for Non-communicable Diseases at the World Health Organisation and was instrumental to the development of the Framework Convention on Tobacco Control. Backed by a distinguished career in epidemiology, Dr Yach published a seminal paper in 2020 entitled 'Accelerating an end to smoking: a call to action on the eve of the FCTC's COP9'[5]. Yach's paper provides geopolitical context to the slow progress in reducing global smoking rates in the last 20 years, before addressing the key premise of the paper: "to cut death and disease rates within two decades, we must consider new strategies for accelerating adult cessation. In particular, we must embrace empathetic tactics that encourage individual smokers to quit or switch – including the use of harm reduction products (HRPs)."

The FCTC: 'Frozen in Time'

Whilst the principle of harm reduction is explicitly enshrined and encouraged in Article 1(d) of the original FCTC treaty in 2003[4], there is no clear elaboration on which harm reduction products (HRPs) this includes. Yach notes that this is in part due to the era in which the treaty was penned: "Except for snus, the range of nicotine technologies available today did not exist 20 years ago". The continued lack of integration of HRPs in an integrated approach to smoking cessation exemplifies one way in which the FCTC remains "essentially frozen in time"[5].

SAVING LIVES LIKE SWEDEN

Dr Yach's methodology for estimating trends in tobacco-related mortality

Yach summarised projected tobacco-related deaths from 2020 through 2060, basing his estimates on:

- Projections developed by researchers within the public and private sectors
- Published reports on the uptake of harm reduction products
- Data on the well-established displacement of combustible cigarettes associated with HRP uptake.

Yach's projections take the 'very conservative view' that a 90% drop in harmful exposures associated with HRPs compared to cigarettes would translate into a 60% reduction in the actual death rate. Furthermore, his projections do not take into account the rapid improvement in detection rates and outcomes of tobacco-related cancers, such as lung cancer, which is responsible for more than a third of annual smoking-related deaths[5].

Projections for 2020-2060

If the full package of WHO's FCTC recommendations is implemented, annual tobacco-related deaths will rise from 7 million in 2020, and then peak at 10 million in the early 2030s. After that point, deaths will slowly decline as seen in Figure 19 below ('status quo'). However, this slow decline can be accelerated by adopting HRPs at scale, and catalysing innovation to these novel products so that they yield one-year smoking cessation rates of around 50% ('THR + cessation'). According to Yach's estimates, the potential public health benefit is 3 to 4 million fewer annual tobacco-related deaths within four decades; "there is no other public health issue where the potential gains approach that order of magnitude":

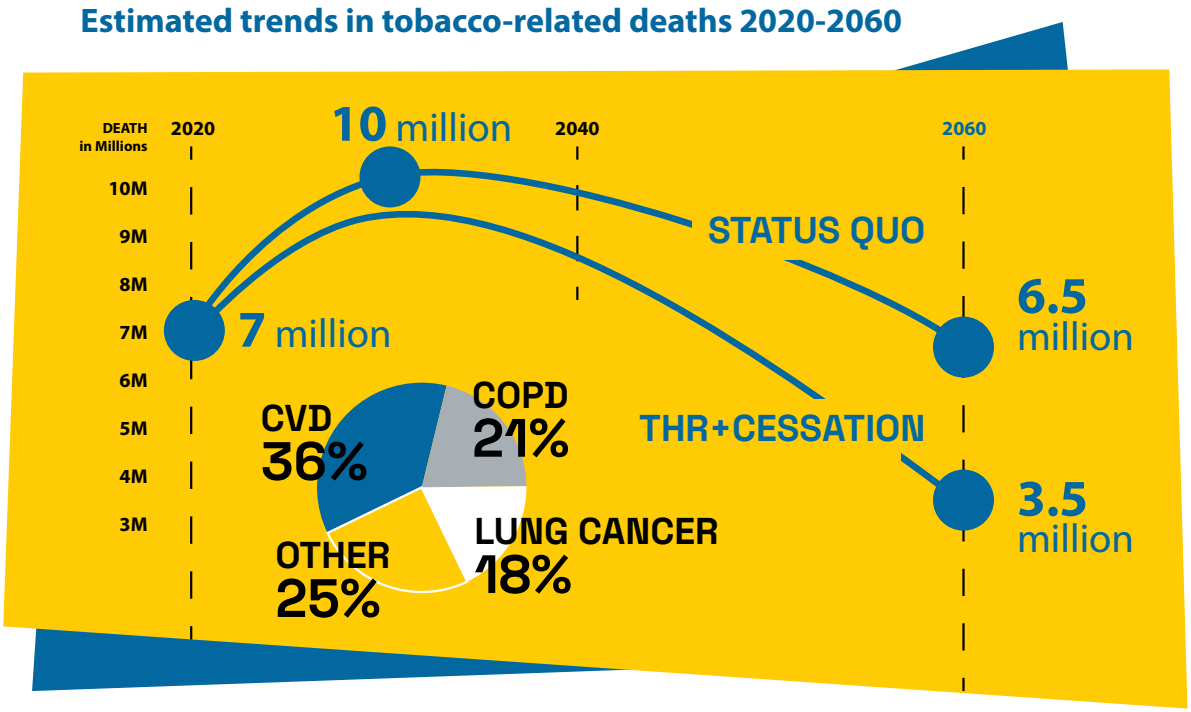


Figure 19: Yach's projections showing how the widespread adoption of HRPs would drastically reduce tobacco-related deaths by 2060[5].

3.2.3 Warner & Mendez (2018)

Professor Kenneth E. Warner has published over 300 articles pertaining to the economic and policy aspects of tobacco and health. In addition to a distinguished academic career at the University of Michigan School of Public Health, he has served as an adviser to the World Bank, WHO, US Surgeon General, FDA, and as President of the Society for Research on Nicotine and Tobacco. Similarly, his colleague Professor David Mendez is a respected Professor of Health Management and Policy and specialises in the evaluation of tobacco control policies and their population health impact, using simulation models. Mendez has shared his expertise internationally, including the CDC, Institute of Medicine, NASEM, FDA, and WHO. In 2018, Warner and Mendez co-published a paper entitled: "E-cigarettes: Comparing the Possible Risks of Increasing Smoking Initiation with the Potential Benefits of Increasing Smoking Cessation"[82].

Vaping is now the most popular smoking cessation aid in UK and US

Warner and Mendez note that while there are many reasons for vaping, e-cigarettes are now the most commonly used aid in smoking cessation attempts in the United States. Similarly, in the UK, more than a third of smokers report that, though they no longer vaped, they had used e-cigarettes to help them quit smoking[82]. This corroborates a large body of evidence synthesised by the Cochrane Collaboration's living systematic review, which demonstrates that successful smoking cessation rates are higher in those who use e-cigarettes with nicotine than with nicotine replacement therapies[12].

Tried and tested simulation model

Using a model that they have successfully worked with since 1995, Warner and Mendez refined their simulation to compare the effects of vaping on both smoking cessation and initiation in the US in terms of the number of life-years saved or lost to the year 2070. The base case takes the conservative assumption that vaping annually increases smoking initiation by 2% and smoking cessation by 10%.

Result: Life years gained

With the above case base assumptions, the authors projected that the US population would gain almost 3.3 million life years by 2070 thanks to smokers switching to e-cigarettes. They concluded: "The benefits to public health will exceed the potential costs of vaping-induced new smokers." This view was corroborated by a seminal paper co-published by fifteen past presidents of the Society for Tobacco and Nicotine Research:

> **While evidence suggests that vaping is currently increasing smoking cessation, the impact could be much larger if the public health community paid serious attention to vaping's potential to help adult smokers, smokers received accurate information about the relative risks of vaping and smoking, and policies were designed with the potential effects on smokers in mind. That is not happening."**
>
> **- Balancing Consideration of the Risks & Benefits of E-Cigarettes (2021), Balfour et al.[83]**

3.2.4 Lars Ramström method (2019)

Lars Ramström PhD founded the Institute for Tobacco Studies in 1991, after having served as Director General of the National Smoking and Health Association where he worked for 24 years. He is frequently engaged as a reviewer for scientific journals and as a special adviser on numerous expert committees, including the WHO[84].

In 2017, as part of the Swedish Snus Commission Report, Ramström et al demonstrated the difference between the current level of tobacco-related mortality in EU countries and the level that would have been achieved had all other EU countries adopted the same tobacco consumption patterns as in Sweden. The basis for the calculations in the report[58] was data from the World Health Organization (WHO) Global Report: Mortality Attributable to Tobacco[53]. The data processing was carried out by Institutet för Tobaksstudier (Institute for Tobacco Studies) and a compilation of the data was referenced in the report. The group studied was men over the age of thirty in each individual country and related to several disease groups. The report shows that Sweden has the lowest tobacco-related mortality rate of all EU countries relative to its population size. As compared with Sweden, tobacco-related mortality rates are more than twice as high relative to population size in 24 of the other 27 EU member states.

In total and among men (over the age of 30), 355,000 lives per year could have been saved if the other EU countries had matched Sweden's tobacco-related mortality rate[58].

Sweden clearly has the lowest tobacco-related mortality rate within the EU in relation to its population size, despite daily nicotine consumption among men being at the same level as other countries in Europe. In other words, the tobacco-related mortality rate would have been lower across the EU today had harm-reduced nicotine alternatives such as snus been permitted within the union over the past few decades.

In 2019, Ramström compiled data from the IHME's Global Burden of Disease study[54] to compare tobacco-attributable death rates in Sweden versus the rest of the European Union[52], which is elaborated below.

Methodology

Since comparisons of mortality data from different countries can give misleading impressions due to differences in age distributions, the following datasets were used to account for this:[52]

- Age-standardised data for the total male population
- Age-standardised data for the total female population
- Men aged 45-49

Mortality data from Sweden were compared to data from the EU average across eight tobacco-attributed causes of death: total mortality, respiratory tract cancers, oral cancers, larynx cancers, pancreatic cancers, ischaemic heart disease, stroke, and COPD.

Differences in outcomes in Swedish men vs women

While smoking is more prevalent than snus use among women, snus use is dominating smoking among men. This is reflected in the 2019 mortality data shown below – Swedish men have the EU's lowest tobacco-related mortality and cancers, whereas women appear to have levels around the EU average. These data suggest that the move from cigarettes to non-combustible nicotine alternatives among Swedish men has yielded public health benefits.

Death rates per 100,000 attributable to tobacco in Sweden and the rest of the European Union in 2019 / Total All causes

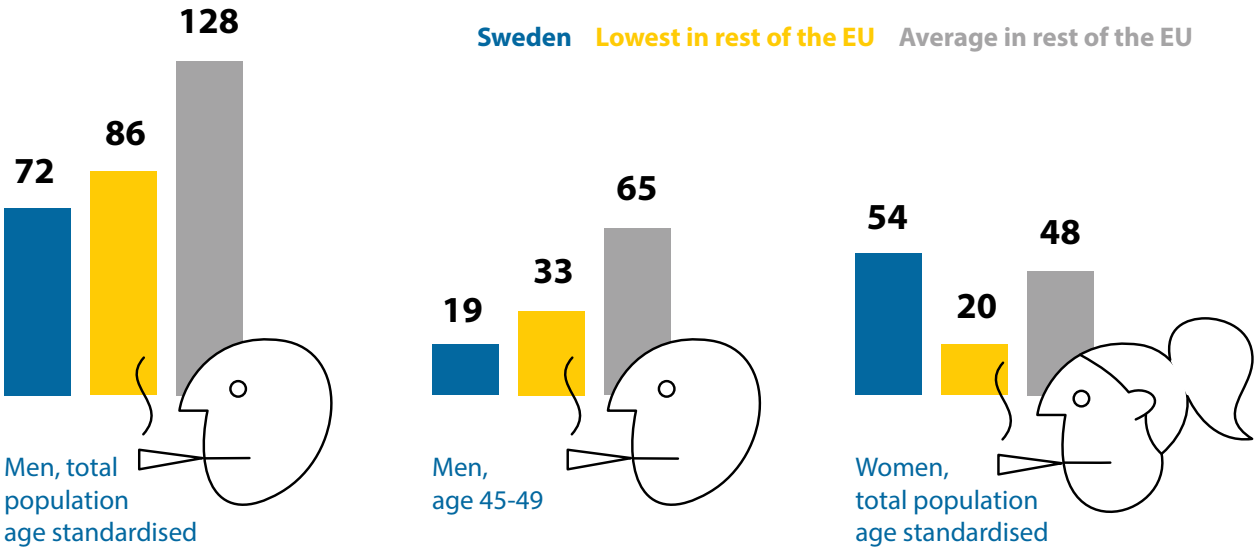


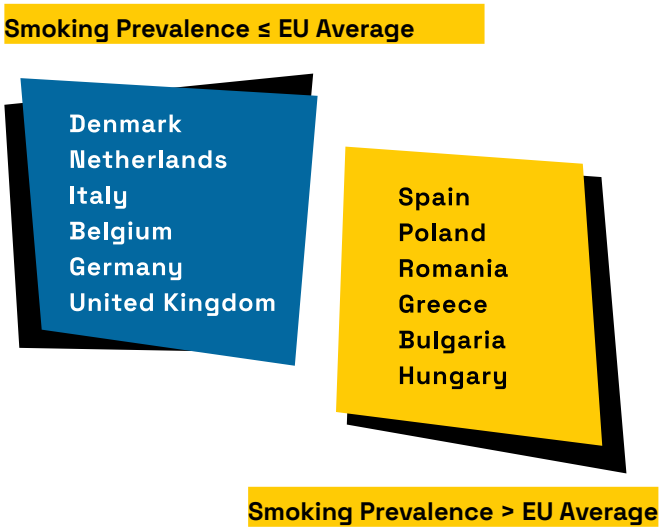
Figure 20: Sweden has the lowest tobacco-related male mortality in the EU, as per Ramström's compilation[52] of IHME GBD data[54].

3.3 Retrospective Modelling

EXPLANATION OF COUNTRY COMPARISONS

Prevalence of Smoking vs Non-Combustibles

In Appendix A, 12 countries have been selected for comparison with Sweden – half of them with a smoking prevalence equal to or below the EU average (23%), and the other half above the EU average. Statistics regarding smoking prevalence, sex distribution of smokers, and prevalence of use of non-combustibles (e-cigarettes, heated tobacco products (HTPs), and oral tobacco (including oral nicotine and snus)) are sourced from the European Commission's 'Special Eurobarometer 506: Attitudes of Europeans towards tobacco and electronic cigarettes'[85], which is data from 2020. This analysis will focus on 'current' users of tobacco and/or non-combustibles, rather than 'previous' or 'occasional' users. The countries selected are:



HUMAN DEVELOPMENT INDEX

Each country will have its Human Development Index (HDI) displayed below its name. HDI, created by the United Nations Development Programme (UNDP), is a summary measure of average achievement in three key dimensions of human development: a long and healthy life, being knowledgeable, and having a decent standard of living[57]:

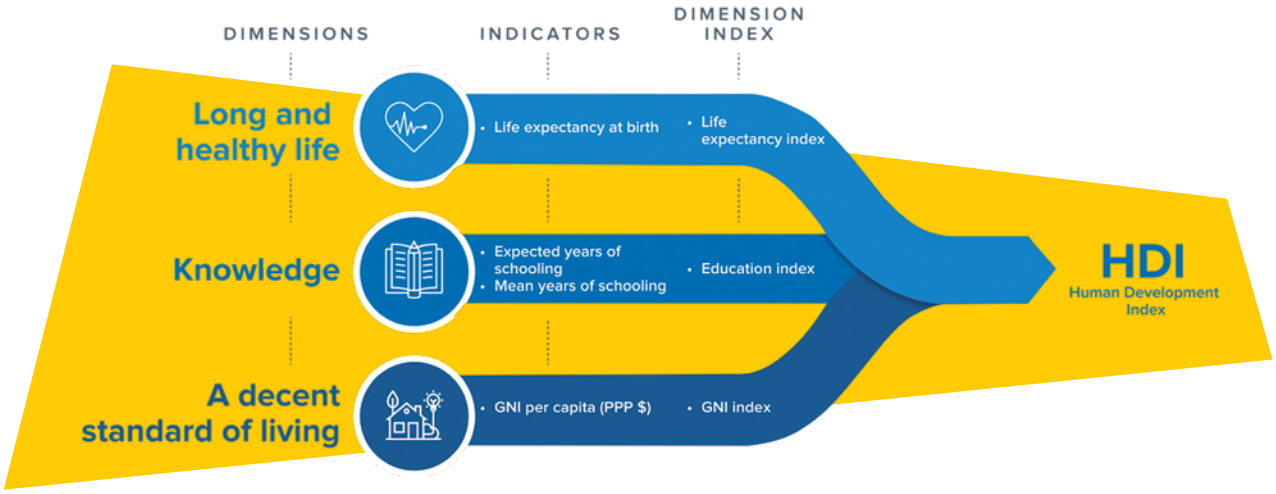


Figure 21: Human Development Index (HDI) explained[57]

The closer the calculated HDI is to 1.000, the more developed the country is. Each country's HDI is categorised as follows:

- **0.800-1.000 – 'very high'**
- **0.700-0.799 – 'high'**
- **0.550-0.699 – 'medium'**
- **0.000-0.550 – 'low'**

SMOKING-ATTRIBUTED DEATHS, LYLS AND DALYS

The Global Burden of Disease (GBD) Study by the Institute for Health Metrics and Evaluation (IHME) is a collaborative research project led by the University of Washington[54]. It is the largest and most detailed scientific effort to compile health metrics observational data. It is highly respected by the scientific and policymaking communities; there have been over 400 peer-reviewed publications since 2010 using IHME data. Data from this study will be used to quantify and compare smoking-attributed deaths and DALYs in each country in the twenty years between 2000-2019.

By comparing the rates of death, life years lost (LYLs), and DALYs, differences in countries' populations are accounted for when comparing their smoking-attributed mortality and morbidity. A DALY is a universal metric that equals the sum of life years lost (LYLs) and years lived with disability (YLDs). One DALY is equivalent to one lost year of healthy life[54].

POTENTIAL ECONOMIC SAVINGS

The economic cost per DALY was recently calculated by Daroudi et al[56] using IHME data for countries with different levels of Human Development Index (HDI). The estimated cost per DALY averted was:

- **US$998 - low HDI**
- **US$6522 - medium HDI**
- **US$23,782 – high HDI**
- **US$69,499 – very high HDI**

In the future, it will be possible to quantify and compare the potential economic costs of smoking between countries. Of the 27 EU countries, 26 are classed as 'very high HDI', and one (Bulgaria) as 'high HDI'[57]. For the purpose of this report, the key metrics to be compared between Sweden and selected countries will include:

- Potential deaths averted
- Potential life years gained
- Potential disability-adjusted life years averted

3.4 Individual Health and Consumer Choice: Why Smokers Switched to Alternative Nicotine Options in Sweden

In addition to simulation modelling based on population health data, much can be learned from individual health and consumer choices. A recent opinion poll[84] conducted by Ipsos and commissioned by We Are Innovation has found that Swedes who switch to Alternative Nicotine Products (ANPs), such as snus, nicotine pouches, vaping and heated tobacco, are primarily motivated by health concerns. The study titled "Swedes' views on the alternatives to cigarettes. Usage of alternative nicotine products among former cigarette smokers" sheds light on what enabled ex-smokers in Sweden to turn to ANPs and what factors influence their decision-making. According to the Ipsos poll, the combination of stringent tobacco control measures and the promotion of safer nicotine products has incentivised consumers to switch from traditional cigarettes to ANPs.

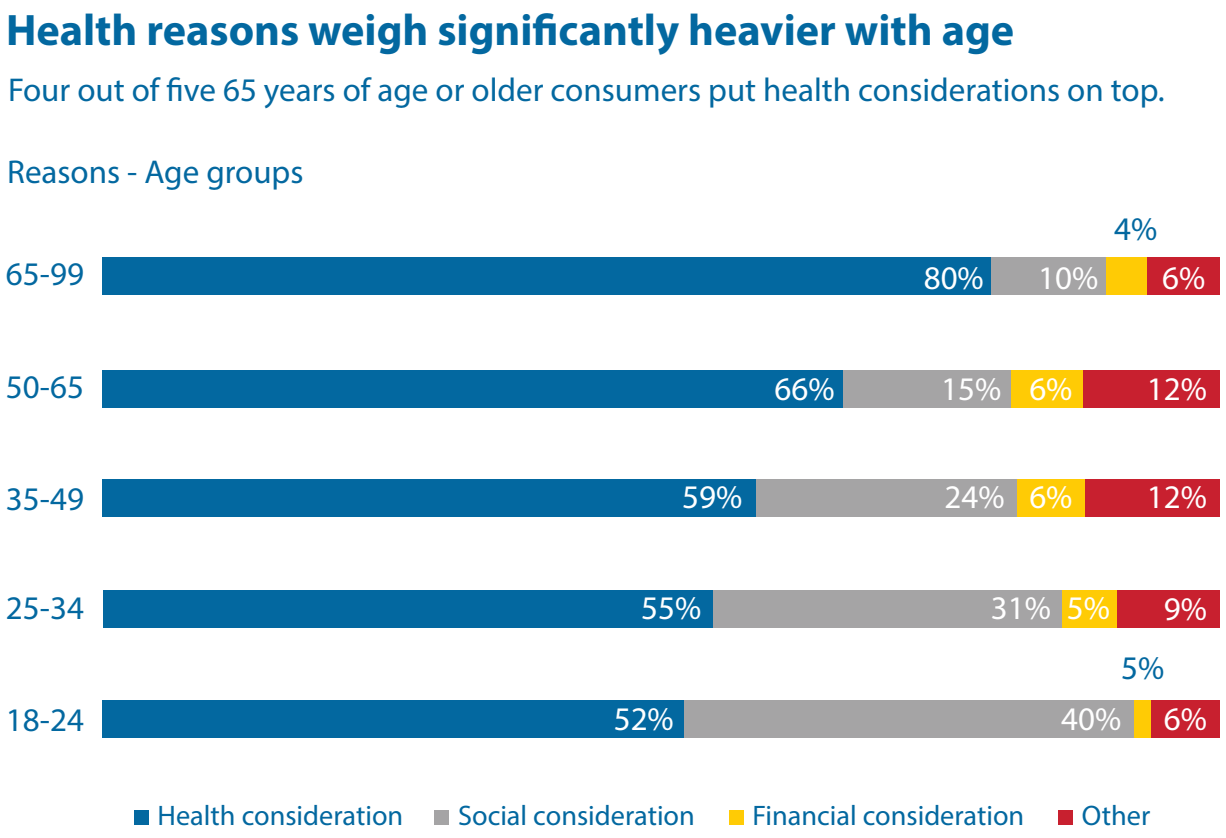


Figure 22: The We are Innovation poll conducted by IPSOS, found "that Swedes who switched to ANPs are primarily motivated by health concens. This is followed by social, financial and other considerations[86]"

Conclusions

The Swedish case study is an example of how effective tobacco control is, if complemented by sound harm reduction strategies. This is why smoking prevalence has been driven down faster than in any other country in the world.

In our first report, "A Roadmap to a Smoke Free Society", we showed that if the rest of Europe adopted the Swedish model of embracing tobacco harm reduction and encouraging smokers to switch to a range of smoke free nicotine alternatives, during the next decade, over 3.5 million premature deaths could be prevented.

In this follow-up report, we further developed the models to calculate the "size of the prize" for public health. At the same time, the building blocks of the Swedish case study were analysed:

POLICY CONSIDERATIONS

- **Risk-proportionate regulation:** Currently, in all but a few countries such as Sweden, regulatory policy toward tobacco is contradictory and not based on the best science. Often there is policy-biased evidence-seeking, rather than sound evidence-based policy. Ultimately, public policy must enable persistent smokers to either quit or to switch to smoke free nicotine alternatives. Supported by research and development of innovative smoke free products, risk-proportionate policies are the best way to reach that goal.
- **Impact Assessment:** Governments ought to develop mechanisms to assess the impact of risk-proportionate policies on smoking cessation and switching from combustible cigarettes to smoke free alternatives.
- **Incentives:** As the consumer survey showed, it matters how risk is communicated - labelling, taxation, and flavours should be regulated in a way that incentivises people who smoke to quit, or switch to safer nicotine alternatives down the harm continuum.

SCIENCE CONSIDERATIONS

- **Retrospective and prospective studies:** Need to be encouraged to more adequately quantify and qualify the potential of tobacco control and harm reduction. The primary objective of public health is to prevent disease and premature death. Calculating the potential deaths and DALYs averted and life years saved, is a galvanising force for all stakeholders.
- **Saving lives:** A comparison of tobacco-attributed mortality between 2000-2019 in Sweden versus the European Union (EU), using data from the IHMA's Global Burden of Disease Study, showed that potentially 2.9 million premature deaths could have been averted.
- **Averting disability-adjusted life years (DALYs):** Moreover, the Swedish model could have an even greater impact on averting Disability-Adjusted Life Years (DALYs). If the EU had employed the Swedish model, potentially 108 million DALYs could have been averted in the EU. In short, the EU population could have led healthier and more productive lives, as in Sweden.
- **Preventing disease:** WHO data shows clearly that Sweden's incidence of cancer is 41% lower than the rest of its European counterparts, corresponding to a 38% lower level of total cancer deaths. Sweden has a 39.6% lower rate of death of all tobacco-related diseases compared to the EU average.
- **Country case studies could play a beneficial role:** For example, if Belgium had the same rate of smoking-related deaths and DALYs as Sweden between 2000-2019, potentially 90,000 deaths and 2.5 million DALYs could have been averted.

CONSUMER CONSIDERATIONS

- **Consumer research:** Consumer choice can drive change, as has been proven in Sweden. The Ipsos study showed that acceptability, affordability, and accessibility are key drivers of consumer migration from the most harmful form of tobacco consumption (cigarettes) towards quitting or switching to non-combustible nicotine alternatives.
- **Consumer engagement:** A whole-of-society approach is needed to solve tobacco-related harm. Large-scale consumer perception studies and attention to the real-life experiences of those most affected by tobacco use harms, those who have successfully quit and those who have switched to less harmful products, require well-designed and inclusive consumer research.
- **Youth prevention policies:** To prevent youth initiation and use of tobacco and harm reduction products, comprehensive marketing and youth use restrictions need to be in place. These should be distinct from policies that encourage adult smokers to quit or switch to less harmful products.
- **Combat misinformation and develop more accurate risk communication for tobacco harm reduction:** Identify and combat sources of misinformation and encourage trusted messengers and messages, to ensure accurate information is delivered to consumers.

TECHNOLOGICAL INNOVATION

- **Innovating smoke free products:** Sweden has cautiously embraced innovative technology and products that deliver nicotine without the dangers to health caused by the combustion of tobacco. With the support of extensive research, the development of this technology must be encouraged.
- **Lower- and Middle-Income Countries are more vulnerable:** Over 80% of the world's smoking-related deaths occur in LMICs. Efforts to reduce smoking prevalence in LMICs must be accelerated. Additionally, the harmful synergy between smoking and tuberculosis must be accounted for in endemic countries. In LMICs, there is an urgent need to improve access, affordability, and consumer acceptability for smoking cessation and THR products.

About the Authors

DR. DELON HUMAN is a specialist family physician, global health advocate, published author, international speaker and health care consultant specialising in global health strategy, harm reduction and health communication. He is the former Secretary-General of the World Medical Association, International Food and Beverage Alliance and Co-founder of the African Harm Reduction Alliance (AHRA). He has acted as an adviser to three WHO Directors-General and to the UN Secretary-General on global public health strategies.

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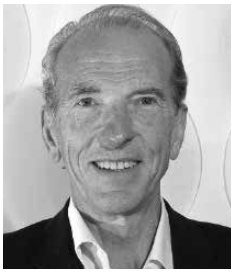
Dr. Milton's resumé also includes stints as President and CEO of the Swedish Medical Association (SMA), and as President of the Swedish Red Cross, the People and Defence Foundation and the Swedish Confederation of Professional Associations (SACO).



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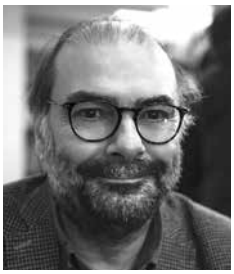

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JESSICA PERKINS completed her degree in Chemistry, at the University of Southampton, and worked as a scientist in the R&D of a multinational company. The focus of her work was the novel implementation, development, and testing of analytical devices to characterise the aerosols from reduced risk products, in the tobacco and nicotine industry. She then became an innovation product developer, where she focussed on materials science and device development within the heated tobacco products category. Jessica is now a harm reduction advocate and leading several advocacy platforms (including THR.net) communicating harm reduction science.

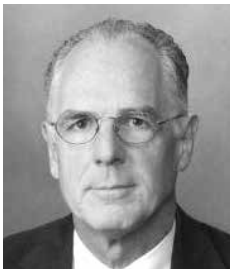
DR. DIEGO VERRASTRO is a general surgeon, specialising in emergency medicine, abdominal mini-invasive surgery, ultrasonography and obesity. He is also spokesperson for RELDAT, The Latin - American network for the reduction of tobacco - associated harm. In this role, he has called for further discussion of the merits of harm reduction in Latin America, drawing attention to the examples provided by other countries - including the UK, New Zealand and Sweden.

SCOTT D. BALLIN, JD has spent more than 50 years involved in issues related to tobacco and public health. He has worked on a spectrum of tobacco and nicotine issues ranging from labeling reforms on cigarettes and smokeless tobacco products, FDA regulation of tobacco and nicotine, excise taxes, clean indoor air laws, tobacco agriculture reforms, tobacco harm reduction, and stakeholder engagement. For more than 10 years he served as the American Heart Association's Vice President and Legislative Counsel, and a Steering Committee Member and two-time Chairman of the Coalition on Smoking OR Health (AHA, ACS, ALA) which was the first truly active national coalition in the tobacco control movement.

FEDERICO N. FERNÁNDEZ is Executive Director of Somos Innovación, a network of over 30 think tanks and NGOs dedicated to seeking innovative solutions to problems in both Europe and Latin America. He is also Founder and President of Fundación Internacional Bases, an organisation that thinks globally and acts locally in issues related to individual freedoms and the market economy. Fundación Internacional Bases also has responsibility for the organisation of Escuela Austríaca, a congress focused on economics, with Federico N. Fernández acting as Chairman of the organising committee. His writing has been featured in a wide variety of media outlets across both Europe and Latin America and he has also authored several academic articles and has co-edited books.

DR. MAREWA GLOVER is one of New Zealand's leading tobacco control researchers. She has worked on reducing smoking-related harm for 30 years. She is recognised internationally for her advocacy on tobacco harm reduction; and locally was a Finalist in the New Zealander of the Year Supreme Award in 2019 recognising her contribution to reducing smoking in NZ.

Dr Glover has chaired numerous committees and organisations including End Smoking NZ, an independent NGO that lobbied for a harm reduction approach even before electronic cigarettes were introduced. In 2018 Dr Glover established the Centre of Research Excellence: Indigenous Sovereignty & Smoking - an international programme of research aimed at reducing tobacco related harms among Indigenous peoples globally. www.coreiss.com The Centre of Research Excellence: Indigenous Sovereignty and Smoking (the Centre) was established with the help of a grant from the Foundation for a Smoke-Free World, Inc. ("FSFW"), a US non-profit 501(c)^{3} private foundation. The work of the Centre, under the terms of the grant agreement with FSFW, is editorially independent of FSFW. The Centre's work and any opinions expressed by them, are the sole responsibility of the author and under no circumstances should they be regarded as reflecting the positions of FSFW.



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Appendix A:

Retrospective Country by Country Estimates of Smoking-Attributed Public Health Burden in Relation to Smoking Prevalence

(Sweden versus selected countries)

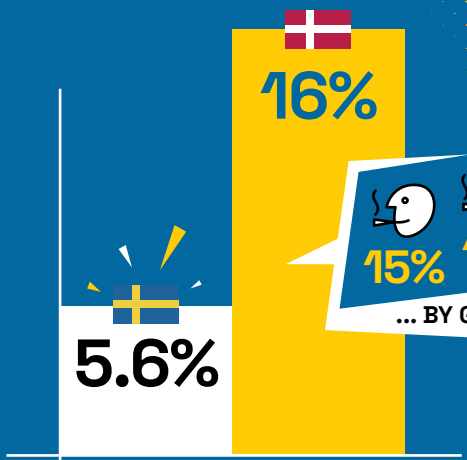
IF DENMARK HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

POTENTIAL DEATHS AVERTED
116,284

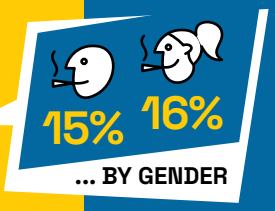
POTENTIAL LIFE YEARS GAINED
2,125,295

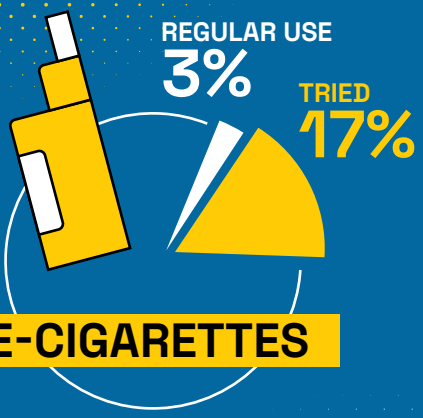
POTENTIAL DALYS AVERTED
2,470,455

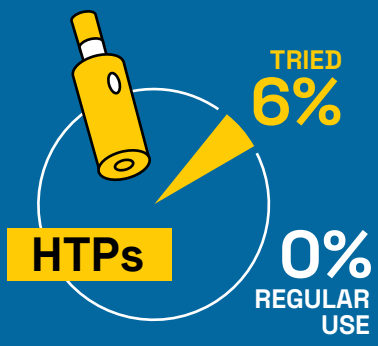
DENMARK



SMOKING PREVALENCE

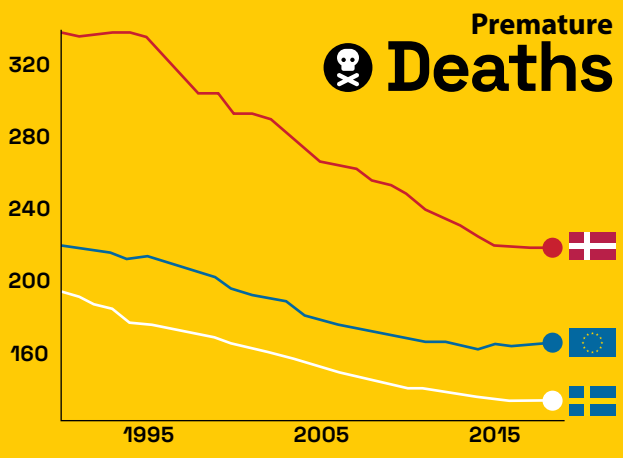






ANNUAL TOBACCO-ATTRIBUTED DEATHS
13,877

CURRENTLY USE ORAL TOBACCO **2%**



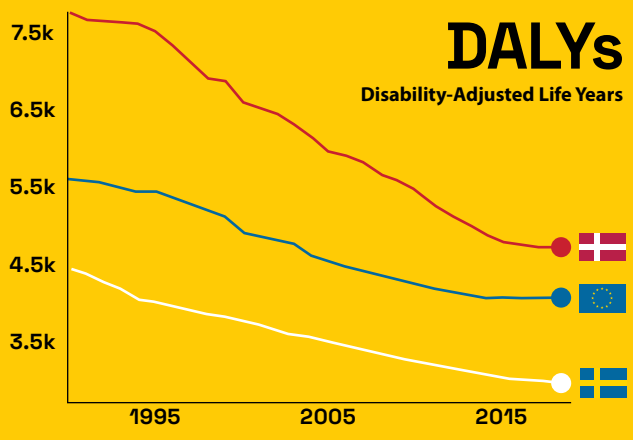


Figure A.1: Graphic presentation: potential deaths and DALYs averted if **DENMARK** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

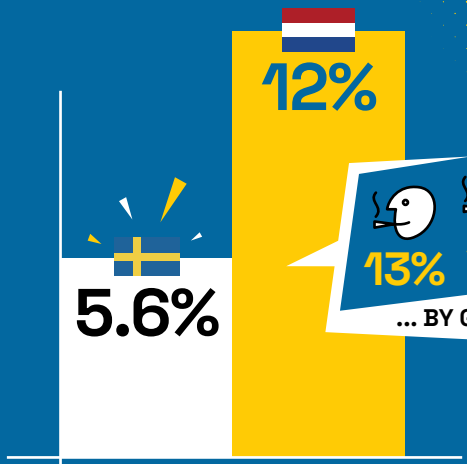
IF THE NETHERLANDS HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

POTENTIAL DEATHS AVERTED
125,151

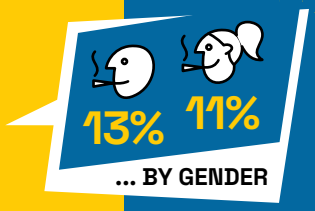
POTENTIAL LIFE YEARS GAINED
3,178,308

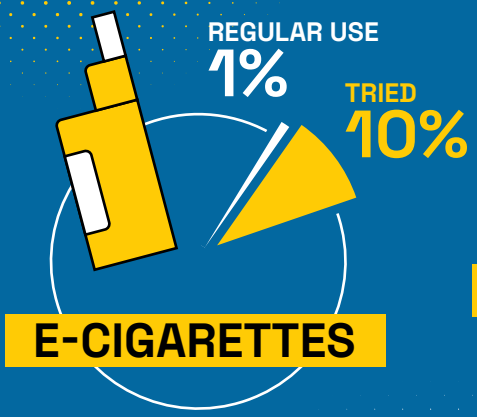
POTENTIAL DALYS AVERTED
3,572,180

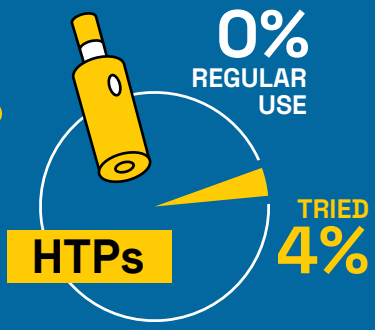
NETHERLANDS



SMOKING PREVALENCE

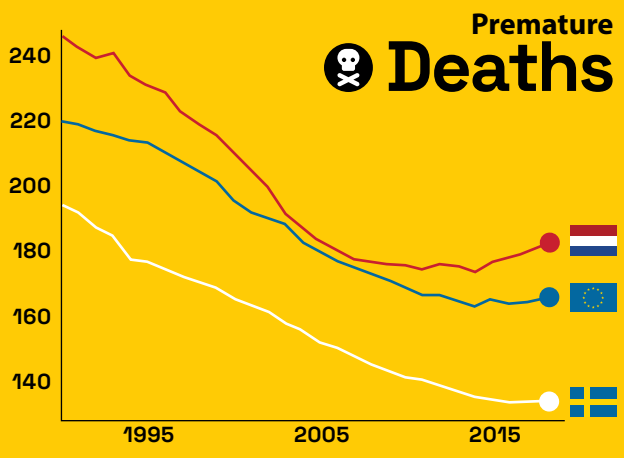


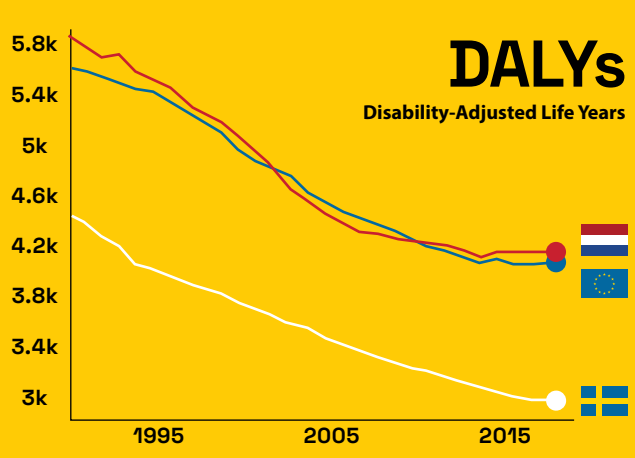




ANNUAL TOBACCO-ATTRIBUTED DEATHS
30,366

CURRENTLY USE ORAL TOBACCO 0%





rate per 100k

Figure A.2: Graphic presentation: potential deaths and DALYs averted if the **NETHERLANDS** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

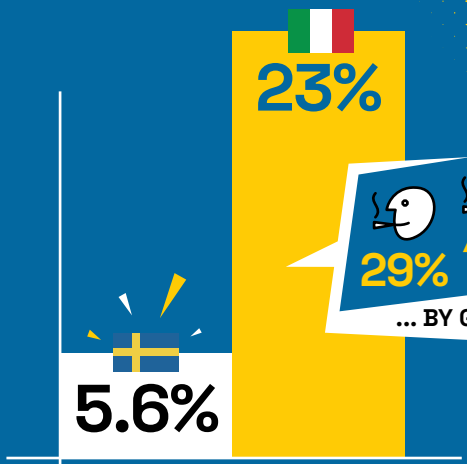
IF ITALY HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

POTENTIAL DEATHS AVERTED
124,750

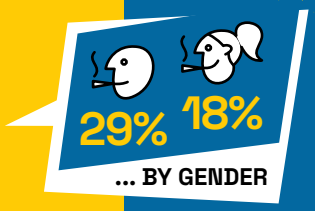
POTENTIAL LIFE YEARS GAINED
4,263,002

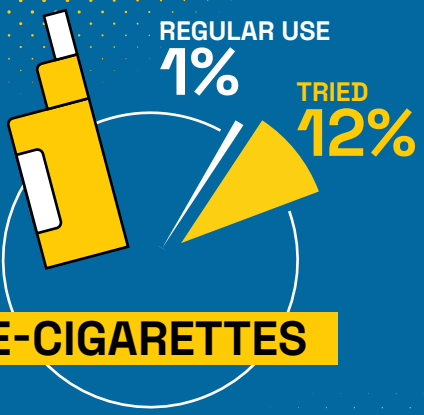
POTENTIAL DALYS AVERTED
4,369,863

ITALY

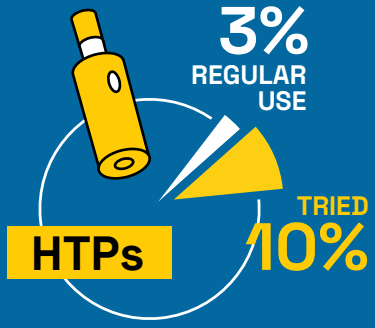


SMOKING PREVALENCE





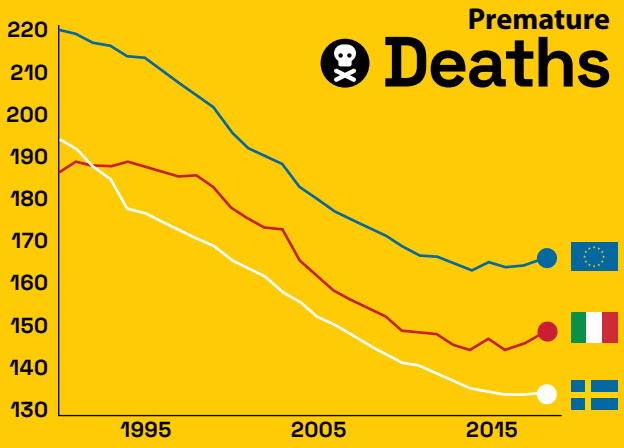
E-CIGARETTES

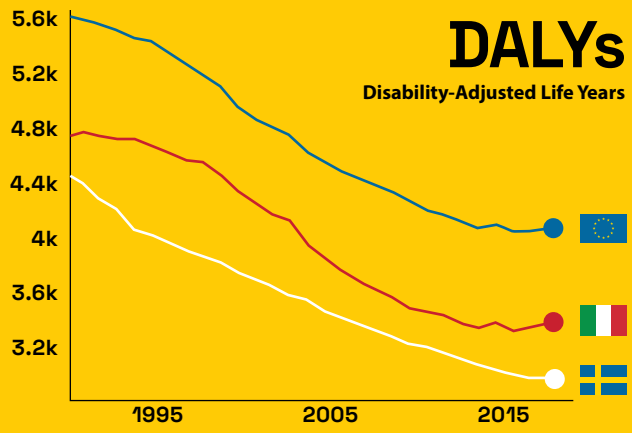


HTPs

ANNUAL TOBACCO-ATTRIBUTED DEATHS
92,682

CURRENTLY USE ORAL TOBACCO 1%





rate per 100k

Figure A.3: Graphic presentation: potential deaths and DALYs averted if **ITALY** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

IF **BELGIUM** HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

POTENTIAL DEATHS AVERTED
90,570

POTENTIAL LIFE YEARS GAINED
2,303,844

POTENTIAL DALYS AVERTED
2,511,439

BELGIUM

21%

21% 20%
... BY GENDER

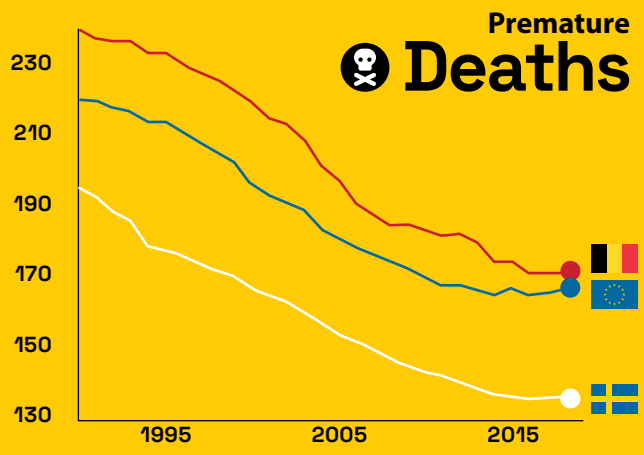
5.6%
SMOKING PREVALENCE

REGULAR USE 3%
TRIED 20%
E-CIGARETTES

2% REGULAR USE
TRIED 8%
HTPs

ANNUAL TOBACCO-ATTRIBUTED DEATHS
20,290

CURRENTLY USE ORAL TOBACCO **1%**



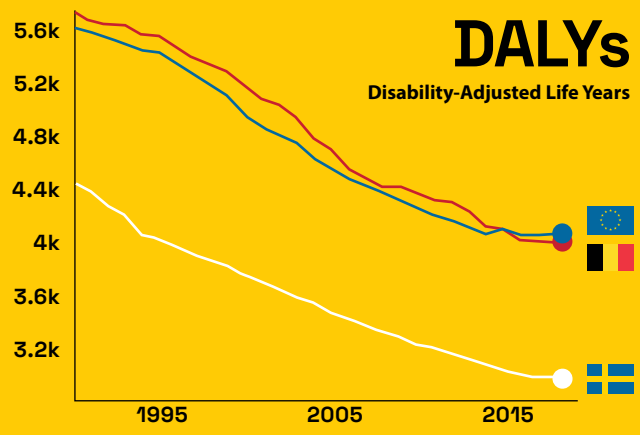


Figure A.4: Graphic presentation: potential deaths and DALYs averted if **BELGIUM** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

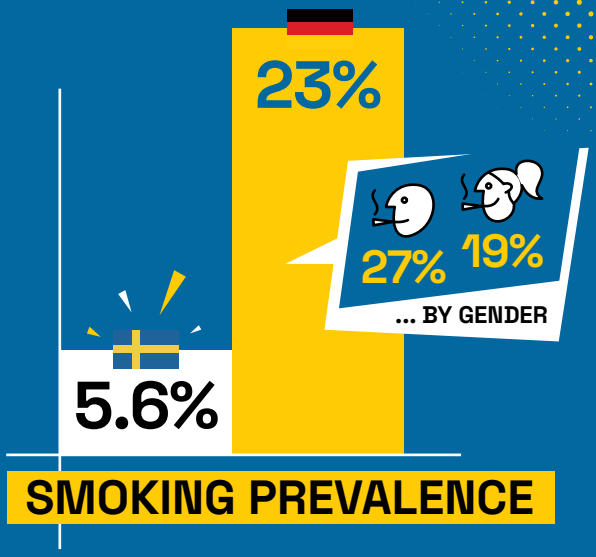
IF GERMANY HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

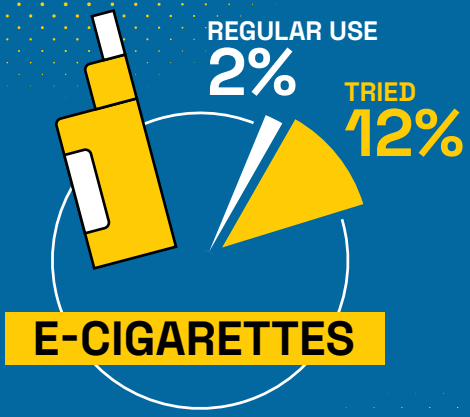
POTENTIAL DEATHS AVERTED
454,366

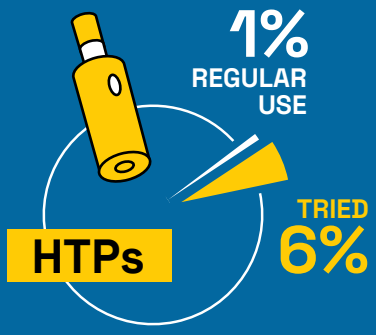
POTENTIAL LIFE YEARS GAINED
15,504,344

POTENTIAL DALYS AVERTED
17,981,109

GERMANY

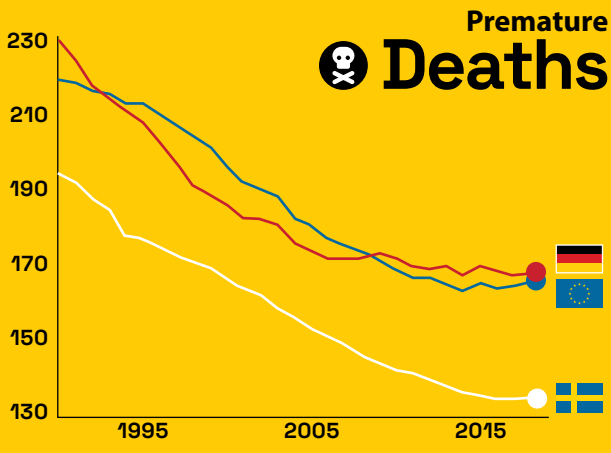






ANNUAL TOBACCO-ATTRIBUTED DEATHS
143,138

CURRENTLY USE ORAL TOBACCO 1%



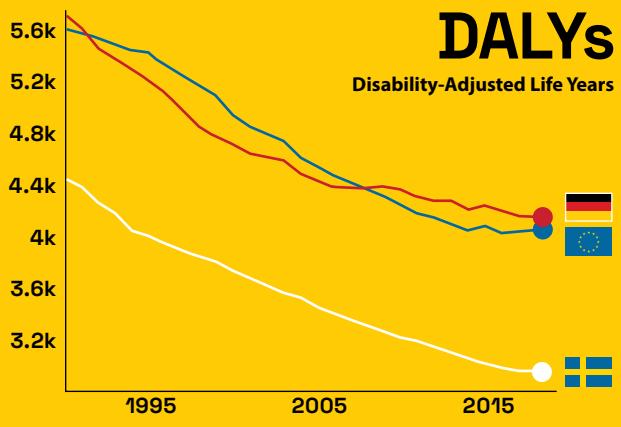
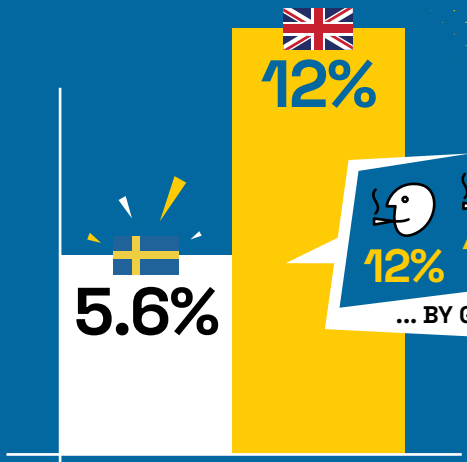


Figure A.5: Graphic presentation: potential deaths and DALYs averted if **GERMANY** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

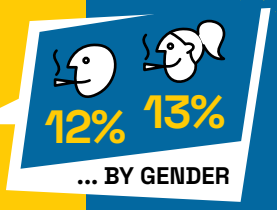
IF THE UNITED KINGDOM HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

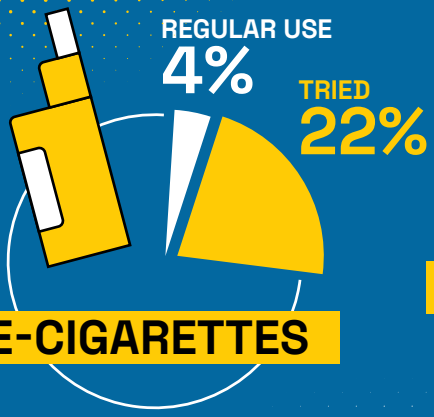
POTENTIAL DEATHS AVERTED	POTENTIAL LIFE YEARS GAINED	POTENTIAL DALYS AVERTED
680,808	13,477,253	15,856,067

UNITED KINGDOM

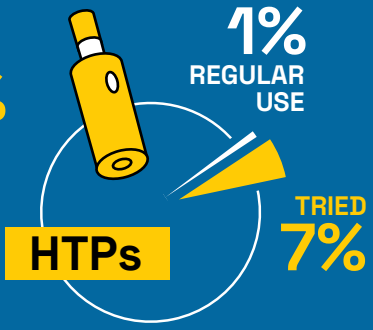


SMOKING PREVALENCE





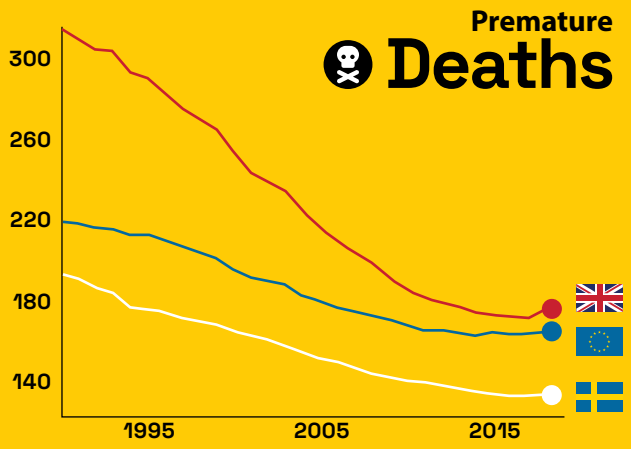
E-CIGARETTES

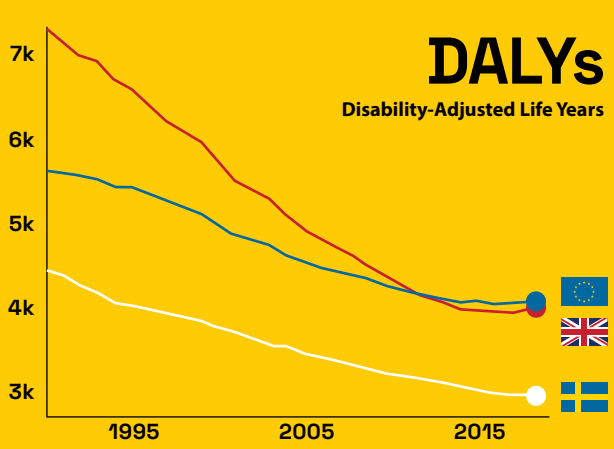


HTPs

ANNUAL TOBACCO-ATTRIBUTED DEATHS
126,108

CURRENTLY USE ORAL TOBACCO 1%





rate per 100k

Figure A.6: Graphic presentation: potential deaths and DALYs averted if the **UK** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

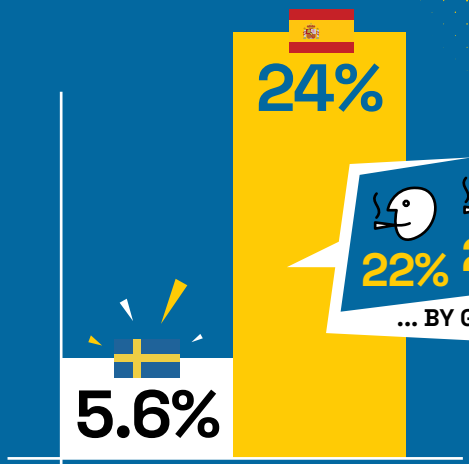
IF SPAIN HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

POTENTIAL DEATHS AVERTED
30,865

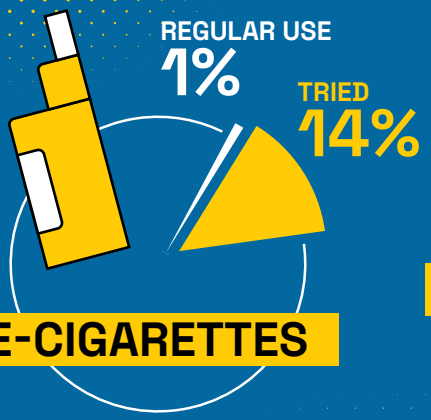
POTENTIAL LIFE YEARS GAINED
3,900,229

POTENTIAL DALYS AVERTED
3,352,663

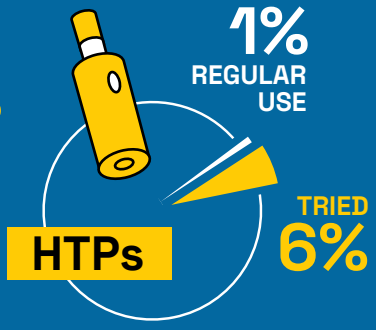
SPAIN



SMOKING PREVALENCE



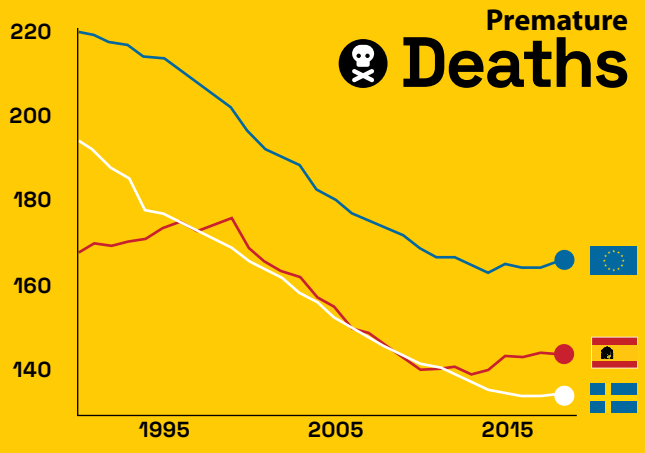
E-CIGARETTES



HTPs

ANNUAL TOBACCO-ATTRIBUTED DEATHS
67,308

CURRENTLY USE ORAL TOBACCO 0%



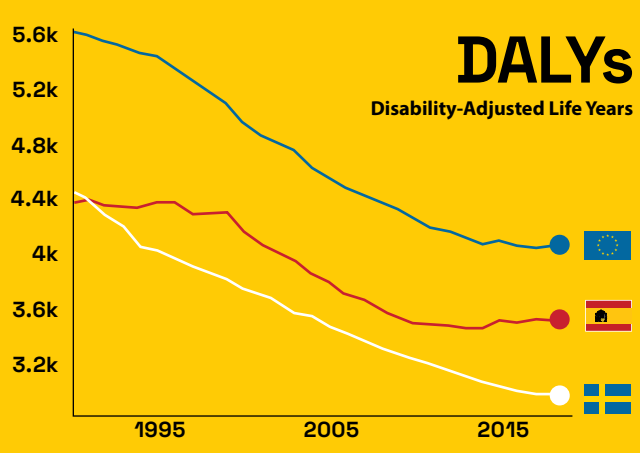


Figure A.7: Graphic presentation: potential deaths and DALYs averted if **SPAIN** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

IF POLAND HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

POTENTIAL DEATHS AVERTED	POTENTIAL LIFE YEARS GAINED	POTENTIAL DALYS AVERTED
442,020	16,829,681	17,498,524

POLAND

26%

32% 20%

... BY GENDER

5.6%

SMOKING PREVALENCE

REGULAR USE 1%

TRIED 6%

E-CIGARETTES

1% REGULAR USE

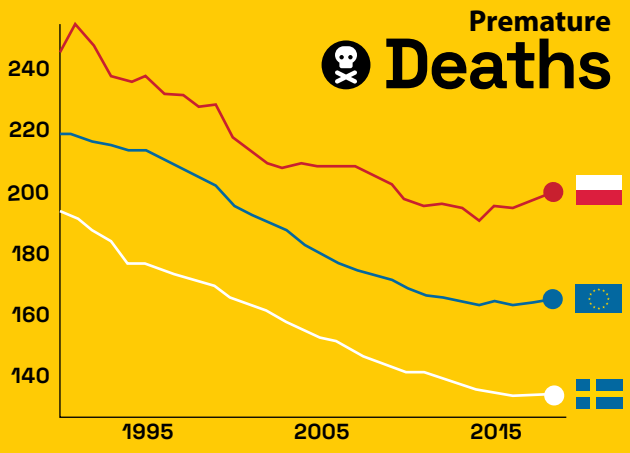
TRIED 4%

HTPs

ANNUAL TOBACCO-ATTRIBUTED DEATHS

77,997

CURRENTLY USE ORAL TOBACCO 0%



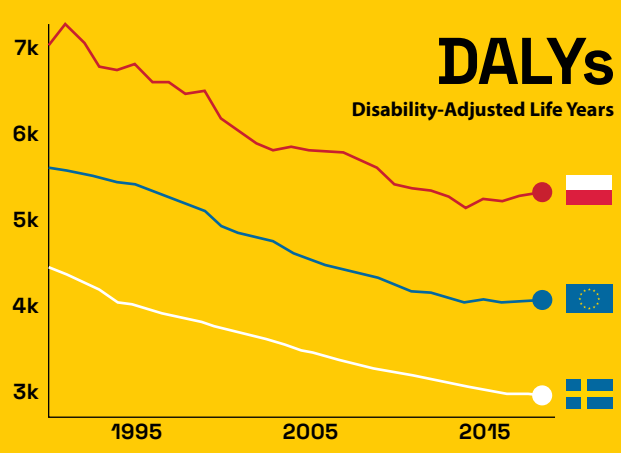


Figure A.8: Graphic presentation: potential deaths and DALYs averted if **POLAND** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

IF ROMANIA HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

POTENTIAL DEATHS AVERTED	POTENTIAL LIFE YEARS GAINED	POTENTIAL DALYS AVERTED
251,205	10,530,736	10,479,915

ROMANIA

30%

38% 23%

... BY GENDER

5.6%

SMOKING PREVALENCE

REGULAR USE 1%

TRIED 7%

E-CIGARETTES

1% REGULAR USE

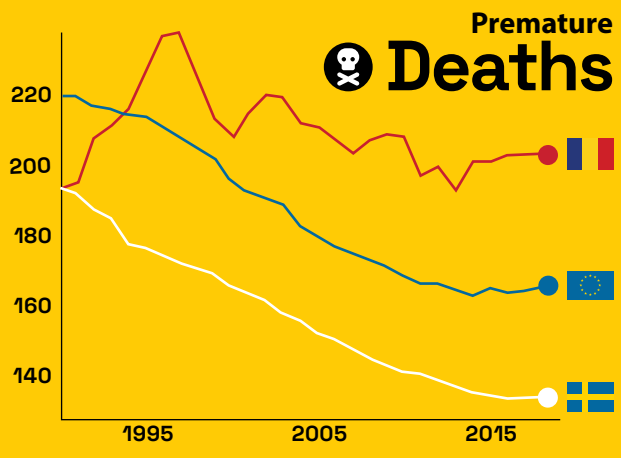
TRIED 5%

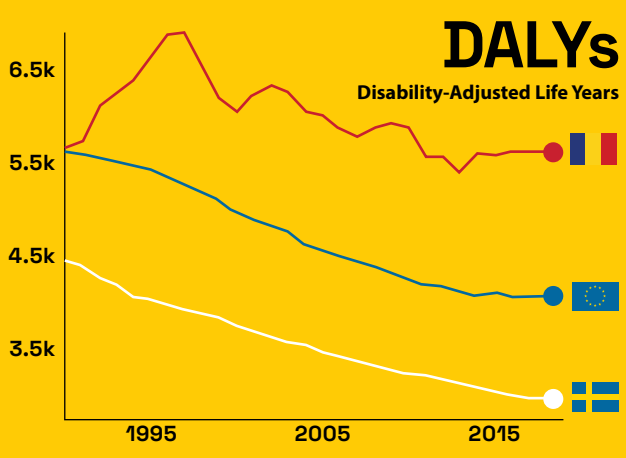
HTPs

ANNUAL TOBACCO-ATTRIBUTED DEATHS

42,985

CURRENTLY USE ORAL TOBACCO 0%





rate per 100k

Figure A.9: Graphic presentation: potential deaths and DALYs averted if **ROMANIA** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

IF GREECE HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

POTENTIAL DEATHS AVERTED
169,522

POTENTIAL LIFE YEARS GAINED
4,040,339

POTENTIAL DALYS AVERTED
4,511,619

GREECE

42%

46% 38%
... BY GENDER

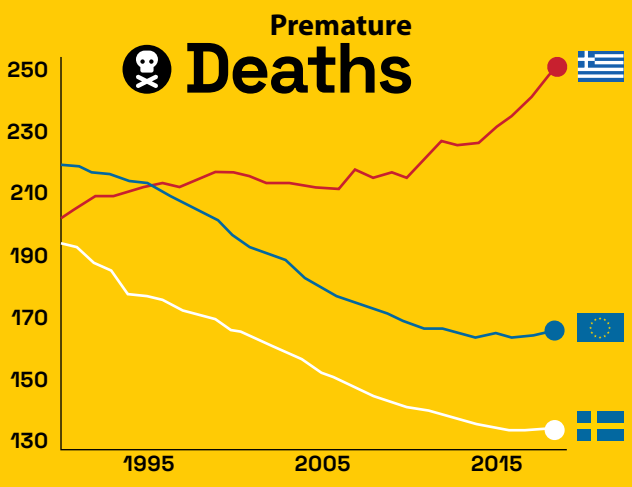
5.6%
SMOKING PREVALENCE

REGULAR USE 2%
TRIED 17%
E-CIGARETTES

2%
REGULAR USE
TRIED 9%
HTPs

ANNUAL TOBACCO-ATTRIBUTED DEATHS
24,407

CURRENTLY USE ORAL TOBACCO 0%



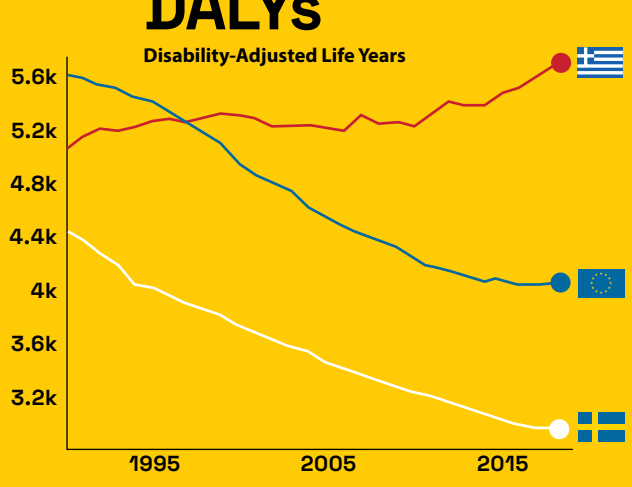


Figure A.10: Graphic presentation: potential deaths and DALYs averted if **GREECE** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

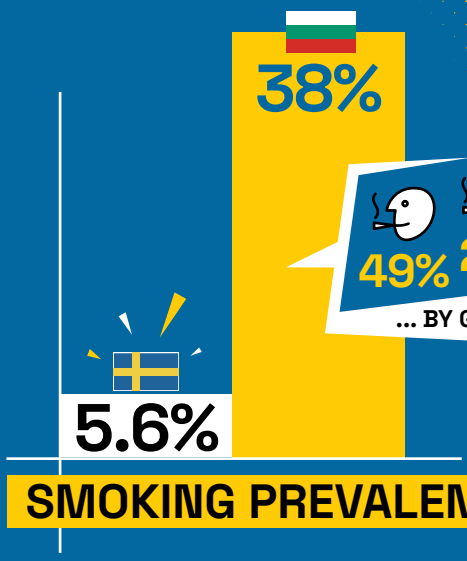
IF BULGARIA HAD THE SAME RATE OF TOBACCO-ATTRIBUTED MORTALITY AND MORBIDITY AS SWEDEN BETWEEN 2000-2019:

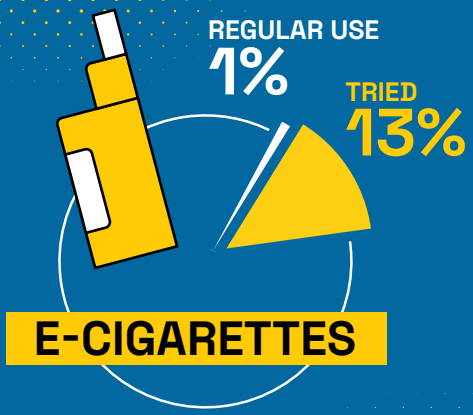
POTENTIAL DEATHS AVERTED
249,280

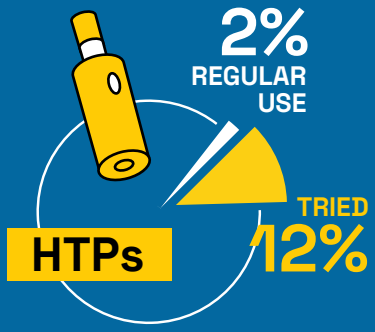
POTENTIAL LIFE YEARS GAINED
7,660,410

POTENTIAL DALYS AVERTED
8,109,450

BULGARIA

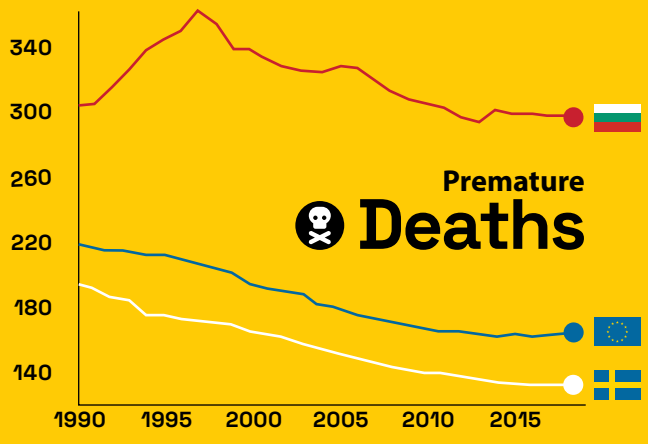


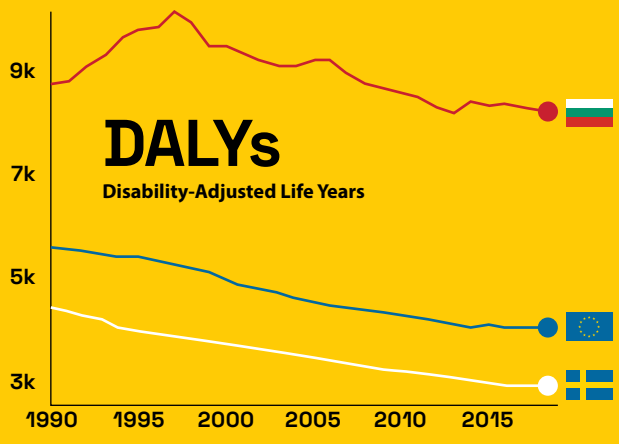




ANNUAL TOBACCO-ATTRIBUTED DEATHS
23,363

CURRENTLY USE ORAL TOBACCO **1%**





rate per 100k

Figure A.11: Graphic presentation: potential deaths and DALYs averted if **BULGARIA** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

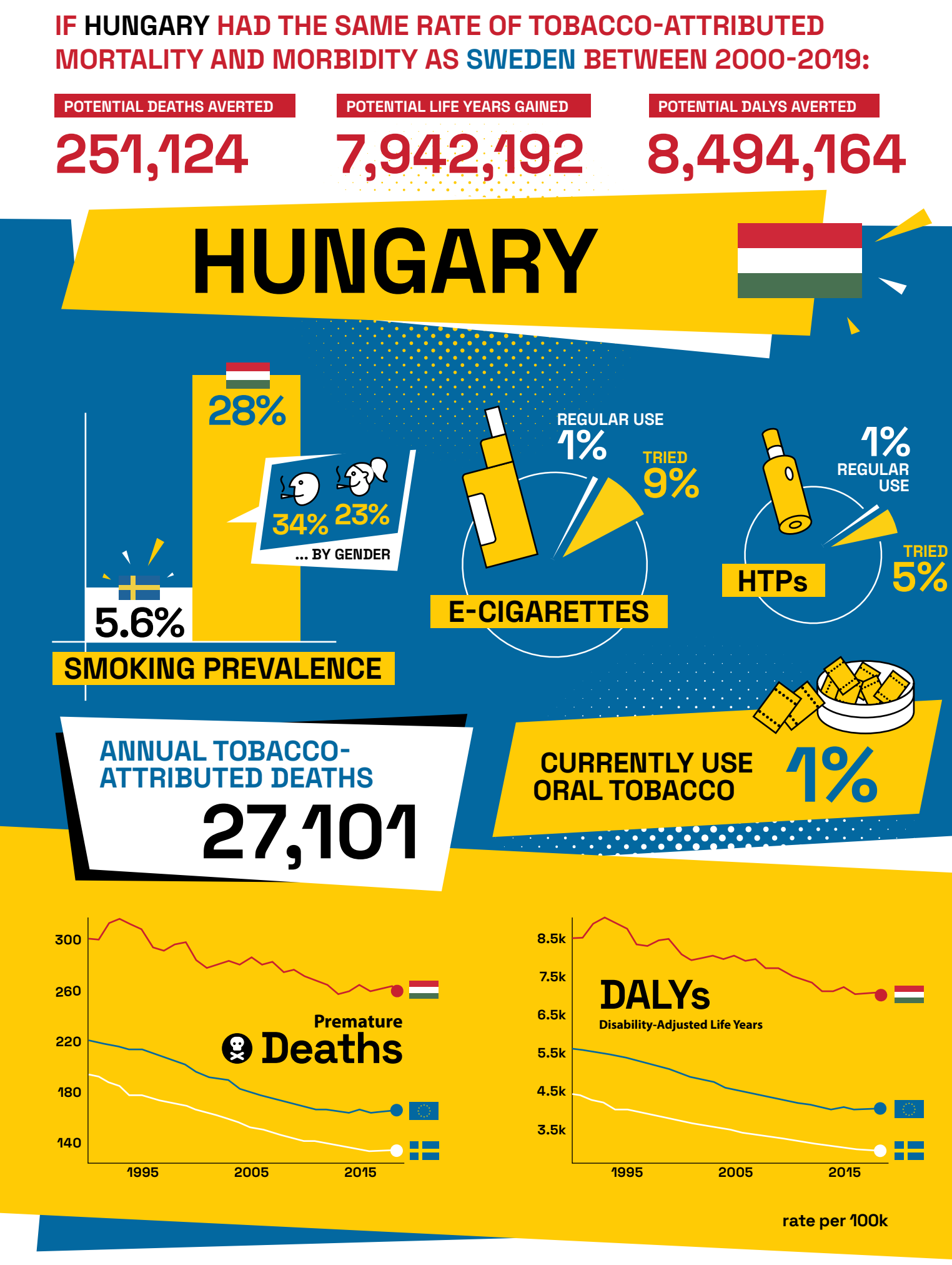


Figure A.12: Graphic presentation: potential deaths and DALYs averted if **HUNGARY** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

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year in its battle against TB, compared to the African average. DALY data from IHME GBD[54].

Figure 13: Graphic reproduced from Levy et al[80] depicting the transition states between users of product categories in their journey to smoking and/or NVP cessation.

Figure 14: What would happen if adult smokers in the USA switched to nicotine vaping products? According to Levy et al's SAVM model[80], 1.8 million deaths would be avoided, and 38.9 million life years gained.

Figure 15: What would happen if adult smokers in Canada switched to nicotine vaping products? According to Levy et al's SAVM model[80], 130,000 deaths would be avoided, and 3.5 million life years gained.

Figure 16: What would happen if adult smokers in Germany switched to nicotine vaping products? According to Levy et al's SAVM model[80], 300,000 deaths would be avoided, and 4.7 million life years gained.

Figure 17: What would happen if adult smokers in England switched to nicotine vaping products? According to Levy et al's SAVM model[80], 200,000 deaths would be avoided, and 5 million life years gained.

Figure 18: What would happen if adult smokers in Australia switched to nicotine vaping products? According to Levy et al's SAVM model[80], 104,200 deaths would be avoided, and 2.05 million life years gained.

Figure 19: Yach's projections showing how the widespread adoption of HRPs would drastically reduce tobacco-related deaths by 2060[5].

Figure 20: Sweden has the lowest tobacco-related male mortality in the EU,
as per Ramström's compilation[52] of IHME GBD data[54].

Figure 21: Human Development Index (HDI) explained[57]

Figure 22: The We are Innovation poll conducted by IPSOS, found "that Swedes who switched to ANPs are primarily motivated by health concens. This is followed by social, financial and other considerations[86]"

Figure A.1: Graphic presentation: potential deaths and DALYs averted if **DENMARK** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

Figure A.2: Graphic presentation: potential deaths and DALYs averted if the **NETHERLANDS** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

Figure A.3: Graphic presentation: potential deaths and DALYs averted if **ITALY** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

Figure A.4: Graphic presentation: potential deaths and DALYs averted if **BELGIUM** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

Figure A.5: Graphic presentation: potential deaths and DALYs averted if **GERMANY** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

Figure A.6: Graphic presentation: potential deaths and DALYs averted if the **UK** had the same rate of tobacco-attributed mortality and morbidity as **SWEDEN** between 2000-2019.[54]

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