

# **BELGIAN NATIONAL BURDEN OF DISEASE STUDY**

**Patterns of tobacco use and sales in  
Belgium: a critical appraisal of available  
data sources**

April 2024, Brussels, Belgium

# Sciensano

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# ABBREVIATIONS

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<b>AB</b>	Attributable burden
<b>BOD</b>	Burden of Disease
<b>BeBOD</b>	The Belgian National Burden of Disease Study
<b>CoD</b>	Cause of Death
<b>CRA</b>	Comparative risk assessment
<b>DALY</b>	Disability-adjusted life year
<b>EB</b>	The Eurobarometer survey on public opinions in the European Union
<b>FCC</b>	Fondation contre le cancer
<b>GBD</b>	Global Burden of Disease
<b>HIS</b>	The Belgian Health Interview Survey
<b>HBSC</b>	Health Behaviour in School-aged Children study
<b>NCD</b>	Non-communicable disease
<b>PAF</b>	Population attributable fraction
<b>RR</b>	Relative risk
<b>TMRED</b>	Theoretical minimum risk exposure distribution
<b>TMREL</b>	Theoretical minimum risk exposure level
<b>WHO</b>	World Health Organization

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# 1. Introduction

Tobacco use is a risk factor for six out of the eight highest causes of deaths (CoD) in the world with over 8 million estimated attributable deaths annually (GBD 2019 Risk Factors Collaborators, 2020). It represents an important public health issue worldwide that results in many premature deaths, and large losses of healthy life due to morbidity and disability (Gisle et al., 2018; World Health Organization, 2009, 2022; World Health Organization Regional Office for Europe, 2019). Indeed, tobacco is responsible for 250 million Disability-Adjusted Life Years (DALY) worldwide (GBD 2019 Risk Factors Collaborators, 2020). Despite its high impact as a preventable cause of death in the world today (World Health Organization, 2008) there remain currently 1.3 billion tobacco users worldwide (World Health Organization, 2022). The tobacco use epidemic has thus a large impact on society and imposes both direct economic costs on health care systems for treating diseases that arise from tobacco consumption and indirectly leads to loss of productivity and an environmental burden from the tobacco industry (World Health Organization, 2022). Because of the large time gap between when people start using tobacco and the health consequences, the impact of tobacco-related disease and death has only relatively recently begun to be felt.

The Framework Convention for Tobacco Control was a landmark, binding agreement by the United Nations to implement aggressive tobacco control policies aimed at reducing the impact of tobacco use worldwide (WHO Framework Convention on Tobacco Control & World Health Organization, 2003). The framework has led to effective policies that have contributed to a decrease in tobacco use in recent years. Many countries, including Belgium, are going further to target a “tobacco-free generation.” The Belgian government recently adopted the Interfederal Strategy on a Tobacco-Free Generation 2022-2028 which includes a number of measures and policies aimed at reducing tobacco use and stopping young people from developing the habit (Cellule Général de Politique de Drogues, 2022). Understanding the role of tobacco on population health as an attributable burden will be useful to help monitor progress on the effectiveness of strategies like the Interfederal plan (World Health Organization, 2009, 2021)

In Belgium, tobacco use remains a public health concern and a challenge as daily tobacco use in 2018 was reported by 15% of the adult population (Gisle et al., 2018). Indeed, the Global Burden of Disease Study (GBD) estimates one in seven deaths can be attributed to a disease related to tobacco and is the leading cause of lung cancer, one out of three of all cancer types, and cardiac and respiratory diseases. Those diseases lead the cause of premature deaths in Belgium (Devleeschauwer et al., 2023; GBD 2016 Risk Factors Collaborators, 2017; Gisle et al., 2018).

## 1.1 ESTIMATING TOBACCO ATTRIBUTABLE BURDEN

Currently, the GBD is the single best source for global health estimates and has calculated the attributable burden of tobacco for all countries including Belgium (Devleesschauwer et al., 2014; GBD 2019 Risk Factors Collaborators, 2020). However, the GBD study is limited in its use for monitoring in Belgium in particular because it lacks estimates on a sub-national level, updates are not always consistent with the monitoring needs of the country, and there are gaps in the methodology that make it difficult to reproduce the estimates. As a result, the Belgian National Burden of Disease Study (BeBOD) established a coherent framework for routinely quantifying the burden of disease in Belgium. The BeBOD study produces estimates of years of life lost, years lived with disability, and disability-adjusted life years tailored for the Belgian context, stratified by age, sex, and region (De Pauw et al., 2023). The current phase of the BeBOD study includes work to extend these burden estimates to include the burden of disease attributable to risk factors.

The “Improved and routine monitoring of the burden and the cost of substance use” or SUBOD project aims to quantify the disease burden attributable to tobacco and alcohol use in Belgium and integrate these findings into the BeBOD project to support regular surveillance and monitoring of the impact of these risk factors. Having a consistent time series of exposure data is imperative to provide estimates of the burden attributable to tobacco use over time. This burden will be assessed by using the **Comparative Risk Assessment methodology** (CRA). This method is used to evaluate and quantify the burden of disease (BOD) associated with a specific risk factor (e.g. tobacco use) (Ezzati, 2008). This is done by comparing the level of exposure and the associated risk for disease in the population to a counterfactual scenario or a **theoretical minimum risk exposure distribution** (TMRED) (e.g. no tobacco use) which assumes a low or no associated impact on health. The product of this calculation is the **population attributable fraction** (PAF) or the fraction of disease that is attributable to exposure (Plass et al., 2022). As part of SUBOD, this report will describe the patterns of tobacco consumption by critically appraising the past and current evolution of tobacco use and sales across various data sources from 1997 to 2020. This appraisal will help to establish the most appropriate data sources for developing a time series of tobacco exposure in order to contribute to the estimation of the attributable burden of disease.

## 1.2 EXISTING BURDEN OF DISEASE STUDIES INCLUDING TOBACCO

Burden of disease studies (BOD) and the CRA methodology rely on consistency in definition, units of the exposure data, and the exposure-response functions to calculate the PAF (Plass et al., 2022). These indicators are essential as they provide information on the degree to which the exposure (e.g. tobacco or alcohol use) increases the risk of developing a certain disease in that population. The indicators will be different depending on data availability and study

settings (Plass et al., 2022). Different approaches from BOD studies in other countries are described and compared below and in Table 1.

**Table 1. Overview of tobacco use indicators found in other burden of disease studies**

Indicator	Definition	Burden of Disease Study
Current and former smoking	Current smokers as individuals who currently use any smoked tobacco product on a daily or occasional basis  Individuals who quit using all smoked tobacco products (Australian Institute of Health and Welfare, 2019a).	Australian Burden of Disease Study 2015
Second-hand smoke	Involuntary exposure involving inhaling carcinogens and toxic components present in tobacco smoke at home, at work, or in other public places (Australian Institute of Health and Welfare, 2019a).	Australian Burden of Disease Study 2015  Global Burden of Disease Study 2019
Pack-years	A measure of smoking that includes intensity and time smoked. It is calculated by multiplying the number of packs of cigarettes smoked per day by the number of years the person has smoked (National Cancer Institute, 2011)	Global Burden of Disease Study 2019
Number of cigarettes per day	Cigarette-equivalents per day smoked by a daily smoker	Global Burden of Disease Study 2019
Number of years since quitting	Number of years since quitting for former smokers	Global Burden of Disease Study 2019
5-year lagged daily smoking	Smoking prevalence lagged by 5 years from the current rate, used to represent the exposure-lag response of smoking prevalence on disease (Smith et al., 2021)	Global Burden of Disease Study 2019

### 1.2.1 The Australian Burden of Disease study

The Australian Burden of Disease study provides estimates on past and current tobacco use using smoking status indicators as well as secondhand smoking. By using CRA methodology, the study provides estimates of the attributable burden of tobacco use stratified by age, sex, and region (Australian Institute of Health and Welfare, 2019b). Using relative risk estimates (RR) from the GBD study, Australia uses the same exposure indicators as the GBD study: current tobacco use but they also study different dimensions of attributable tobacco use. Indeed, the study gives insight into the attributable burden (AB) of secondhand smoking, in people living with mental health and projections of the expected impact of the burden



(Australian Institute of Health and Welfare, 2019b). Lastly, they focus on estimating the combined burden of multiple risk factors such as tobacco, alcohol, and illicit drug use (Australian Institute of Health and Welfare, 2019b).

### **1.2.2 Global Burden of Disease study**

The GBD study represents the most comprehensive study of connecting risk to outcomes with a full exploration of causality based on the Bradford Hill criteria to identify diseases attributable to tobacco use as well as a meta-analysis to estimate relative risks from exposure. The study provides results of the attributable burden of tobacco use for 204 countries (GBD 2019 Risk Factors Collaborators, 2020). The exposure indicators used and defined in the 2019 risk study were indicators of frequency and intensity such as the number of cigarettes smoked, number of packs-years, number of years since quitting, and 5-year lagged daily smoking prevalence, they can be found in Table 1. Data for those indicators were stratified by 5-year age groups, sex, and location (GBD 2019 Risk Factors Collaborators, 2020).

### **1.3 INDICATORS OF TOBACCO USE**

The most commonly used data for assessing tobacco use is through self-reported surveys of the population. While these data are robust in the sense that they go directly to the individual, they can suffer bias from the respondent forgetting or misrepresenting their true exposure. Nevertheless, the majority of data on exposure to tobacco use comes from self-reported studies. In addition, data sources such as sales could also contribute to an understanding of tobacco consumption in Belgium. Survey data can lead to bias such as under-reporting harmful use of a dependence including tobacco use (Jackson et al., 2019). Triangulation between consumption and sales data can help account for and adjust for this bias (Jackson et al., 2019). To do so, we compare the annual tobacco sales data such as government tax revenues, tobacco tax signs delivery, and tobacco product sales from 1980 to 2021, and assess if the observation aligns with self-reported tobacco consumption. Below we describe the data sources for tobacco use and assess their quality based on a set of criteria inspired by the MORBISTAT project (Schutte et al., 2020).

## 2. Critical appraisal methodology

Estimating population consumption has traditionally relied on standardized self-reported measures from surveys (Gartner et al., 2010; Reid & Robinson, 2017). However, to gain a comprehensive overview of tobacco consumption, data sources comprising non-survey data such as sales data can be used (Reid & Robinson, 2017). These additional sources can help to overcome limitations and biases often associated with survey data, as underestimation can arise and can help give a more comprehensive understanding of tobacco consumption (Gartner et al., 2010; Reid & Robinson, 2017). The objective is to see if the sales data follow a similar trend to the survey data and if survey data are comparable to survey data to account for underestimation.

### 2.1 SEARCH STRATEGY FOR TOBACCO USE AND SALES DATA

The data on tobacco use in Belgium were extracted from different national, and international surveys that use various and heterogeneous methodologies. In addition, data from other sources including sales were reviewed and assessed. The identified sources were chosen for their potential relevance to the SUBOD project. It is almost certain some have been missed, but this review provides an overview of those deemed most applicable.

#### 2.1.1 Inclusion criteria

Available datasets to monitor tobacco use and sales in the past 20 years in Belgium were identified and critically assessed for the methodology to identify a representative estimate with a minimum of bias. We identified sources of tobacco sales using an unstructured literature review (e.g. web search) and expert consultations. We applied broad inclusion criteria to include a variety of estimates and to provide a complete picture of tobacco use in Belgium. Data sources were assessed that provided information on tobacco use at a national level and had more than one year of data.

#### 2.1.2 Quality assessment criteria

For each identified source, we assessed a series of criteria that included:

- Frequency
- Bias assessment
- Type of survey
- International comparability
- Consistency over time (methodology changes YES/NO)
- Representativeness of the sample
- Level of aggregation: EU, national, regional, provincial

**Table 2. Overview of the criteria used for the quality assessment of available data sources on tobacco use and sales**

Quality criteria	Objective	Assessment
Frequency	Support the development of a time series on tobacco use.	Frequency of data collection and reporting
Bias assessment	To minimize underestimation and produce results representative of the general population	Evaluation of the sampling frame, response rates, reporting methods, and likelihood of impacts on the estimates
Data collection	Minimize bias in the data collection process	Preference for self-completed, self-reported collection with little interference from interviewers
International comparability	To be able to compare to other BoD studies estimates	Comparison of overall methods to other studies or multi-country data sources
Consistency over time (methodology changes YES/NO)	To have an accurate estimation of the data over time	Evaluation of the methods applied from one year to the next and whether there were any changes and how those impact validity
Representativeness of the sample	Nationally representative sample with details by age, sex, and region	Reach of the sample and how well it can represent the distribution of smoking geographically
Age groups	To have multiple age categories to ensure a broader overview of the data by considering various age groups	Description in the sample of the age groups included
Level of aggregation: EU, national, regional, provincial	Detailed data at various levels of aggregation	Strata with multiple levels of aggregation

## 3. Tobacco use data

### 3.1 MAIN DATA SOURCES

We identified four main sources that included at least one of the selected indicators over time and met the inclusion criteria:

- The Belgian Health Interview Survey (HIS)
- The Foundation Against Cancer Survey (FCC)
- The Eurobarometer survey on public opinions in the European Union (EB)
- The Health Behavior in School-aged Children International Study (HBSC)

Table 3 summarizes the key characteristics of these sources.

#### 3.1.1 [Belgian Health Interview Survey](#)

The Belgian Health Interview Survey (HIS) is a household cross-sectional population-based survey of the whole of Belgium including all age groups. It provides a broad picture of the population health in Belgium by identifying the main health problems, as well as the social and behavioral factors that have an impact on them (Demarest et al., 2018). The survey uses a stratified multi-stage, clustered sampling with proportional representation and replacement by region of Belgium. The HIS started in 1997 and is conducted every four or five years with a new sample (Demarest et al., 2018). Data are self-reported with a small sub-sample (around 10%) completing an examination survey that includes objective measures including urine cotinine, relevant for assessing tobacco use (Nguyen et al., 2020).

The HIS assesses a broad range of indicators for tobacco use including smoking habits and history, intensity of smoking, duration of tobacco use, age at initiation, and attempts to quit. The measures are all self-reported but the portion of the survey where these data are collected is self-administered to reduce the risk of interviewer bias (Demarest et al., 2018). Data on tobacco use are only collected for people  $\geq 15$  years, thus adolescent's tobacco use is not included. Some data on second-hand smoke exposure is also collected.

#### *Appraisal*

The HIS stands out as a consistent and nationally representative survey of self-reported health, covering more than two decades. However, it has limitations in terms of monitoring tobacco use. The tobacco-related data in the survey provide snapshots and do not perfectly or annually reflect the tobacco consumption situation in Belgium. Since the HIS employs a random sample, there is always an inherent 'uncertainty' associated with these prevalence figures, as indicated by the 95% confidence intervals (CI). For instance, if the same surveys were conducted infinitely many times with the same sample size in the same population, 95% of all these prevalence estimates would fall between 18% and 22%. While the HIS primarily

focuses on tracking changes in the population's health rather than exact prevalence estimates, understanding long-term trends might require a costly cohort study, which is susceptible to loss of follow-up.

The primary strength of the HIS lies in its consistent and representative methodology spanning from 1997 to 2018. It utilizes a weighted sample from the national registry as a sampling frame, providing a robust overview of tobacco use in Belgium for individuals aged 15 years and above. Although participants differ across survey waves, they are considered representative of the population due to the sampling methods, including regional and age stratification, standardization of age and sex, as well as systematic multi-stage survey and clustering. Moreover, the survey employs a representative sample of the Belgian population, not just a simple random sample, ensuring high-quality results that reflect the entire population (Demarest et al., 2018). The adherence to international recommendations further enables comparability with European data. Additionally, the HIS survey includes all necessary indicators for evaluating tobacco exposure when calculating the attributable burden.

### **3.1.2 Foundation Against Cancer Survey**

The Foundation Against Cancer (FCC) has conducted an annual survey of tobacco consumption in Belgium since 2012 with the help of IPSOS, a marketing firm (Gisle, 2008). The aim was to estimate tobacco consumption in the Belgian population using phone calls and then online surveys based on an (online) panel. This panel consists of a large group of people who are willing to participate in surveys and are also paid for doing so. This is a multi-purpose panel, which can be used for a wide range of surveys. Based on the composition of the population (in terms of age, gender, level of education, etc.), strata are determined (combination of age, gender, etc.) and it is known what percentage of the population each stratum comprises (Fondation contre le cancer, 2021).

#### ***Appraisal***

The annual cross-sectional survey conducted by Fondation contre le cancer (FCC) uses a predetermined sample size with the number of participants per category calculated as quotas. Panel members are invited to participate until these quotas are met; initially conducted via phone, the survey transitioned to an online format in 2018. Any refusals are replaced with similar individuals. However, the FCC approach lacks detailed information on the sampling frame, hampering a comprehensive evaluation of sample quality. There is a potential risk of selection bias in the sampling frame but without more details, this can be difficult to assess. For instance, participants are invited by telephone which would exclude those without a registered phone number.

### 3.1.3 Eurobarometer

The Eurobarometer (EB) survey on public opinions in the European Union is also a good source of information on tobacco use. The survey was conducted for tobacco use from 2002 to 2016 and is defined as a cross-sectional survey (Nissen, 2014). During each wave, the same sample design is applied in all Member States and several sampling points are drawn with a probability proportional to population size, to aim for a total coverage of the country, to have a sample of 1000 participants within each European country (Bogdanovica et al., 2011; Nissen, 2014). The national samples were weighted. They used face-to-face interviews in each country's national language and data were collected via CAPI in the countries where face-to-face interviews were not applicable.

#### *Appraisal*

The methodological limits of the Eurobarometer survey are described by Nissen (2014). Specifically, the comparison between different years of the EB survey is limited since it can be due to a change of phrasing of the questions asked and not necessarily due to a real change in behaviors. In addition, when assessing behaviors between countries, it is important to take into account that for cultural reasons some respondents might underreport their consumption (European Union, 2010, 2014). Finally, only self-reported prevalence rates for tobacco use were available on a national level with no stratification for age, sex, and region. The only comparisons that can be made are at a country level and within the countries of the EU. Those limitations make it hard to assess the real impact of tobacco use in Belgium.

### 3.1.4 Health Behavior in School-aged Children study

By incorporating the international Health Behavior in School-aged Children (HBSC) study, we aim to obtain a comprehensive overview of tobacco use in Belgium across various sociodemographic variables. Taking place in Flanders and French-speaking community for the past twenty years, with the supervision of the regional office of the World Health Organization, the study aims to describe the health behaviors, health status, and well-being of teenagers and bring to light demographical, school-related, and social disparities (Moreau et al., 2017).

The study is a school-based survey, where the questionnaires were administered in class. Three questionnaires were launched to take into account level disparities. The methodology is consistent over time and is decided on an international level (Moreau et al., 2017; Roberts et al., 2009) and uses cluster sampling and a large sample with proportional stratification by school population by province and school network. Two steps were used to create the sample: first, a random selection of schools within each province based on the list from FWB and FL per province and by the network were made then they randomly selected class in the fifth

primary grade to the sixth secondary grade to have all ages available in the sample. Those steps were us to obtain a representative sample of pupils that are enrolled full-time in Belgium (Roberts et al., 2009).

### *Appraisal*

The HBSC surveys are part of an international collaboration and have a well-documented methodology. The sample is limited to school-aged children enrolled in schools, thus excluding those who are not enrolled. This presents a selection bias which means the validity of the results can only be interpreted as representing children in school. They cover age groups that are not captured by surveys on adults and thus provide a useful window into the ages at which most adolescents begin experimenting with tobacco. They are conducted by language community in Belgium (Dutch and French) and the two surveys are not combined, nor do they have perfectly overlapping reporting of their results or questions. This limits the utility of the surveys to create a national picture. The limited age groups exclude this survey from being considered for a wider assessment of tobacco use nationally. In terms of attributable burden of disease, the risk of disease from tobacco use begins to accumulate from around age 30, which is well beyond the age of this survey. Therefore, while it provides important information on the early adoption and use of tobacco in Belgium, it cannot be extended in any consideration of the burden of disease.

**Table 3. Summary overview of the appraisal of survey-derived data sources on tobacco use**

Criterion	Health Interview Survey	FCC	Eurobarometer	HBSC FWB	HBSC Flanders
<b>Frequency</b>	Every 4-5 years	Annually	Every 3 years	Every 4 years	Every 4 years
<b>Date started</b>	1997	2012	2002	1998	2002
<b>Bias assessment</b>	Minimal	Possible but lacking detail	Likely	Minimal	Minimal
<b>Data type</b>	Face-to-face interviews data collected via CAPI (Computer-Assisted Personal Interviews) + self-administered questionnaires	Phone survey → online survey (from 2018)	Face-to-face interviews (data collected via CAPI)	School-based surveys, and questionnaires administered in class	School-based surveys, and questionnaires administered in class
<b>International comparability</b>	Yes (Standard EHIS methodology)	No	Yes	Yes (International survey)	Yes
<b>Consistency over time (methodology changes YES/NO)</b>	Small changes in variable assessment but no big methodological changes	No: change in methodology (until 2012: calls; 2013-2017: CATI; 2018 onwards: online survey)	Changes in studied variables: larger throughout the years	No	No
<b>Representativeness of the sample</b>	Nationally representative stratified random sample taken from the national registry with methodology documented in scientific literature	Difficult to assess because of a lack of detail on the sampling frame. Data are available at a national level The survey conducted by a marketing firm: IPSOS	Multi-country public opinion poll, nationally representative of Belgium Random sample taken from EUROSTAT NUTS areas with replacement.	Nationally representative random sample of children enrolled in schools. Schools were randomly selected within each province. Includes random sample of P5 to S6 students.	Nationally representative random sample of children enrolled in schools. Schools were randomly selected within each province. Includes random sample of P5 to S6 students.



<b>Age groups</b>	Yes, 15 years and above	Yes	No age breakdown	Younger age groups	Younger age groups
<b>Level of aggregation</b>	National and Regional (province only 1997)	National and Regional (province in 2012)	EU level, national (BE level)	Regional	Regional

Abbreviations: CAPI: computer-assisted personal interview; CATI: computer-assisted telephone interview; EHIS: European health interview survey; FCC: Fondation contre le cancer; FL: Flanders; FWB: Fédération Wallonie-Bruxelles; HBSC: health behaviour in school-aged children

## 3.2 OTHER DATA SOURCES

In addition, the following sources were found but as they are using data that are gathered from other data sources, they were not included in the mapping of the sources as they did not meet our quality criteria. Nevertheless, we still found it relevant to present them briefly.

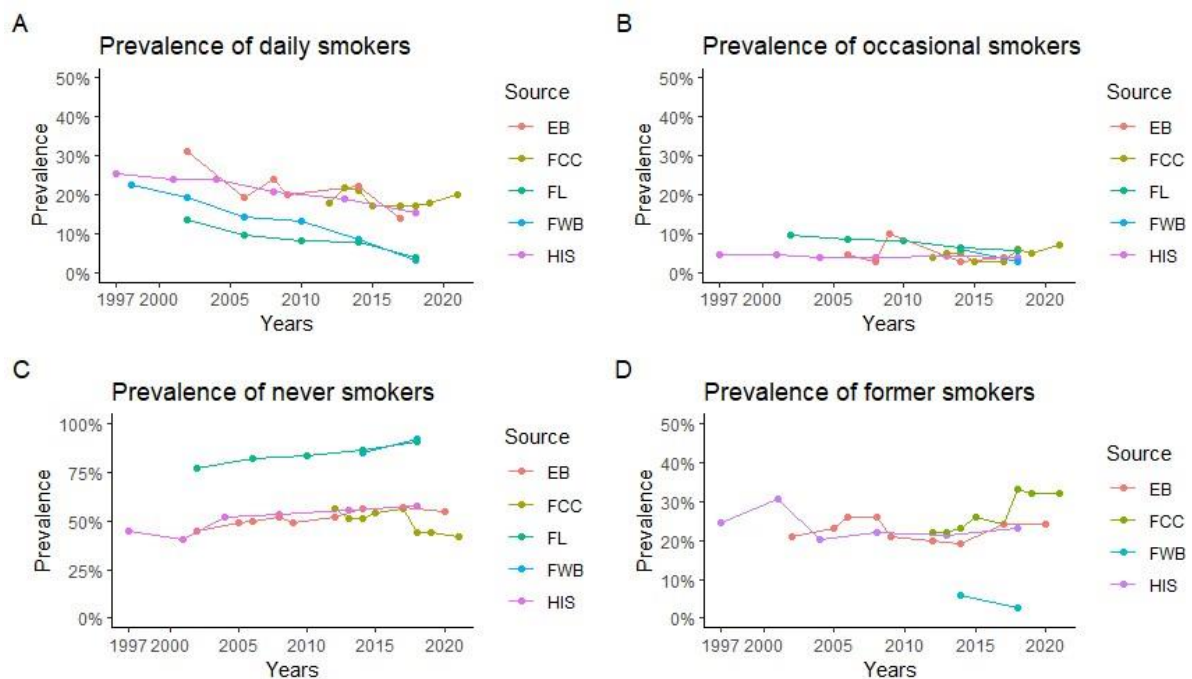
- **[Preventiebarometer](#)**: Sciensano has conducted the Prevention Barometer survey in the Flemish Region, targeting residents aged 18 and above, regardless of nationality or existing health behaviours. A random sample is drawn from the national register, and participants are invited via mail to complete the questionnaire online. The survey aims to gather insights into health behaviours, including tobacco consumption frequency and intentions to change behaviours, with a goal of at least 3,000 participants (Sciensano, n.d.).
- **[The European Social Survey](#)**: The survey is an international research initiative carried out every two years throughout Europe since 2002. Its objective is to evaluate the attitudes, opinions, and behaviours of populations across more than twenty countries. Within the framework of the ESS, information is gathered through in-person interviews, with a preference for employing the Computer-Assisted Personal Interview (CAPI) method, across all participating nations. Participants are individuals aged 15 and above within the population and have an identical likelihood of being selected. The sampling frame is based on the national register. Data assessing tobacco consumption in Belgium are available for the year 2014-2015 (European Social Survey, n.d.).
- **[The EU-SILC](#)**: The EU Statistics on Income and Living Conditions (EU-SILC) is a European survey that serves as a source for comprehensively understanding the various dimensions of social inclusion for households and individuals in society. It employs a multi-dimensional approach, facilitating comparisons between different Member States. Conducted in 2013, 2017, 2018, and 2022, the EU-SILC surveys approximately 6,000 households in Belgium, including a specific focus on 1,000 households in Brussels. The data provides valuable insights into income distribution, poverty, social exclusion, and various living conditions, contributing to a better understanding of the diverse factors impacting social inclusion across regions (Commission communautaire commune, n.d.). Information on tobacco consumption in Belgium by age, sex, and region is available in the latest run of the survey.

### 3.3 TRENDS IN SURVEY-DERIVED SELF-REPORTED TOBACCO USE

Based on the main survey-derived data sources, we summarize the evidence on self-reported tobacco use over time.

Table 4 highlights the availability of the indicators that we have found in the five data sources that met our inclusions and quality criteria by year. Indicators were available depending on the data sources' frequency and regarding those frequencies in each data source or only captured in one data source (e.g., second-hand smoking).

Figure 1 shows the distribution of smoking from Belgian surveys. There is overall a downward trend in daily smoking (Figure 1 A) and a concomitant rise in people reporting never smoking (Figure 1 C). Former smokers and occasional smokers have a more stable pattern with some heterogeneity across surveys.



**Figure 1. Prevalence of daily smokers, occasional smokers, ex-smokers, and never smokers from 1997 to 2021 according to different sources.** Abbreviations: EB: Eurobarometer; FCC: Fondation contre le cancer; FL: HBSC/Flanders; FWB: HBSC/Fédération Wallonie-Bruxelles; HIS: health interview survey

**Table 4. Availability of data on self-reported tobacco use per year**

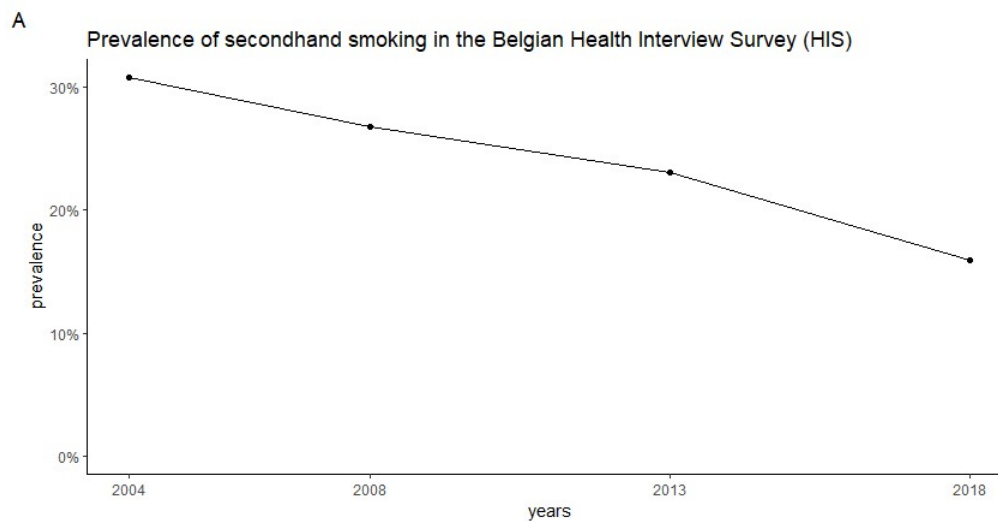
Data source	Indicator	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	
HIS	Smoking status (Current – Former – Never)	x				x			x				x					x					x				
FCC																	x	x	x	x	x	x	x	x	x	x	x
EB							x				x	x		x	x			x					x				
HBSC/FWB*			x				x									x				x				x			
HBSC/FL								x								x				x				x			
HIS	Smoking status stratified by gender/age	x				x			x				x					x					x				
FCC																	x	x	x	x	x	x	x	x	x	x	x
EB**							x				x	x		x	x			x					x			x	
HBSC/FWB*								x								x				x				x			
HBSC/FL									x							x				x				x			
HIS	Number of cigarettes smoked/day								x				x					x					x				
FCC																	x	x	x	x	x	x	x	x	x	x	
EB**								x			x			x				x					x			x	
HBSC/FWB									x							x				x				x			
HBSC/FL																x											
HIS	Second-hand smoking								x				x					x					x				
FCC																											
EB														x	x				x				x				
HBSC/FWB																											
HBSC/FL																											

Abbreviations: EB: Eurobarometer; FCC: Fondation contre le cancer; FL: Flanders; FWB: Fédération Wallonie-Bruxelles; HBSC: Health behaviour in school-aged children study; HIS: health interview survey

\*Not for every smoking status

\*\*Not at regional level

Secondhand or passive smoking was only assessed in the HIS by looking at the proportion of households with daily exposure to smoking indoors, and shows a similar downward trend. This is consistent with the decrease in daily smoking seen across the surveys.



**Figure 2. Prevalence of secondhand smoking in Belgium from 2004 to 2018 according to the Belgian health interview survey**

### 3.4 DISCUSSION OF DIFFERENT SURVEY-DERIVED DATA SOURCES

Mapping existing sources gave us insights into the availability of data for most of the past 20 years in Belgium for tobacco consumption in Belgium. We found that those sources use different methodologies, and have different findings regarding the same variables with sometimes different prevalence estimates for the same year. This difference can in part be explained in the paper of Bogdanovica et al. (2011) stating that national surveys use a larger sample size, different phrasing in the questions, frequency, and methodological differences when studying the population health and smoking status.

Another example was found between the HIS and FCC survey is the prevalence of daily smoking is increasing in the FCC survey but decreasing in the HIS for the year 2018.

Which figures then provide an accurate representation of the smoking behavior situation? It is important to note that the percentages reported by the FCC approach differ significantly from those obtained by the HIS and the alleged evolution of smoking behavior also shows discrepancies (HIS: decrease, FCC: stable).

This difference may have something to do with the sampling strategies for each survey. While the approach is similar at the point of sampling, the sampling frame (or where the sample is drawn from) is not explained by the FCC and may be inadvertently biased, potentially selecting from people who smoke and are therefore more likely to engage in a survey about tobacco. Without more detail on this strategy, it is not clear what may lead to the differences.

Similarly, the Eurobarometer data is higher and follows more closely that of the FCC sample. This, again, may be a result of the sampling frame which we know comes from the NUTS categories in the population, but for which we do not have further details. Despite these differences, there is general agreement in the overall trends across the surveys, showing a downward trajectory for daily smoking across Belgium.

## 4. Tobacco sales data

Indirect methods, such as monitoring sales, packaging, tax signs, and discarded cigarette butts, can contribute to enhancing our comprehension of tobacco usage among the population in Belgium. These alternative data sources can also offer insights into the number of people using tobacco products. We identified one data source based on expert opinion and one data source based on an internet search:

- FPS Finance data on tobacco sales and labelling
- The Center for Consumer Research and Information (CRIOC)

### 4.1 TOBACCO SALES DATA SOURCES

#### 4.1.1 FPS Finance sales data

Sales data collected by the FPS Finance includes the following indicators:

- Government tax revenues from manufactured tobacco products (cigarettes, cigars, and manufactured tobacco) from 1980 to 2021.
- Excise duties on manufactured tobacco products (cigarettes, cigars, and manufactured tobacco) from 1980 to 2021, represented in millions of euros.
- Government tax signs from manufactured tobacco products (cigarettes, cigars, and manufactured tobacco) in Belgium from 1980 to 2021.
- The evolution of tobacco product sales (cigarettes, cigars, and manufactured tobacco) in Belgium from 1980 to 2021.

These data points were available annually and covered the country at a national level. Data were collected by monitoring and tracking imports and exports from customs.

Monitoring of tobacco consumption using sales data has been ongoing in Belgium since 2019 as part of the track and trace.

#### *Appraisal*

Data from the FPS Finance are nationally representative and a useful complement to survey-derived tobacco use data. The findings reinforce the trends seen in the self-reported data. The data are also collected on an annual basis which makes it possible to see fluctuations in sales and track more closely the impact of policies in the short term. This is currently not possible with survey-derived data sources. However, the data include a lot of variability which makes it difficult to connect to individual behaviour of people on tobacco use. It is thus not useful for the estimation of disease burden but can help to describe the supply side of tobacco over time.

Although the data offer insights into tobacco product sales in Belgium, it lacks breakdowns by age, region, or sex. Additionally, the FPS Finance data does not take into account illicit or

cross-border purchases of tobacco products and underage purchases which can lead to an underestimation of the sales (Reid & Robinson, 2017).

#### **4.1.2 The Center for Consumer Research and Information (CRIOC)**

The Center for Consumer Research and Information (CRIOC) was a public interest foundation established to safeguard consumer interests and provide vital consumer protection information related to various forms of consumption (Centre de recherche et d'information des organisations de consommateurs (CRIOC), 2011). The report compiled by CRIOC includes valuable insights into various aspects of tobacco sales in Belgium, comprising the following:

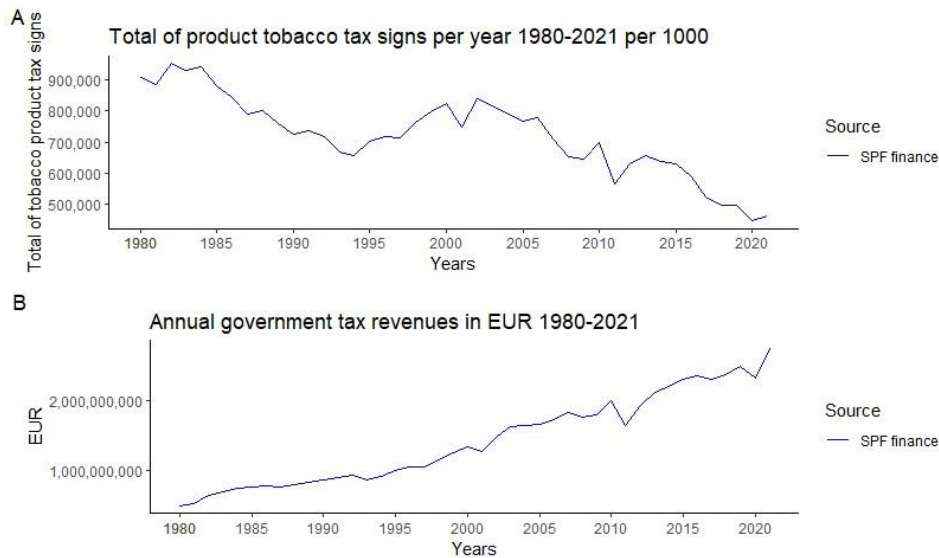
- The number of regular smokers in Belgium, both nationally and regionally, from 1980 to 2009.
- Government tax revenues generated from tobacco products in Belgium from 1980 to 2009.
- Evolution of tobacco product sales in Belgium from 1980 to 2009 using SPF Finance data

However, it is important to note that data on tobacco use, which was derived from surveys conducted by the former institute, will not be displayed in our report due to the lack of information on the sampling methodology in those surveys. While CRIOC data will not undergo critical appraisal, the information gathered in the report helps to validate trends in tobacco use and supply.

## **4.2 TRENDS IN TOBACCO SALES**

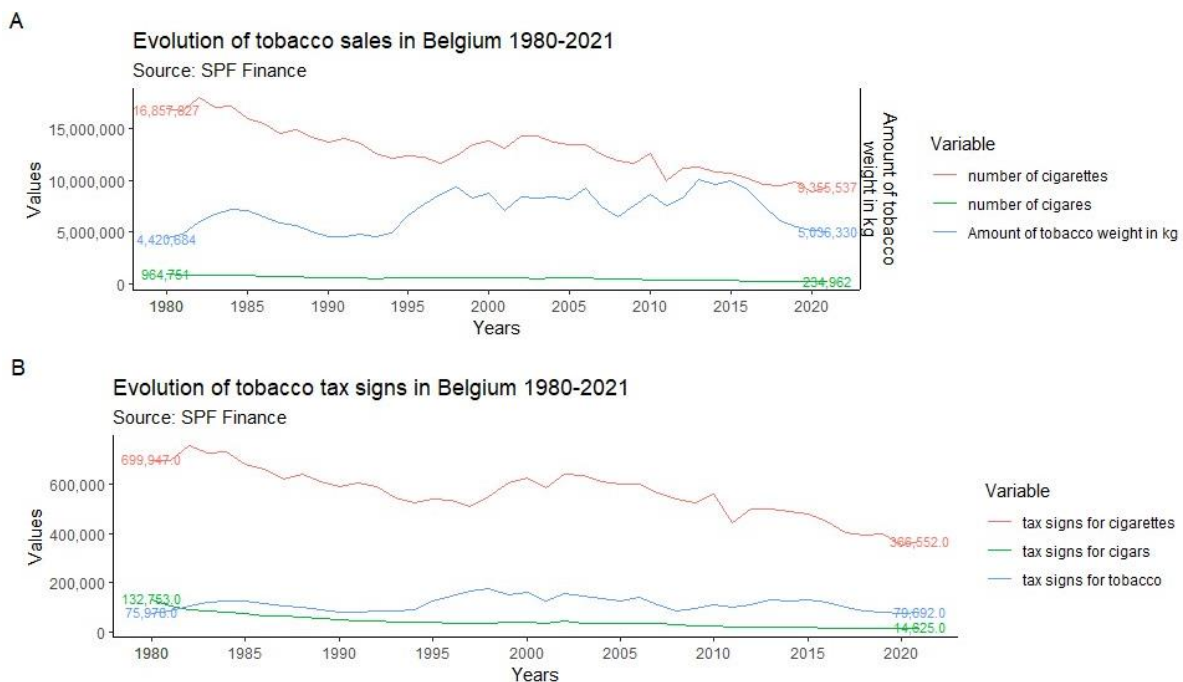
Figure 3 highlights the trend in the yearly count of tobacco tax signs and government tax revenues from 1980 to 2021. Over this period, as the number of tobacco tax signs declines, annual government tax revenues rise steadily, reaching their peak in 2021. The declining tax signs reflects an overall decrease in tobacco use seen in the survey-derived data sources. Tobacco tax signs can then be an indirect method to have an understanding of the consumption in Belgium using sales data. They are interesting as they indicate that taxes have been paid on tobacco products for a certain period (Cour des comptes, 2015). Overall, sales data follow the same decreasing trend as consumption data. The increases in tax revenues can reflect increases in the cost-per-package applied to tobacco products.





**Figure 3. Total of tobacco tax signs and annual government tax revenues in EUR from 1980 to 2021**

Figure 4 illustrates the sales trends of tobacco products in Belgium spanning four decades, from 1980 to 2021. The graph offers insights into the fluctuations in sales figures for different tobacco products over time, with each product depicted in a specific color and labeled in the legend. Changes in sales could be linked to regulation actions, shifts in consumer behavior, or economic influences. The variations in the lines indicate periods of growth, decline, or stability in the sales of specific tobacco products. Growth can be explained by cross-border purchases as the price of cigarettes and rolled tobacco in Belgium was low compared to other countries at the beginning of the year 2000 (Centre de recherche et d'information des organisations de consommateurs (CRIOC), 2010).



**Figure 4. Total of tobacco tax signs and annual government tax revenues in EUR from 1980 to 2021**

The decrease in cigarettes sold over time can be attributed to several policy interventions: smoking banned in restaurants, café and hotels (2007), price increase for packs of cigarettes and roll-your-own tobacco, smoking banned in the car with a minor present in the car (2014), increasing the minimum age of purchasing tobacco products (2016), standardize packaging (2017) (Cellule Général de Politique de Drogues, 2022).

The global financial crisis of 2008 might have impacted consumer spending behaviours, leading some individuals to cut down on non-essential expenses, including tobacco products, and can explain the decrease that can be seen in Figure 4 (Dom et al., 2016). An increase in Roll-Your-Own Tobacco sales over time may have led to some smokers switching from cigarettes to this option due to its relatively lower cost compared to cigarettes (Centre de recherche et d'information des organisations de consommateurs (CRIOC), 2010).

## 5. Summary and conclusion

A number of data sources exist over at least 25 years assessing the self-reported use of tobacco and for 40 years on tobacco sales data. Together, these data paint a picture of a declining use of tobacco in Belgium with some fluctuation but reflective of an effort through policy and prevention to reduce that use. These data sources each have their strengths and limitations. For the purposes of the SUBOD project, we must select a data source (or data sources) that can help to provide a nationally representative sample of tobacco use including breakdowns by age, region, and sex for as many years as possible and with a high level of methodological quality and integrity. This source underpins the calculation of attributable burden of disease which requires an estimation of the exposure in the population.

After considering the sources included in this appraisal, the SUBOD study will base its estimates on the Belgian Health Interview Survey (HIS) which provides the most complete and consistent assessment of tobacco use in Belgium and includes the necessary variables to support calculations (number of smokers, former smokers, and never smokers; cigarettes per day; pack-years; time since quitting for former smokers). The HIS is not without its limitations. The frequency of every five years means it lacks the detailed fluctuation of year-to-year smoking patterns that may arise from policy changes. In addition, survey data often face limitations such as low response rates and selection bias leading to underestimation of substance use (Rehm et al., 2021). In an ideal situation, an annual population-based nationally representative survey would capture the necessary surveillance on these trends. In addition, the HIS has the level of aggregation necessary to perform the analyses at the level of detail that would support integration into the National Belgian Burden of Disease study.

No adjustment of consumption data using sales data will be made. In addition, we are exploring the attributable burden of secondhand smoke for which exposure data are available in the HIS and the potential impact of underreporting for certain populations using cotinine and hydroxycotinine in urine samples of the Health Examination Survey (a subsample of the HIS) (Nguyen et al., 2020) to get a more complete vision on tobacco use in Belgium.

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