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BELGIAN NATIONAL BURDEN OF DISEASE STUDY

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

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Sponsors

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ABBREVIATIONS

AB	Attributable burden
AFF	Alcohol attributable fraction
APC	Alcohol per capita
BOD	Burden of Disease
BEBOD	The Belgian National Burden of Disease Study
COD	Cause of Death
CRA	Comparative risk assessment
DALY	Disability-adjusted life year
EB	The Eurobarometer survey on public opinions in the European Union
EU	European Union
GBD	Global Burden of Disease
GHO	The Global Health Observatory
HIS	The Belgian Health Interview Survey
HBSC	Health Behaviour in School-aged Children study
NCD	Non-communicable disease
PAF	Population attributable fraction
RR	Relative risk
TMRED	Theoretical minimum risk exposure distribution
WHO	World Health Organization

CONTENTS

1. Introduction

In 2016, 2.3 billion people worldwide were reported drinking alcohol in the previous 12 months (WHO, 2018) and the consumption of alcohol contributed to 3 million deaths and 131 million Disability Adjusted Life-Years (DALYs). In the Global Burden of Disease Study of 2019 (Murray et al., 2020) alcohol use is described as one of the top fifteen primary risk factors contributing to premature mortality and poor health globally for both women and men. This places alcohol high on the agenda of global public health concerns, as emphasized by (Anderson et al., 2012) and (WHO, 2018).

In Europe, alcohol consumption is the highest in the world. In 2009, the average alcohol consumption among adults aged 15 and over was 12.5 liters of pure alcohol per year, more than double the global average (Anderson et al., 2012). Alcohol use increases a person's risk for non-communicable diseases such as cancers, cardiovascular diseases, liver diseases also infectious diseases such as HIV/AIDS, tuberculosis, and pneumonia. Alcohol consumption can also lead to intentional and unintentional injuries (Anderson et al., 2012; Bryazka et al., 2022; WHO, 2018), which presents a health risk to both those consuming alcohol and those around them (Connor et al., 2015).

The relationship between alcohol use and health can be controversial since alcohol is commonly part of the social landscape and events (Gisle et al., 2018; Rehm et al., 2009; WHO, 2018). In this context, it might be easy to overlook the physical, mental, social, and economic burden of alcohol use or misuse (Gisle et al., 2018; WHO, 2018).

The health impacts linked to alcohol consumption can be acute or chronic. Intoxication, injuries, self-harm, and unintentional injuries will arise from the acute effects, while health and social effects will arise from a long-lasting consumption of multiple episodes of heavy drinking. Alcohol use leads to an increased risk of certain conditions, both in the short term and over an extended period. These effects are cumulative, meaning they accumulate or build up over time (Connor et al., 2015; Kraus et al., 2015).

Alcohol also has a great social and economic burden (Anderson et al., 2012; Connor et al., 2015; WHO, 2018). The consequences of alcohol consumption are not equal across societies and lead to a greater risk of harm among people in socially disadvantaged circumstances (Anderson et al., 2012). In addition, the detrimental use of alcohol significantly affects the economic well-being of society. This includes the allocation of resources towards social policies for the unemployed and providing benefits, as well as increased healthcare expenditures due to alcohol-related deaths and diseases. Moreover, the habit of heavy

drinking resulting in absenteeism leads to a loss of productivity (Anderson et al., 2012; WHO, 2018).

In Belgium, the excessive consumption of alcohol remains a major public health concern, surpassing the average levels seen across the European Union (EU) (OECD, 2019, 2021). This issue can be attributed to the ineffectiveness of public health policies designed to reduce alcohol consumption, as indicated by OECD reports in 2019 and 2021 (OECD, 2019, 2021).

Looking back to 2014, Belgium ranked second in terms of alcohol consumption among European Union countries, coming after Lithuania. Belgian adults consumed 12.6 litres of alcohol per person, exceeding the EU average of 9.9 litres (OECD, 2017). Unlike most EU nations, Belgium has seen a steady rise in overall alcohol consumption since 2000, although a slight decrease has been observed more recently, according to OECD's 2017 reports.

1.1 ESTIMATING ALCOHOL ATTRIBUTABLE BURDEN

For the past years, many global initiatives have been taken to reduce the use of alcohol but have failed to achieve substantial reductions (Shield et al., 2020). The “Improved and routine monitoring of the burden and the cost of substance use (SUBOD)” project aims to quantify the disease burden attributable to tobacco and alcohol use in Belgium and integrate these findings into the Belgian National Burden of Disease Study (BeBOD) project to support regular surveillance and monitoring. In the context of the Health for All policy framework and the Interfederal Strategy on the harmful use of alcohol, this report aims to provide direct support for those policies by observing the trend and evolution of alcohol use in Belgium and by mapping the currently available data for various subgroups.

This report will describe the patterns of alcohol consumption by critically appraising the past and current evolution of alcohol use and sales across various data sources from 1997 to 2020. This appraisal will help to establish the most appropriate data sources for understanding alcohol use in order to produce estimates of burden that can be integrated in the BeBOD study. The attributable disease burden of alcohol use will be assessed by using the Comparative Risk Assessment methodology (CRA). This method is a framework of risks or causes that contribute to certain health outcomes or diseases that seeks to evaluate and quantify the changes in the Burden of disease (BOD) related to a specific risk factor, (e.g. alcohol use). The purpose is to compare the population of exposure or the selected risk factor to a theoretical minimum risk exposure distribution (TMRED) (e.g. no alcohol use). This implies minimum health loss. CRA allows for estimating the population-attributable fractions (PAF) or the fraction of disease that is attributable to exposure (Plass et al., 2022).

1.2 EXISTING BURDEN OF DISEASE STUDIES INCLUDING ALCOHOL

Burden of disease study (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 exposure indicators are essential as they provide information on the exposure that increases the risk of developing a certain disease that will be needed further in the PAF calculation. 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 alcohol use indicators found in other burden of disease studies

Indicator	Definition	Burden of Disease Study
Current drinkers	Proportion of individuals who have consumed at least one alcoholic beverage (or some approximation) in 12 months.	Global Burden of Disease Study 2016, 2019 Australian Burden of Disease Study 2011, 2015 Scotland Burden of Disease Study 2018 Public Health England 2020
Lifetime abstainers	Proportion of individuals who have never consumed an alcoholic beverage.	Global Burden of Disease Study 2016 Public Health England 2020 Australian Burden of Disease Study 2011 Scotland Burden of Disease Study 2018
Former drinkers	Person who is not a current drinker but who has drunk alcohol in the past.	Public Health England 2020 Australian Burden of Disease Study 2015 Scotland Burden of Disease Study 2018
Binge drinkers	Drinking more than eight units for men and more than six units for women on a single drinking occasion	Public Health England 2020
Alcohol consumption (in grams per day)	Grams of alcohol consumed by current drinkers, per day, over 12 months.	Global Burden of Disease Study 2016, 2019 Public Health England 2020 Australian Burden of Disease Study 2011, 2015 Scotland Burden of Disease 2018
Alcohol litres per capita	Defined in litres per capita of pure alcohol, over a 12-month period.	Global Burden of Disease Study 2016 Scotland Burden of Disease Study 2018 Public Health England 2020
Number of tourists within a location	Defined as the total amount of visitors to a location within a 12-month period.	Global Burden of Disease Study 2016, 2019
Unrecorded alcohol stock	Defined as a percentage of the total alcohol stock produced outside established markets.	Global Burden of Disease Study 2016, 2019
Tourists' duration of stay	Defined as the number of days resided in a hosting country.	Global Burden of Disease Study 2016, 2019

1.2.1 Global Burden of Disease Study

The Global Burden of Disease (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 a wide range of risk factors. The latest GBD study that estimated the attributable burden of alcohol use was published in 2019. Data on alcohol use were gathered from self-reported surveys from 204 countries. The self-reported data were corrected for underestimation using estimates of sales of alcohol in litre per capita (GBD 2019 Risk Factors Collaborators, 2020; Griswold et al., 2018). The inclusion criteria for including studies were the following: "*to report a categorical or continuous dose for alcohol consumption, as well as uncertainty measures for their outcomes, and the population under study was representative*" (GBD 2019 Risk Factors Collaborators, 2020; Griswold et al., 2018). The exposure indicators included are drinking category (current, abstainers), alcohol consumption in grams/day, alcohol litres per capita stock, number of tourists within a location, unrecorded alcohol stock, tourists' duration of stay. Note that the GBD study does not account for the increased risk to disease for former drinkers (Shield et al., 2020).

1.2.2 Public Health England

Public Health England has been calculating Alcohol Attributable Fraction (AAF) since 2008. The latest report was published in 2020. The authors use exposure estimates from the Health Survey for England conducted in 2016 and corrected under-reporting survey data with sales data (Jaccard et al., 2020). The methodology for relative risk (RR) is based on the work of Jones & Bellis. (2017) that comprises 20 meta-analyses studying the relationship between alcohol use and chronic conditions and the risk of injury (acute conditions). For this update, Jaccard et al. (2020) used the previous work of Jones & Bellis. (2017) but conducted a new systematic search to identify new sources on the subject. The AAF was calculated for chronic diseases and acute conditions separately, using two different equations for each. The indicators used for chronic conditions were: Current drinkers, former drinkers, lifetime abstainers, and alcohol consumption in grams/day. The indicators for acute conditions were: binge drinkers (6 or more drinks in one sitting in a month).

1.2.3 Scottish Burden of Disease Study

In 2018, the Scottish Burden of Disease (SBoD) study team published comprehensive estimates of hospital admissions, deaths, and the overall burden of disease attributable to alcohol consumption in Scotland. The study uses exposure estimates from the National Health Interview Survey and corrected for under-reporting using sales data. The indicators for exposure data are presented and defined in Table 1. A total of 61 conditions were included in the study. The findings are coming from a review of the strength of causality engaged by Public Health England in their on the alcohol-attributable burden of disease in England (2013) (The

Scottish Public Health Observatory, 2018). The Relative risks (RR) derived from the work of Public Health England on Alcohol-attributable fractions for England. The RR were stratified for chronic diseases and acute conditions. Self-reported data from the Scottish Health Interview Survey were adjusted with alcohol sales to acknowledge the under-reporting of alcohol consumption in the survey (The Scottish Public Health Observatory, 2018). The indicators used were: current drinkers, lifetime abstainers, consumption in grams/day, and former drinkers.

In 2022, Scotland used the INTERMAHP (The International Model of Alcohol Harms and Policies) tool to estimate the attributable burden of alcohol use and evaluate the impact of alcohol minimum unit pricing (MUP) on deaths and hospital admissions in Scotland (Wyper et al., 2022). The tool aims to assess the impact of alcohol consumption on public health and to evaluate the effectiveness of alcohol-related policies. InterMAHP empowers users to calculate AAFs for all alcohol-related conditions identified by the model, employing internationally standardized and documented techniques. The tool comes with default assumptions, such as predefined risk curves and factors applied to per capita consumption. Researchers, going through the step-wise process, can easily customize it to align with their specific regions, whether on a national, provincial, state, or city level (Sherk & Dorocicz, n.d.).

1.2.4 Australian Burden of Disease Study

Finally, the Australian Burden of Study assessed the impact of alcohol use on the burden of disease in Australia in 2011. The report was published in 2018 using exposure data of alcohol consumption in Australia from their national health survey NDSHS 2016. The self-reported data of the survey were inflated with the data of alcohol sales using the method of GBD 2013 since the amount of self-reported data does not reflect the true extent of the consumption (Australian Institute of Health and Welfare, 2019; Gao & Ogeil, 2018; Rehm, Baliunas, et al., 2010). The RR comes from the GBD 2015 and comprises 26 diseases linked with the risk factor (Gao & Ogeil, 2018). Current drinkers, lifetime abstainers, and former drinkers were used as exposure indicators for alcohol use. Another report was published in 2020 looking at data from 2015. No methodological changes were made in this period.

1.3 INDICATORS OF ALCOHOL USE

The most important indicators for assessing alcohol use and its associated burden are a categorization of alcohol consumption (current drinkers, lifetime abstainers, former drinks, etc.), and consumption of alcohol in grams per day. The latter is complicated by the fact that it is systematically underestimated (Jones & Bellis 2017). To correct for this underestimation data on sales of alcohol can be used to upshift the distribution of self-reported alcohol. In that sense, both components are essential to get an accurate picture of alcohol use.

2. Critical appraisal methodology

As mentioned above, various data sources must be included to accurately assess alcohol use. These are considered and appraised below, starting with the survey-derived self-reported estimates and then data on estimates of sales.

2.1 SEARCH STRATEGY FOR ALCOHOL USE AND SALES DATA

Data on alcohol use in Belgium were extracted from different national, and international surveys that use various and heterogeneous methodologies. 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.

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 alcohol 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 alcohol consumption (Gartner et al., 2010; Rehm, Kehoe, et al., 2010; Reid & Robinson, 2017). This under-reporting is illustrated in Figure 1 (Devaux & Sassi, 2015, p19) and can be explained by survey methodology, sampling bias, and self-reported bias (Devaux & Sassi, 2015; Kilian et al., 2020; Rehm et al., 2021). Survey data typically cover only 20% to 70% of alcohol consumption when compared to sales data (Kilian et al., 2020; World Health Organization, 2000). Triangulation methods between consumption and sales data can help account for and adjust for under-reporting (Jackson et al., 2019; Rehm et al., 2007; Rehm, Kehoe, et al., 2010). We therefore additionally searched for data on alcohol sales from any source in Belgium to be able to produce a triangulation of survey data. The data on alcohol sales were found in discussions with experts on the subject and from national data sources.

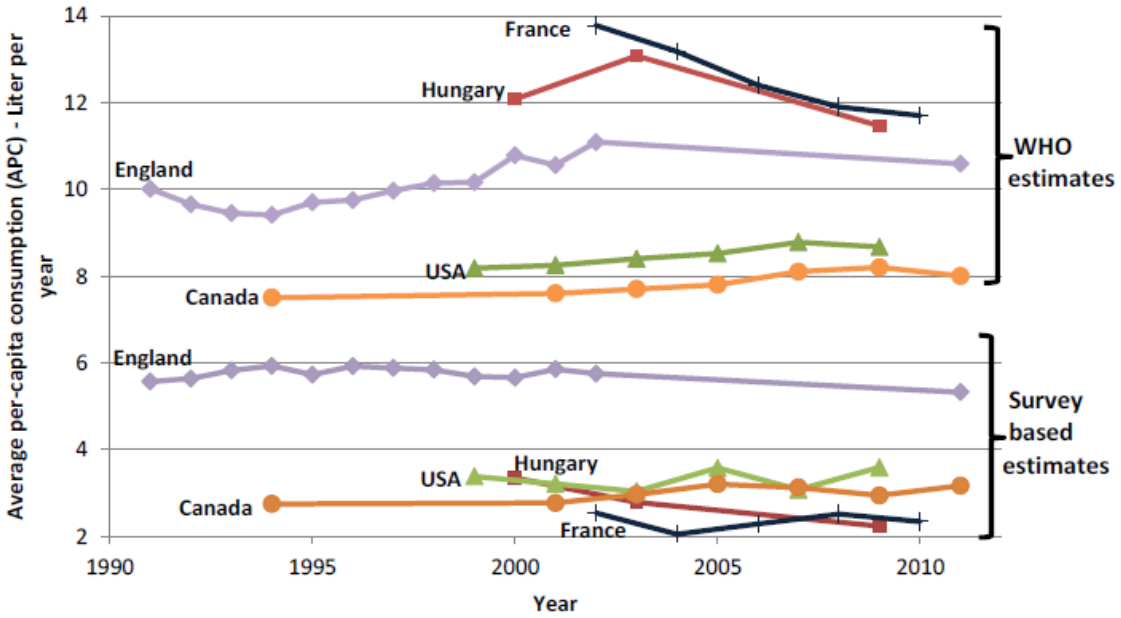

Figure 1. Comparison of WHO sales data and survey-based estimates by Devaux and Sassi (2015)

2.2 SEARCH STRATEGY FOR ESTIMATED TOTAL ALCOHOL PER CAPITA DATA (APC)

To overcome the limitations of individual survey and sales data, different initiatives seek to integrate available information and estimate total alcohol per capity (APC). Data on total APC were found in discussions with experts on the subject, from international data sources and grey literature such as the InterMAHP (The International Model of Alcohol Harms and Policies) where total APC is presented as an accurate estimate produced by the WHO, incorporating both recorded and unrecorded alcohol consumption, accounting for spillage and adjusting for tourism-related consumption in WHO member countries (Sherk & Dorocicz, n.d.).

2.3 INCLUSION CRITERIA

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

2.3.1 Quality assessment and inclusion criteria

To choose alcohol use data, we established a list of quality criteria inspired by the MORBISTAT project (Schutte et al., 2020). 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 alcohol use and sales

Quality criteria	Rationale	Assessment
Frequency	Support the development of a time series on alcohol 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 drinking 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
Frequency	Support the development of a time series on alcohol use.	Frequency of data collection and reporting

3. Alcohol use data

3.1 MAIN DATA SOURCES

We identified three main sources meeting our inclusion criteria:

- The Belgian Health Interview Survey (HIS)
- The Eurobarometer survey on public opinions in the European Union (EB)
- The Health Behaviour 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 behavioural 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 years with a new sample.

The HIS assesses a broad range of indicators for alcohol use including drinking patterns and history, intensity and volume of drinking, but also age at initiation. 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. Data on alcohol use are only collected for people ≥ 15 years, thus adolescent alcohol use is not included.

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 alcohol use. The HIS is a repeated cross-sectional survey with a sampling strategy that is consistent from one wave to the next. Some questions within the survey may change, but overall monitoring of alcohol use has remained consistent since its inception. Because the HIS has a broad focus on many aspects of health, there is no special attention paid to minimizing non-response to alcohol-related questions. This leads to some strata of the survey having more missing values than others (particularly older age groups), which may affect the validity of those estimates and lead to wide confidence intervals around point estimates. The collection of details on grams per day of alcohol consumption has changed since the beginning of the HIS and a new set of questions was included in 2008. Furthermore, data on former drinkers is only available since 2018 and no data on the amount of drinking for this group exists.

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 alcohol 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 global data. Additionally, the HIS survey includes all necessary indicators for evaluating alcohol exposure when calculating the attributable burden but not necessarily for all years of the HIS.

3.1.2 Eurobarometer

The **Eurobarometer** (EB) survey on public opinions in the European Union is also a good source of information on alcohol use. The survey was conducted for alcohol 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 computer-assisted personal interviewing (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, between different years of Eurobarometer 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 alcohol 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 alcohol use in Belgium.

3.1.3 Health Behavior in School-aged Children

The International **Health Behaviour in School-aged Children** (HBSC) study assesses the health of students from 5th primary to 6th secondary school. 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 behaviours, health status, and well-being of adolescents (Moreau et al., 2017) The study is a school-based survey, where the questionnaires are administered in class. 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 Federation Wallonie-Bruxelles (FWB) and Flanders (FL) per province, and by the network was made, then a class is randomly selected in the fifth primary grade to the sixth secondary grade to have all ages available in the sample. Those steps were used to obtain a representative sample of pupils who are enrolled full-time in Belgium (Roberts et al., 2009).

Appraisal

The HBSC surveys are part of an international collaboration and have a sound and 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 alcohol. They are conducted by the 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 alcohol use nationally. In terms of the attributable burden of disease, the risk for disease for many conditions from alcohol use begins to accumulate from around age 15, which is well beyond the age of this survey. Therefore, while it provides important information on the early adoption and use of alcohol 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 alcohol use

Criterium	Health Interview Survey	Eurobarometer	HBSC FWB	HBSC FL
Frequency	Every 4-5 years	Every 3 years	Every 4 years	Every 4 years
Date started	1997	2002	1998	1998
Bias assessment	Minimal	Likely	Minimal	Minimal
Data type	Face-to-face interviews data collected via CAPI (Computer-Assisted Personal Interviews) + self-administered questionnaires	Face-to-face interviews (data collected via CAPI)	School-based surveys, and questionnaires administered in class	School-based surveys, and questionnaires administered in class
International comparability	Yes (Standard EHIS methodology)	Yes	Yes (the HBSC study is an international survey)	Yes
Consistency over time (methodology changes YES/NO)	Collection on the amount of alcohol consumed changed in 2008; no assessment of former drinking before 2018	Changes in studied variables: larger throughout the years but overall robust and transparent methodology	No	No
Representativeness of the sample	Nationally representative stratified random sample taken from the national registry with methodology documented in scientific literature	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.
Older age groups/ Younger age groups	Yes; 15 years and up	No age breakdowns	Adolescents	Adolescents
Level of aggregation	National and Regional (province only 1997)	EU level, national (BE level)	Regional	Regional

Abbreviations: CAPI: computer-assisted personal interview; EHIS: European health interview survey; 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.

- The **EUROTOX** reports reporting tool that collects data and describes trends on substance use in Wallonia in Brussels. While the main focus is the use of illicit drugs, the report presents regular estimates and trends of alcohol use in Brussels and Wallonia using the HBSC study and the HIS survey (EUROTOX, n.d.).
- **The VAD** (Flemish Center of Expertise on alcohol, illegal drugs, psychoactive medication, gambling, and gaming) reports and factsheets combine information on substance use from various sources e.g.: surveys, a national database such as Statbel or National Bank of Belgium database) (VAD, 2021b). They provide an annual update or insight into the evolutions and trends of substance use in Flanders and Belgium presenting results regarding different subgroups: age groups, school-aged children, adults, university students, pregnant women, and workers,… to look at the comparison of how substance use consumption patterns evolves over time (VAD, 2021a, 2021b).
- **The European School Survey Project on Alcohol and Other Drugs (ESPAD)** survey collects data on Flemish teenagers aged 15-16 years old using a representative sampling design of the Flemish secondary schools to assess and monitor substance use among that specific age category (VAD, n.d.).
- **EUROSTAT** gathers information on alcohol consumption in the European Union through the **European Health Interview Survey** (EHIS). The survey occurs on average every 5 years. The results come from national surveys (HIS) as questions from the E-HIS are implemented in the national surveys (EUROSTAT, 2018). For Belgium, data on alcohol consumption is coming from the BHIS (EUROSTAT, 2018). Note that the upcoming wave of the EHIS will be conducted in 2025, independently of national surveys (EUROSTAT, n.d.)
- **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 alcohol 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 alcohol consumption in Belgium are available for the years 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 alcohol 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 ALCOHOL USE

Based on the main survey-derived data sources, we summarize the evidence on self-reported alcohol 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.

Figure 2 presents a comparison of the point estimates on self-reported alcohol use from the three different surveys. The surveys have broad agreement on the level of current drinking but only the HIS has a long enough time span to assess trends. Broadly, self-reported alcohol use has not changed in the last 25 years. Data on former drinkers and abstainers is less available. Daily drinkers also remain a smaller but persistent proportion of alcohol users.

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

Year	Indicator	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
HIS	Alcohol status (Current-Former-Abstainers)	x				x			x				x					x					x	
EB													x											
HBSC/FWB						x				x				x				x				x		
HBSC/FL																				x				
HIS	Average Number of drinks per day																x					x		
EB								x																
HBSC/FWB																								
HBSC/FL																								
HIS	Age at the start of alcohol use												x						x			x		
EB																								
HBSC/FWB												x												
HBSC/FL																								

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

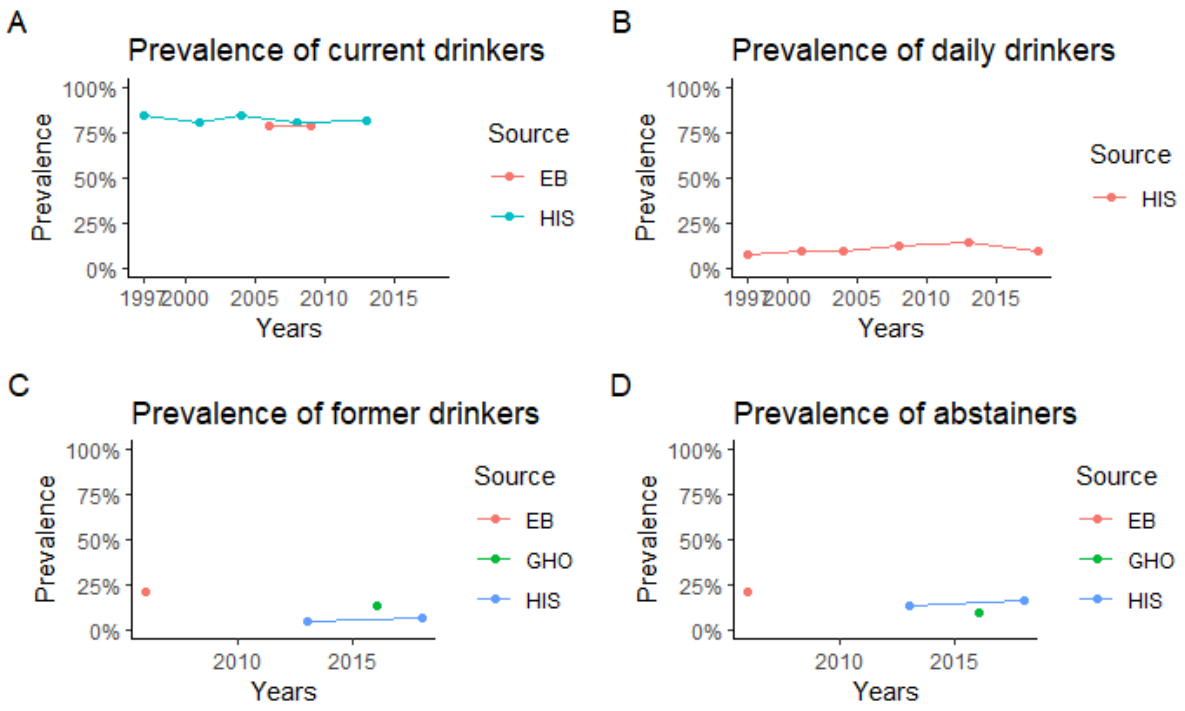

Figure 2. Prevalence of current drinkers, daily drinkers, former drinkers, and abstainers from 1997 to 2020 by sources. Abbreviations: EB: Eurobarometer; GHO: Global Heath Observatory; HIS: health interview survey

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 alcohol use. 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. Most notably, apart from the HIS, most data sources had very few years of data collection, making overall trends and differences difficult to assess. Patterns from the HIS seem to suggest a steady level of current drinking that has not changed in the last decades.

4. Alcohol sales data

4.1 MAIN DATA SOURCE

We identified one source of information on alcohol sales data in Belgium:

- Federal Public Service (FPS) Finance

4.1.1 The FPS Finance

Data collected by the FPS Finance includes the following indicator:

- The volume of pure alcohol (litres) sold in a year

These data points were available from 2008 to 2012 and 2016 to 2019 and covered the country at a national level. Data were collected by motoring and tracking imports and exports from customs.

Appraisal

Data from the FPS Finance are nationally representative and a useful complement to survey-derived alcohol use data. The data are also collected on an annual basis which allows us to observe 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.

Government statistics capture the volume of pure alcohol in litres in a given year. These data are based on sales and production records and are derived from data sources such as production, import, export, sales, or taxation records. Import and export data primarily originate from customs departments. (Rehm et al., 2007). Per capita alcohol consumption or recorded alcohol consumption can be then calculated by summing beverage-specific pure alcohol consumption (beer, wine, spirits, other) expressed in litres of pure alcohol and then divided by the population aged 15 years and above to have per capita consumption (Devaux & Sassi, 2015; Rehm et al., 2007; World Health Organization, n.d.-b).

The accuracy of government data relies heavily on the precision of sales data concerning alcoholic beverages. Relying on production data presents a limitation: it requires obtaining precise export and import figures. Inaccuracies in these numbers can lead to production figures that do not accurately present the actual situation—potentially being either underestimated or overestimated (Rehm et al., 2007; World Health Organization, 2000). Furthermore, these data might not accurately reflect consumption, as beverages bought in a specific year might not be consumed during that same year. This is especially applicable to premium products like quality wines and aged spirits, although they typically make up only a minor fraction of overall consumption. Additionally, establishments selling alcohol might

accumulate stock in anticipation of a tax increase, thereby artificially skewing the data (Kling, 1991). Furthermore, these statistics may underestimate alcohol sales by not accounting for unrecorded consumption, such as homemade production, cross-border smuggling, illegal sales, and other untaxed forms of production and consumption (Manthey et al., 2023; Rehm et al., 2007; World Health Organization, 2000). Additionally, tourist statistics are overlooked, potentially leading to an underestimation of alcohol consumption in Belgium annually. Regarding demographics, sales data do not provide information by age and sex.

4.2 TRENDS IN ALCOHOL SALES

FPS data are presented in Figure 3 and display an overall decline in the volume of pure alcohol sold in Belgium over time spanning from 2008 to 2012 and 2016 to 2018. The graph offers insights into the fluctuations in the volume of pure alcohol sold over time. Changes in sales could be linked to policy regulation, shifts in consumer behavior, or economic influences.

Figure 3: Trends of the volume of pure alcohol (litres) sold in Belgium (2008-2019)

5. Total APC

5.1 MAIN DATA SOURCE

Information regarding this estimate was found in :

- **Global Health Observatory** (GHO) dashboard.

5.1.1 The Global Health Observatory

The GHO serves as a repository and provides a global picture of several indicators useful for understanding the extent of alcohol consumption and sales in each country. Data on alcohol use are coming from national entities and are gathered in the observatory. Several indicators can be found: patterns of consumption, level of consumption (Recorded alcohol per capita consumption in litres per capita and by types of alcohol, unrecorded per capita consumption, tourist consumption), and economic indicators such as government tax revenue and excise revenue from alcohol use (World Health Organization, n.d.-a). Note that the frequency of the data depends on the indicator, not all indicators are available for more than one time point (World Health Organization, n.d.-a). Calculations are derived from national data when available. The WHO Secretariat ensures the validity of the data by compiling country profiles with all the relevant data for key indicators and validates them with countries. The data are then uploaded to the WHO GISAH (Global Information System on Alcohol and Health) and GHO (Poznyak et al., 2014).

The observatory is part of a global initiative to establish a comprehensive monitoring system on alcohol and health. This initiative aims to strengthen the connection between monitoring activities and policy development and evaluation, supporting the strategy to reduce the harmful use of alcohol (Poznyak et al., 2014).

In the dashboard, WHO presents the total APC as a variable that provides a comprehensive measure of alcohol consumed by adults (aged 15 and above) within a calendar year, expressed in liters of pure alcohol per country. This indicator integrates:

- recorded alcohol consumption data,
- unrecorded alcohol consumption,
- tourist consumption (adjusted for)

(Kilian et al., 2020; World Health Organization, n.d.-d).

- **Recorded alcohol consumption** comes from official statistics derived from data sources such as production, import, export, sales, or taxation records and is calculated by summing beverage-specific pure alcohol consumption (beer, wine, spirits, other) from various sources such as Government statistics as the primary

source. Other sources capturing those data exist namely the Food and Agriculture Organization of the United Nations (FAO), and data from the alcohol industry (Poznyak et al., 2014; Rehm et al., 2007). To convert volumes into pure alcohol litres, percentages are applied: Beer (5%), Wine (grape wine 12%, must of grape 9%, vermouth 16%), Spirits (distilled spirits 40%, spirit-like 30%), and Other (varied percentages based on beverage type) (World Health Organization, n.d.-b). To ensure a more stable country estimate, recorded data are presented as averages of previous years, (e.g. estimate for 2019 is calculated as the average of the data from 2017, 2018, and 2019) (Rehm et al., 2007; World Health Organization, n.d.-b).

- **Unrecorded alcohol consumption**, looks at alcohol that is not captured by taxation and falls outside the official governmental system (Manthey et al., 2023). The estimation of unrecorded alcohol consumption in litres of pure alcohol among individuals aged 15 and above, provided by WHO, involves determining its proportion within the total alcohol per capita consumption. This calculation is performed through a regression analysis at the country level to find the percentage of total alcohol consumption attributed to unrecorded alcohol. The analysis also incorporates various factors such as urbanization, migration rates, malnutrition, sanitation, education levels, and per capita gross domestic product adjusted for purchasing power parity (World Health Organization, n.d.-c). This approach is detailed in several studies (Manthey et al., 2023; Probst et al., n.d.).
- **Tourist consumption** considers both tourists visiting a particular country and residents of that country traveling abroad. Data for tourist consumption is obtained from United Nations tourist statistics (Kilian et al., 2020; World Health Organization, n.d.-d).

The total APC is calculated by summing these recorded and unrecorded consumption, adjusted by tourist consumption to provide a comprehensive view of alcohol consumption trends in a respective country (World Health Organization, n.d.-d).

For Belgium, total APC is calculated using the following data sources: for recorded consumption, data is sourced from World Drink Trend (WDT) for the years 1963-1999, Food and Agriculture Organization of the UN (FAO) for 2000-2007, and WHO Global Survey on Alcohol and Health for 2008-2015, along with Belgium Customs and Excise Department for 2016-2019; for unrecorded consumption, data is sourced from the WHO survey of experts; and for tourist consumption, data is sourced from UN tourist statistics for all countries. Data for Belgium are available from 2000 to 2019 by 5 years breaks.

Appraisal

Data on total APC from national entities are gathered in the observatory and are available for almost all countries. Estimates are calculated as a population-weighted average of national data. The recorded alcohol per capita consumption only takes into account the consumption that is recorded from production, import, export, and sales data often derived from taxation (Poznyak et al., 2014; Rehm et al., 2007; World Health Organization, n.d.-a). However, note that the recorded figures presented reflect multi-year averages, and the prevalence of unrecorded alcohol consumption remains inadequately understood (Manthey et al., 2023). Finally, the total APC figures provided are modeled estimates coming from various data sources, offering a synthesized perspective on alcohol consumption in Belgium. The total APC is often seen as a more accurate measure of consumption but lacks regional and demographic breakdowns (Poznyak et al., 2014).

5.2 TRENDS IN TOTAL APC

When separating by sex (Figure 4), the total APC (in litres of pure alcohol) starts notably higher at 18.1 in 2000, experiences a gradual decline, and then shows a more significant drop to 16.2 in 2019 in men. This decrease highlights a noteworthy reduction in male alcohol consumption, although it remains considerably higher than the overall and female APC. Female APC, starting at 5.2 in 2000, remained relatively stable until 2019 when it experienced a slight decrease to 4.7. Females consistently exhibit lower APC compared to males and the overall population, with a minimal decline noted in 2019.

In summary, the data reflect a slight decrease in total and male APC over the years, with a more substantial decline in male consumption leading up to 2019. Female APC remained relatively constant over the period, showing a slight reduction in 2019.

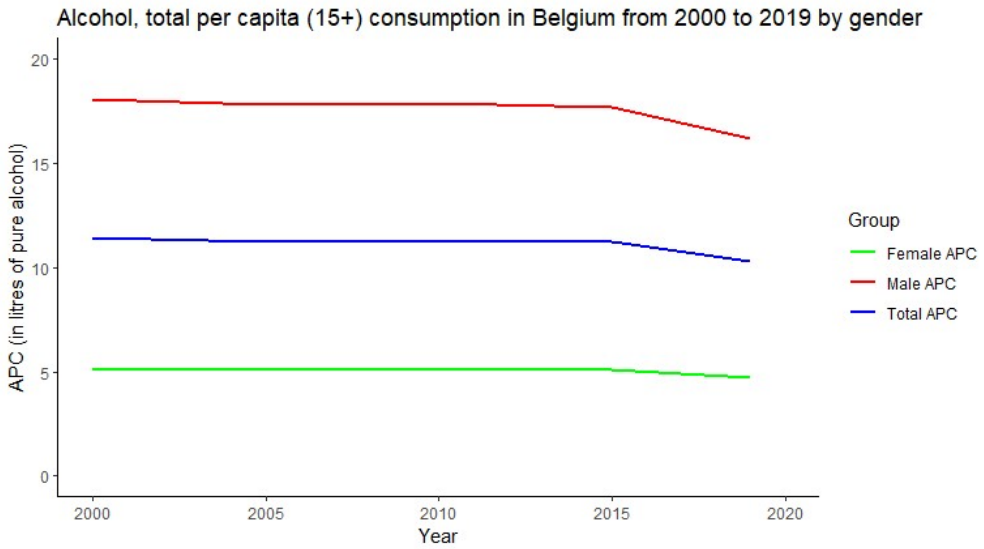

Figure 4. Alcohol, total per capita (15+) consumption (APC) (in litres of pure alcohol per year) in Belgium from 2000 to 2018 by sex (World Health Organization, n.d.-a).

6. Summary and conclusion

In order to establish a consistent time series of exposure data, having representative and transparent estimates of the burden attributable to alcohol use is crucial, especially when analyzing different demographic factors such as sex, age, and region. To achieve this, various data sources were selected in Belgium, considering their specificity and sensitivity. After critically evaluating these sources, we have identified the HIS (for drinking category prevalences) and total APC (for alcohol consumption among current drinkers) as the most suitable data sources and estimates for our project.

However, it is important to note a limitation of the chosen dataset and estimate. The HIS is conducted every five years, and some indicators are not available for every HIS wave (e.g. former drinkers) which might impact the frequency of our analysis. Additionally, survey data often face challenges such as low response rates and selection bias, the tendency for late or non-responses toward heavier drinkers (non-response bias), the methodology used by the survey to assess drinking behavior, potential non-recall bias (omission of episodes of heavy drinking), and individuals' tendency to portray themselves as moderate drinkers (Kilian et al., 2020). Knowing this, relying only on survey data would likely underestimate the burden of alcohol use. Underreporting of alcohol consumption levels in surveys is well-documented and is estimated to represent only 30-40% of actual sales (Stockwell et al., 2018). Total APC however lacks detailed breakdowns by age, sex, and region, and may underestimate actual consumption due to unaccounted illicit and cross-border purchases (Rehm et al., 2007; Rehm, Kehoe, et al., 2010). Addressing these limitations is essential to ensure the accuracy of the estimation of alcohol use and its associated burden of disease.

To address these issues, we will integrate APC with HIS data, by allocating survey distribution data (region, sex, age categories, and year) with total APC to have an adjusted consumption of alcohol. This combined approach aims to provide a comprehensive understanding of alcohol consumption burdens across various levels and is based on the work of Rehm et al. (2007).

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