Public health gains and missed opportunities.
Trends in alcohol consumption and attributable mortality in the WHO European Region, 1990-2014

Report to the WHO European Region

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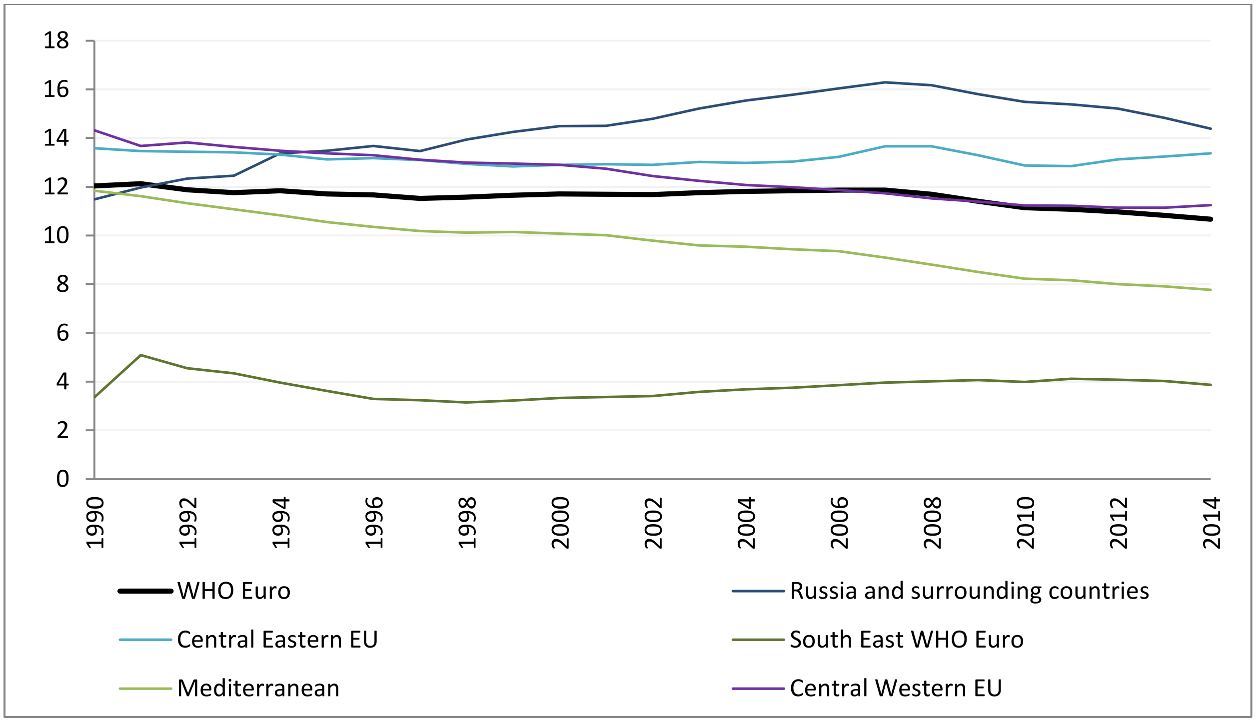
Executive summary

This report tries to contribute to a monitoring system for harmful alcohol consumption in the World Health Organization (WHO) European Region by describing the trends of alcohol consumption and attributable mortality for the time period 1990 – 2014 for all countries in the region and for the region as a whole. It is based on data from the Global Information System on Alcohol and Health and used standard methodology developed for comparative risk assessments over the last decade. While the main emphasis of the report is on the country level, trends are also reported for select sub-regions identified on the basis partly of geography and partly of drinking patterns.

There is high variability between countries of the WHO European Region, as well as within countries over time. Despite divergent trends on the country level, the WHO European Region continues to be the WHO region with the highest adult *per capita* alcohol consumption. There had been slight decreases in the consumption level of the WHO European Region between 1990 and 2014, which, combined with increases in alcohol consumption in Asia and Africa in the same time period, led to some convergence in global drinking levels.

The decrease in alcohol consumption levels in the WHO European Region has been fueled by decreases in the richest countries in the Central Western EU and Mediterranean parts of the Region (see Figure I), whereas drinking levels in the Central Eastern EU part remained stable over the past 25 years, and drinking levels in Russia and surrounding countries and in the South Eastern part of the WHO European region increased. There are indications that Russia and surrounding countries with similar drinking patterns (Belarus, Moldova, and Ukraine) have decreased their consumption levels in recent years, however (around 2007), contributing to the overall decrease in the region.

Unrecorded consumption in the WHO European Region amounted to 18.5% in the year 2012, and has proportionally been relatively stable of the 25 years analysed (1990: 20.5%). It is higher in the Eastern part of the WHO European Region, especially in Russia and surrounding countries.

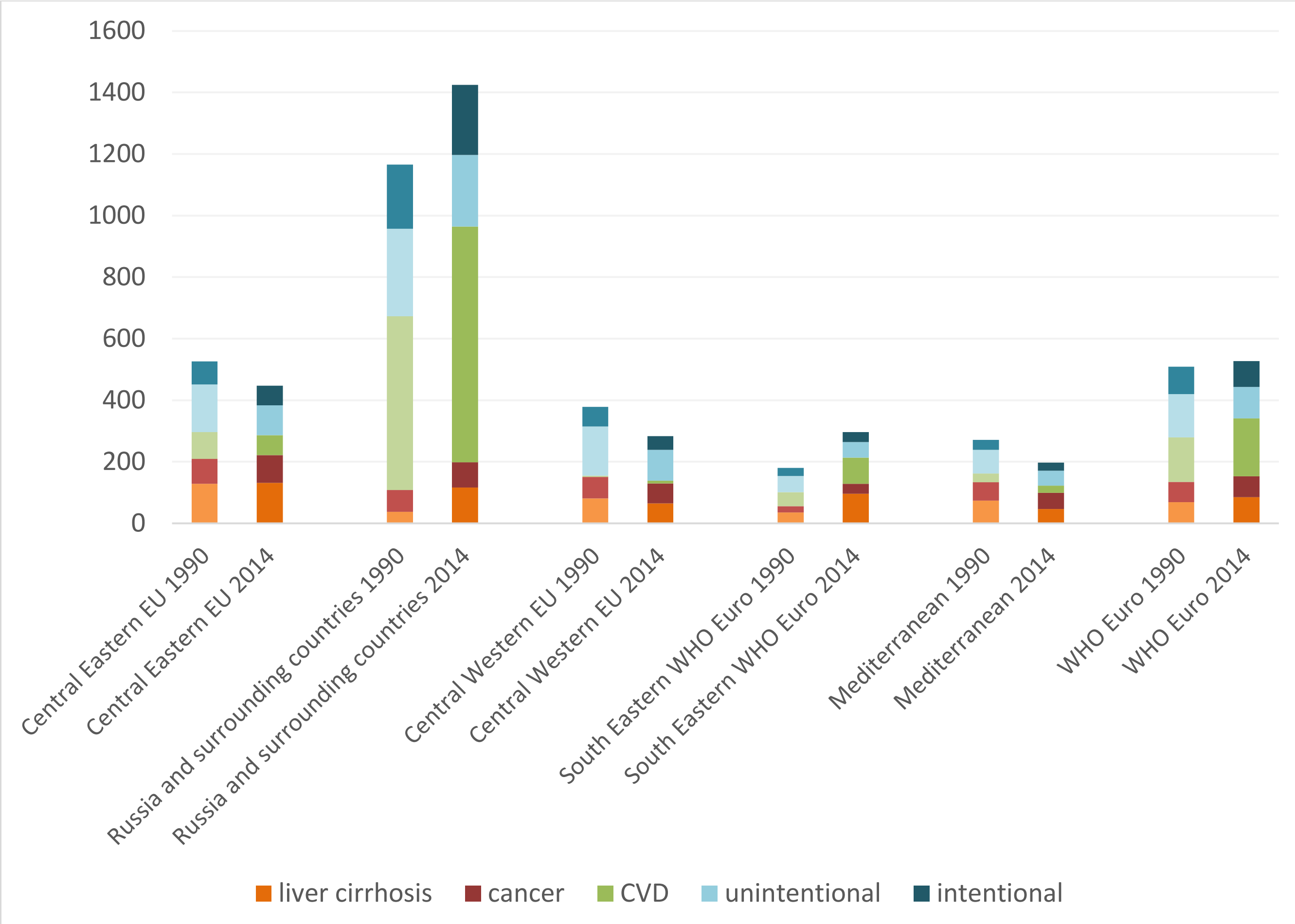


Definitions of regions see Box 2 below

Figure I: Trends in adult per capita *alcohol consumption in the WHO European Region and selected sub-regions, 1990-2014 (in litres pure alcohol per year)*

The high level of alcohol consumption in the WHO European Region led to a substantial amount of attributable mortality burden in chronic and acute causes of death, as evidenced by the burden of mortality by cardiovascular diseases, cancer, liver cirrhosis, and unintentional and intentional injury. These causes of death were selected, as they comprise more than three-fourths of all-cause mortality in WHO European Region (data for 2013), as alcohol has a causal impact, and as almost 90% of the alcohol-attributable mortality burden stems from these causes of death.

While attributable deaths in general followed the trends in average level of alcohol consumption, the overall standardized rate for alcohol-attributable mortality increased in the WHO European Region over the time period between 1990 and 2014 (+4%; see Figure II for details).



Slightly darker shades refer to 2014

Figure II: Comparisons of age-standardized alcohol-attributable mortality for major causes of death, 1990 vs. 2014, in the WHO European Region and selected sub-regions (rates per 1,000,000)

The increase in attributable mortality burden in the WHO European region was mainly fueled by the development in Russia and surrounding countries (+22%) and in the South Eastern part (+65%, albeit from a relatively small base). On the other hand, the more affluent countries decreased their alcohol-attributable morality burden, more in the Mediterranean (-27%) and the Central Western EU regions (-25%) than in the Central Eastern EU region (-15%).

The increase of alcohol-attributable mortality burden in the WHO European region despite a small decrease in overall consumption has a number of reasons:

- the exponential increase of mortality risk with increasing levels of average consumption, which led to a substantial increase in alcohol-attributable mortality, especially in the regions where already high consumption levels further increased (such as in Russia and countries with similar drinking patterns),

- the role of episodic and chronic heavy drinking occasions for cardiovascular mortality and injury, and
- the overall elevated adult mortality rate and low life-expectancy in some parts of the WHO European Region, in particular in Russia and surrounding countries.

The decrease in alcohol-attributable mortality in the Central Eastern EU countries was due to an overall decline in mortality rates in this region. Even with relatively stable alcohol-attributable fractions such a decline results in lower standardized rates.

The following conclusions can be drawn for alcohol policy: overall consumption in the WHO European Region needs to be reduced, as alcohol consumption is causally related to considerable mortality -- up to 25% of all mortality from liver cirrhosis, cancer, cardiovascular disease and injury in certain parts of the region. Currently, the average level of alcohol consumption per drinker in this region already exceeds the threshold for acceptable risk in modern societies for voluntary behaviours. Secondly, heavy drinking occasions, including episodic heavy drinking occasions, should be reduced in particular. Episodic heavy drinking occasions are an important determinant of cardiovascular disease and injuries over and above the average level of consumption.

Different policy options have been proven effective and cost-effective to reduce the level of alcohol consumption, and heavy drinking in particular. These include but are not limited to the so-called "best buys" [FN1] of increasing price via taxation (unless there is too much unrecorded consumption), restrictions of availability and ban of marketing and advertising. Unfortunately, despite the availability of effective and cost-effective policy options to reduce alcohol-attributable mortality, and despite marked decreases in several countries of the WHO European Region, which could serve as benchmarks, the overall development of alcohol-attributable mortality burden in this region cannot be seen as a public health success, as the age-standardized alcohol-attributable mortality rate in 2014 was even slightly higher than 25 years before.

This means that other policies to reduce alcohol-attributable mortality burden should be considered. Specific causes of alcohol-attributable mortality burden may be focused on, such as traffic injury via implementation and enforcement of *per se* laws on blood alcohol concentration while operating machinery. Such specialized measures seem to be better supported by the general population and politicians than omnibus measures. Finally, interventions in the health care system such as screening and brief intervention in primary health care, or treatment of alcohol use disorders have been shown to impact on alcohol-attributable mortality.

[FN1] On the definition of best buys by the World Health Organization ([1], p. 2): "Cost-effectiveness summarizes the efficiency with which an intervention produces health outcomes. A 'highly cost-effective' intervention is defined as one that generates an extra year of healthy life (equivalent to averting one disability-adjusted life year) for a cost that falls below the average annual income or gross domestic product [GDP] per person […]. A 'best buy' is a more pragmatic concept that extends beyond the economic efficiency and cost-effectiveness of an intervention. It is defined as an intervention for which there is compelling evidence that is not only highly cost-effective but is also feasible, low-cost and appropriate to implement within the constraints of the local health system."

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Alcohol as a risk factor for burden of disease

Alcohol is one of the most important risk factors for the global burden of disease[2] (for comparison with other risk factors see [3,4]). The European region has the highest level of alcohol consumption in the world, in part driven by high consumption in the Eastern part of the region.[2] Consequently, the disease burden caused by alcohol is also high in this region, in particular in the Eastern part,[2,5,6] despite the overall high life expectancy in large portions of this region.[7]

The high burden of alcohol has led to a plea for interventions globally[8] and for Europe in particular.[9,10] These intervention initiatives have also been driven by recent insights that substance use policies may be key for population health, and getting them wrong may even lead to reversals in life expectancy for large groups or for nations.[11] Public health policy planning needs to be based on empirical evidence,[12] and monitoring and surveillance of alcohol consumption and of the alcohol-attributable disease burden have been key elements both in the Global Strategy to Reduce the Harmful Use of Alcohol[8] and in the Global Action Plan for Non-communicable Diseases.[13] The Global strategy asked for monitoring of the "harmful use of alcohol," and defined this concept as broadly encompassing all drinking that causes detrimental health and social consequences for the drinker, the people around the drinker (often labelled as harm to others[14]), and society at large, and for monitoring of the patterns of drinking associated with increased risk of adverse health outcomes. More operational definitions with concrete indicators to be used in this report were given within the monitoring framework for non-communicable diseases (NCDs).[13]

The present report tries to contribute to monitoring and surveillance of alcohol-attributable harm. Specifically, it has the following objectives:

- To describe the trends of alcohol consumption and attributable mortality burden for the time period 1990 – 2014 for WHO European region;
- To describe country level trends [FN2], as health care planning and policy decision making is mainly at the country level;
- To describe trends for selected regions;
- To help establish a monitoring system for WHO European region and for countries as an evidence base for alcohol policy.

[FN2] While there had been a few country level studies,[15-17] this is the first time trends for alcohol exposure or attributable burden has been examined systematically for all countries of the WHO European region for an extended period of 25 years.

Monitoring alcohol exposure

The key indicator for monitoring harmful alcohol consumption on the country and international level is adult (defined as age 15 and over) *per capita* consumption,[18] which is a composite measure comprising mainly recorded and unrecorded consumption. Recorded consumption refers to all alcoholic beverages which are officially registered by the respective country where they are consumed, most commonly based on taxation.[18-20] Unrecorded consumption is a summary term for all non-registered products, which include the following main categories:[21,22] legal but unrecorded alcohol products (mostly homemade alcohol); alcohol products recorded outside the jurisdiction where they are consumed (cross-border shopping); surrogate alcohol (non-beverage ethanol-based alcohol products not or not officially intended for human consumption) and illegally produced or smuggled alcohol products intended for human consumption (including illegal homemade alcohol). With respect to surrogate alcohol, sometimes products may not officially be intended for human consumption, but in reality they are only declared this way to avoid higher taxation of officially declared alcoholic beverages. Ethanol-based medicinal tinctures or perfumes with fragrances in Russia would be one such example.[23,24]

Globally, unrecorded alcohol has constituted at least 20% of all alcohol consumed in the last decades, but with high variability between countries and regions, and over time.[25-27] The proportion of unrecorded to total alcohol consumption is in general associated with economic wealth: the higher the wealth of a country (e.g., as measured by its gross domestic product), the lower the proportion of unrecorded alcohol to overall consumption.[2,28] In addition to recorded and unrecorded consumption, tourist consumption is subtracted for a small number of countries where tourists consume a sizable share of the overall alcohol consumption (see[29] for definitions). For most countries, it is assumed that tourist consumption is balanced by the consumption of inhabitants while spending time outside of their country.

The objective of this chapter is to describe long-term trends of total adult *per capita* alcohol consumption [FN3] for all countries which are part of the WHO European Region from 1990 onwards. This is the earliest year for which we have systematic estimates of unrecorded consumption. In addition, we want to provide estimates of recorded versus unrecorded consumption, and estimates of average consumption per drinker. While we will include some regional trends, these will be only to illustrate trends for groups of countries with similar drinking level or drinking patterns. The main emphasis is on the country level.

Methods for estimating alcohol exposure trends

Data

We relied on the Global Information System on Alcohol and Health (GISAH)[29] for estimates of adult *per capita* consumption of alcohol, mostly derived from taxation, or production, import and export data.[18,19]

[FN3] In the remaining text, we will refer to adult *per capita* consumption or alcohol *per capita* consumption, when we refer to total consumption. Sub-categories will always be specified.

For the year 2020, adult *per capita* consumption was estimated based on regression of trends for the respective country.

Estimates of **recorded** adult *per capita* alcohol consumption exist as time series of yearly data since 1960 for all WHO member states; these data are regularly updated based on an algorithm based on the validity and reliability of sources.[18] For the year 2014, data on recorded adult *per capita* consumption for the minority of countries without data available, was estimated based on regressions of previous trends for this indicator.

For the time after 1990, there are estimates of **unrecorded consumption** for select years (1990; 2000; 2010-2014), mostly assembled by the Toronto WHO Collaborating Centre within the WHO monitoring system on alcohol led by the last author (for methodology see: [28,30,31]). The years in between the estimated years have been imputed based on linear interpolation between data points.

Box 1: On estimating the level of unrecorded alcohol consumption

This report is based on the best-available data from all sources for different categories of unrecorded consumption[22,28,30]:

- surveys (such as the STEPS survey where unrecorded alcohol is asked in the expanded alcohol module:[32];
- expert Delphi rounds;
- industry estimates; and
- research studies)

However, even based on this best available and recently increasing evidence base, the quantification of the unrecorded consumption is still fraught with difficulties and contains considerably more bias than recorded consumption.

Tourist consumption has been estimated with the algorithm developed for the Global Status Report on Alcohol and Health,[2] based on World Bank data on the annual number of tourists per country. This algorithm basically specifies that tourist consumption is only taken into account if the number of tourists exceeds the number of inhabitants, with special consideration given to the proportion of Muslims in the country.[33]

The sum of recorded, unrecorded and tourist consumption (all measured in adult – defined as age 15 years and older - *per capita* consumption of pure alcohol) yields total alcohol consumption. All trends are presented as moving three year averages to reduce some of the random yearly variation. For consumption per drinker estimate, adult *per capita* alcohol consumption data were divided by the proportion of drinkers, separate by sex. Any information on drinking by sex and age were derived from surveys, , which had been collected by the WHO Collaborating Centre[34] and which had been made publicly available via the GISAH[15] (see Web Appendix 60 for an overview of sources for surveys on drinking status).

The yearly per country population size by sex and age was taken from the United Nations population division.[35]

Countries and regions

All countries with separate estimates of recorded and unrecorded consumption over time were used: Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Malta, Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, United Kingdom, and Uzbekistan.

We also present exposure estimates for Luxembourg, but these estimates were derived via the consumption of the neighboring countries, as it is difficult to determine for this country how much alcohol is sold to people living in the country as opposed to people from surrounding countries (i.e., France and Germany), or how often inhabitants of these countries buy their alcoholic beverages in surrounding countries. The countries with consumption trends shown in Figures 1-9 below comprise all countries in the WHO European Region with the exception of the following small countries: Andorra, Monaco and San Marino.

In the observation period, there had been considerable political change, and some of the countries above achieved political independence after 1990. Usually, we present data from the year of political independence, or, in case, estimates existed for years before independence, for these years as well (for instance, for Czech Republic, we present data from 1990, even though Czechoslovakia only split up into Czech Republic and Slovakia in 1993). Any national trends of *per capita* consumption are based on three-year moving averages.

In addition to country estimates, we estimated adult *per capita* consumption for the WHO European Region as a whole and for several clusters of countries within the region (see below for definition of clusters) based on drinking style and wealth:[36] In terms of drinking style, the following traditional drinking styles can be found in the WHO European Region ([37]; for a wider discussion on the categorization of drinking patterns[38]) [FN4]: first, a drinking style with wine as the predominant alcohol beverage and frequent (daily or almost daily) alcohol consumption, mostly as part of meals. This so-called Mediterranean drinking style had been prevalent in major wine-producing countries in the Mediterranean region (such as France, Greece, Italy, Portugal and Spain[41]). In Western and Central Western Europe, there had been a drinking style with beer as the predominant alcohol beverage, and less frequent drinking as well as a higher proportion being consumed outside of meals.[2,27,37,42] In the

[FN4] Alcohol consumption has roots in the WHO European region dating back to the Neolithic age,[39] and some scholars argue that the roots for some of the traditional drinking patterns date back to antiquity.[40]

Nordic countries, as well as in many countries in Central Eastern and Eastern part of Europe, the traditional drinking style was less frequent drinking, mainly outside of meals, and spirits as the most popular beverage.[36,43] Abstention is low overall in the WHO European Region,[2] but substantial in several South Eastern and Central Asian countries with higher proportions of Muslim populations.

While the above described the traditional drinking styles, modern European drinking has been moving into more similar drinking levels and patterns for most countries, with almost no more prototypical drinking styles dominating at the population level of any country, with exception of the countries around Russia (see below; for more details on current drinking styles see[2,37,44,45]).

Based on the current drinking patterns and economic wealth of countries [FN5], the following regional clusters were separated [FN6]. Please note, that these clusters were selected as illustrations, neither intended to cover all countries in at least one cluster, nor to be disjunctive:

- **European Union (EU) countries in Central Western Europe (including Switzerland):** Austria, Belgium, Denmark, Germany, Netherlands, Switzerland.
  The countries in the Central Western European part of the EU were all categorized as high-income by the World Bank,[48] and would rank at the higher end within that category within the WHO European Region. All Central Western EU countries also had been part of this category for the whole observation period (i.e., 1990 to 2014). The drinking styles in these countries are characterized by a high proportion of beer and wine as preferred beverages, and by drinking both with and outside of meals in a relatively frequent style (see also footnote [FN6]).

[FN5] Economic wealth is related to level of alcohol consumption, but more in low and lower middle income countries.[46,47] Within the group of high income countries, indicators of economic wealth no longer have predictive value for overall level of consumption.

[FN6] For some regional comparisons we also give trends for the **European Union (EU) as a whole (2015)** comprising the following countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg (only for exposure), Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom.
The EU is mainly of interest as a political organization of high income countries, albeit with different drinking styles. Thus, in 2014, all EU countries were categorized as high-income by the World Bank,[48] and most EU countries had been part of this category for the whole observation period (i.e., 1990 to 2014). While drinking level is similar, drinking styles differ within the EU, with regard to the highest percentage of pure alcohol consumed by alcoholic beverage type.
Those countries where currently (2014) beer is the preferred beverage type are: Austria, Belgium, Czech Republic, Finland, Germany, Hungary, Ireland, Latvia, Netherlands, Poland, Romania, Spain and the UK. Countries with wine as the preferred beverage type are: Croatia, Denmark, France, Greece, Italy, Luxembourg, Malta, Portugal, Slovenia, Sweden and Switzerland. Countries where relatively the most alcohol is consumed from spirits are: Bulgaria, Cyprus, Estonia, Lithuania, and Slovakia. Please note, that for several countries, most preferred and the second most preferred beverage types had almost equal proportions. EU countries also differ with respect to drinking frequency, proportion of heavy drinking occasions and drinking with meals (more details see [2,36,37,49]).

- **EU countries from Central and Eastern Europe**: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia.
  All of these countries joined the EU since 1990, and although categorized as high income, their *per capita* gross national income is lower than in the other parts of the EU. The drinking style in most countries in this region had been traditionally characterized by a comparably high proportion of spirits consumed, with frequent episodic heavy drinking occasions for most countries. However, in 2014, only Bulgaria, Estonia, Lithuania and Slovakia had a spirits preference; and the difference to beer even in these countries was small and mostly within measurement error of standard surveys. There is still a considerable proportion of drinking occasions outside of meals.
- **Mediterranean countries**: Cyprus, France, Greece, Israel, Italy, Malta, Portugal, Spain, Turkey.
  All of these countries are high income countries. Drinking styles were at one time similar and the Mediterranean drinking style had even become a standard term for describing the predominant consumption of (moderate) amounts of wine with meals on an almost daily basis[50] (but see footnote [FN7] below). However, since 2000, there has been a shift to both beer and spirits in Cyprus, Israel, and Turkey; and to beer in Spain.[2,25,27]
- **Russia and surrounding countries with similar drinking patterns**: Russia, Belarus, Republic of Moldova, and Ukraine.
  These countries have lower *per capita* gross national income than countries in the Western parts of WHO European Region, and are in middle income categories. Their drinking style is characterized by episodic heavy drinking occasions, with both longer duration and higher volume of alcohol consumed per occasion than in other parts of the WHO European Region.[51,52]
- **Countries in the South East of the WHO European Region**: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan, and Uzbekistan.
  This part of the WHO European Region is characterized by lower than average *per capita* gross national income, relatively low level of alcohol consumption,[2] in part due to the fact, that in many countries the majority has Muslim faith,[53] and by spirits being the preferred beverage type, the latter with the exceptions of Georgia (wine) and Turkey (beer).[2]

Box 2 gives an overview of the regions used in this report:

Box 2: Regions used in this report and included countries

Central Western EU Countries	Austria, Belgium, Denmark, France, Germany, Luxembourg, Netherlands, and Switzerland
European Union (EU)	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom
EU Countries from Central & Eastern Europe	Bulgaria, Croatia, Czech Republic, Estonia, Hungary,

[FN7] Turkey and Israel had been an exception with respect to almost daily drinking.

	Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia
Mediterranean Countries	Cyprus, France, Greece, Israel, Italy, Malta, Portugal, Spain, Turkey
Russia and neighboring countries with the same drinking patterns	Russia, Belarus, Republic of Moldova, and Ukraine
Countries in the South-East of the WHO European Region	Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan, and Uzbekistan

Any regional trends are based on population-weighted three year moving averages of the respective countries (weighted by the population 15 years and older) for the year under consideration (i.e., for the year 2010, the average 2009-2011 is presented). Finally, we compared the trend in adult *per capita* consumption of the WHO European Region with other WHO regions by comparing the net difference in consumption between 1990 and 2014.

Trends for total adult *per capita* alcohol consumption for all countries in the WHO European Region

In the following, we give trends for total adult *per capita* alcohol consumption, i.e., for the sum of recorded, unrecorded and tourist consumption, for all countries in the WHO European Region, with clusters of several neighboring countries being on the same graph. For comparison purposes, each graph will contain the trend for the WHO European Region as well.

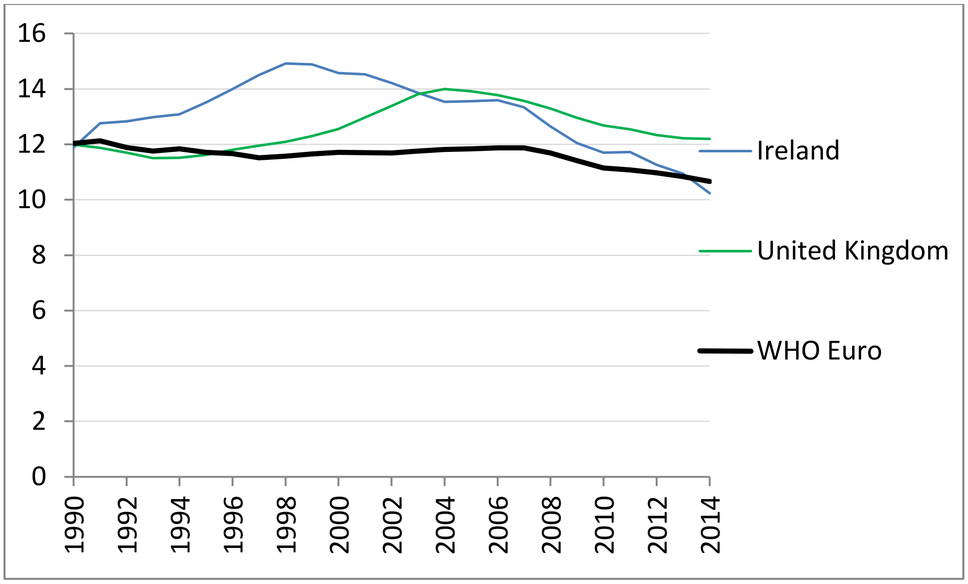


Figure 1: Trends in adult per capita *alcohol consumption for Ireland and the UK, 1990-2014 (in litres of pure alcohol per year)*

In 1990, the Western European countries of Ireland and the United Kingdom (England, Scotland, Wales and Northern Ireland) had similar consumption as the WHO Euro Region as a whole (Figure 1 [FN8]), but lower alcohol consumption than most continental EU countries. While these continental EU countries and the WHO European Region as a whole decreased alcohol consumption over the time period of 25 years, both Ireland and the UK experienced increases in consumption before decreases in consumption were observed. Currently, adult *per capita* alcohol consumption in the UK is still higher than the WHO European Region average.

[FN8] As the main purpose of the Figures on trends of adult *per capita* exposure is the comparison between neighboring countries, we use different scales in different Figures. For overall comparison within the WHO European Region, the trend line for the region as a whole is added as well.

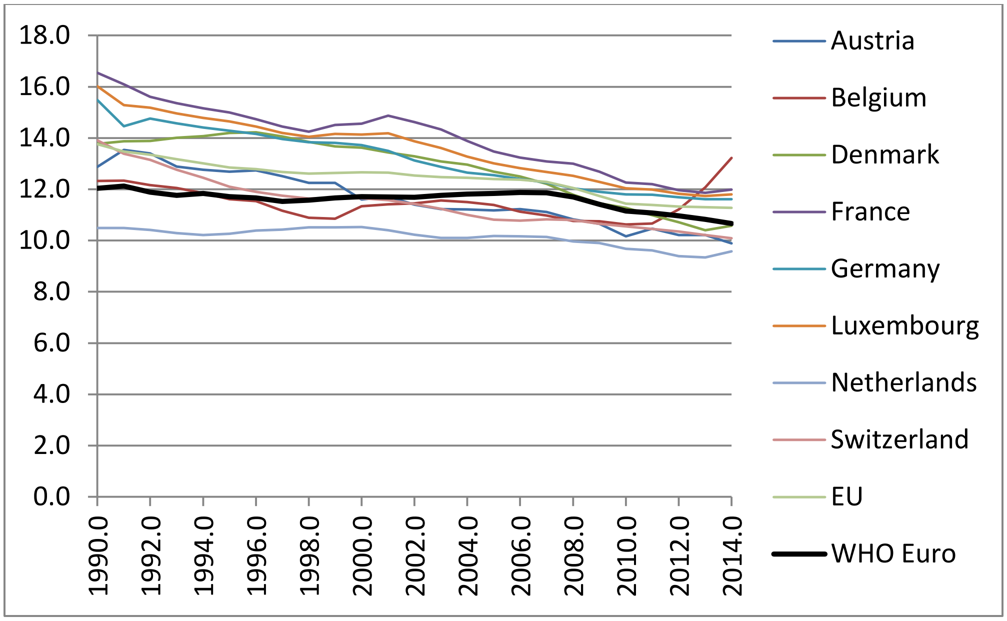


Figure 2: Trends in adult per capita *alcohol consumption for Austria, Belgium, Denmark, France, Germany, Luxembourg, Netherlands, and Switzerland, 1990-2014 (in litres of pure alcohol per year)*

Central Western European countries around Germany very much reflect the downward trend in consumption in most high income countries of the WHO European region, slightly more pronounced than the trend for the WHO European Region as a whole. The variation between the countries in this region has been relatively small.

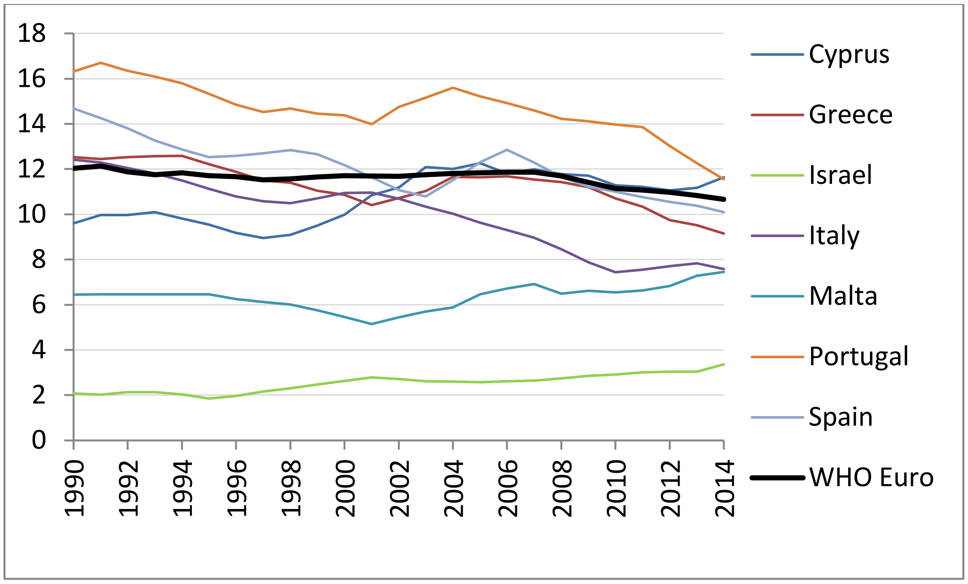


Figure 3: Trends in adult per capita *alcohol consumption for Cyprus, Greece, Israel, Italy, Malta, Portugal, and Spain, 1990-2014 (in litres of pure alcohol per year)*

Overall, alcohol consumption in the countries in the south of the WHO European Region around the Mediterranean Sea has been decreasing, especially in the largest countries of Spain and Italy (Figure 3). However, adult *per capita* alcohol consumption in the south of the WHO European Region is converging, and the countries with the historical lowest consumption have shown increasing trends (Israel, Malta), but still are markedly below other Mediterranean countries and the average for the WHO European Region as a whole.

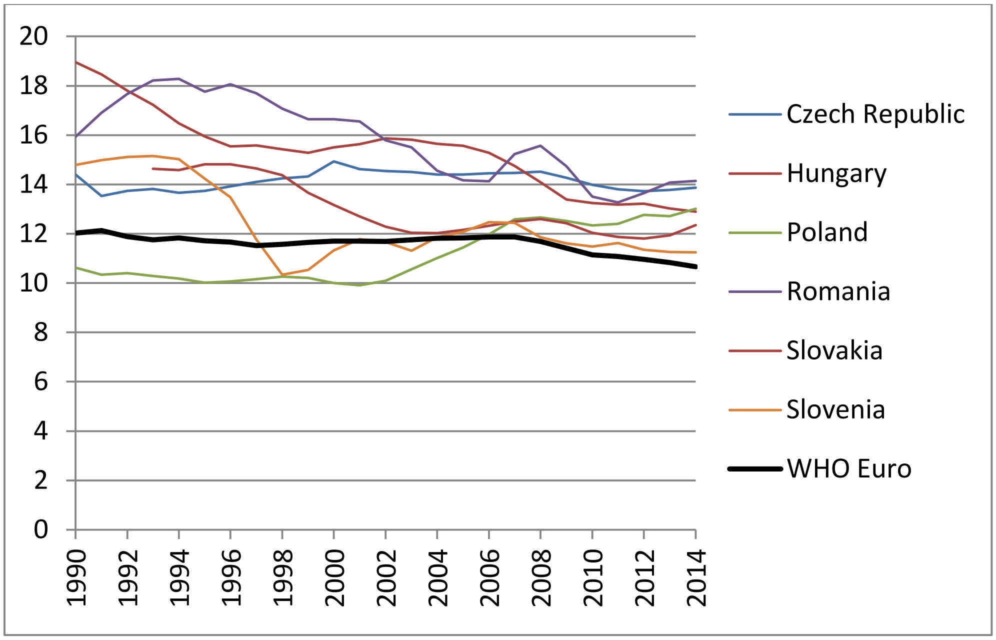


Figure 4: Trends in adult per capita *alcohol consumption for Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia, 1990-2014 (in litres of pure alcohol per year)*

In 2014, all six countries in Figure 4 consumed alcohol at a level which is higher than the WHO European Region average. Alcohol consumption in this region can also be characterized by the higher variation in consumption levels between countries and across time compared to the Central Western EU countries. However, there seems to be convergence over time with 2014 *per capita* consumption being similar for all countries.

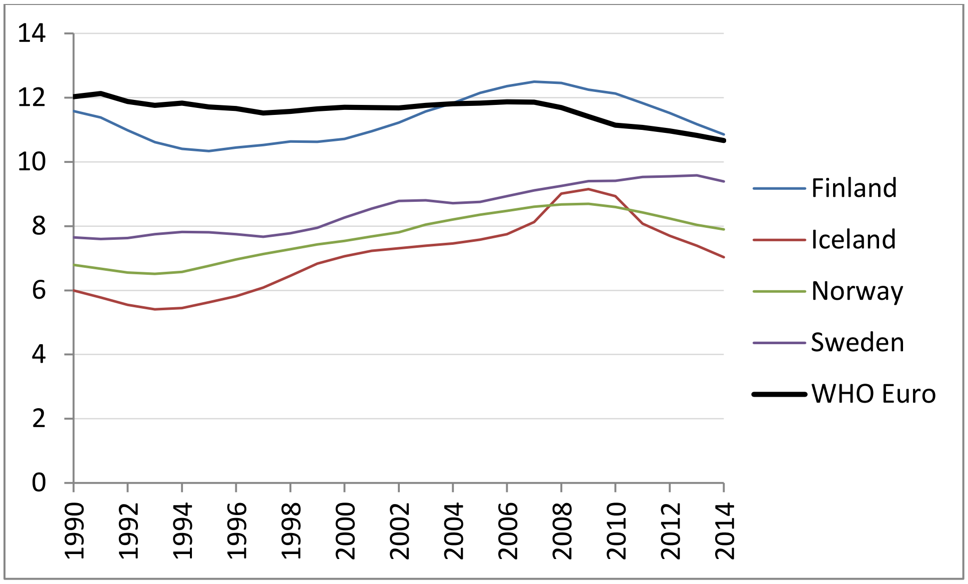


Figure 5: Trends in adult per capita *alcohol consumption for Finland, Iceland, Norway, and Sweden, 1990-2014 (in litres of pure alcohol per year)*

The Nordic countries in Figure 5 historically had been at the lower end of the alcohol consumption continuum of Europe. This changed in the 2000s, and in 2014 consumption in Finland was higher than the WHO European Region average; and the other Nordic countries had increased their consumption since 1990 as well.

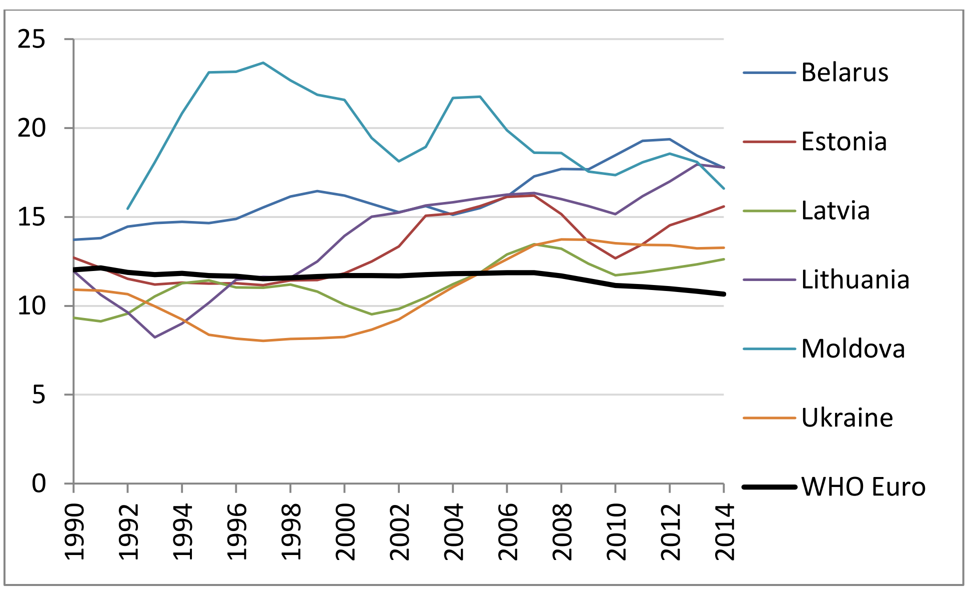


Figure 6: Trends in adult per capita *alcohol consumption for Belarus, Estonia, Latvia, Lithuania, Moldova, and Ukraine, 1990-2014 (in litres of pure alcohol per year)*

The Eastern European countries in Figure 6 had markedly higher consumption levels when compared to the WHO European Region average in 2014; however, this was not always the case. For several of these countries, in the beginning of the 1990s consumption levels were below or at the WHO European Region average. The trends in these countries also showed markedly more variation than trends for other countries in the WHO European Region.

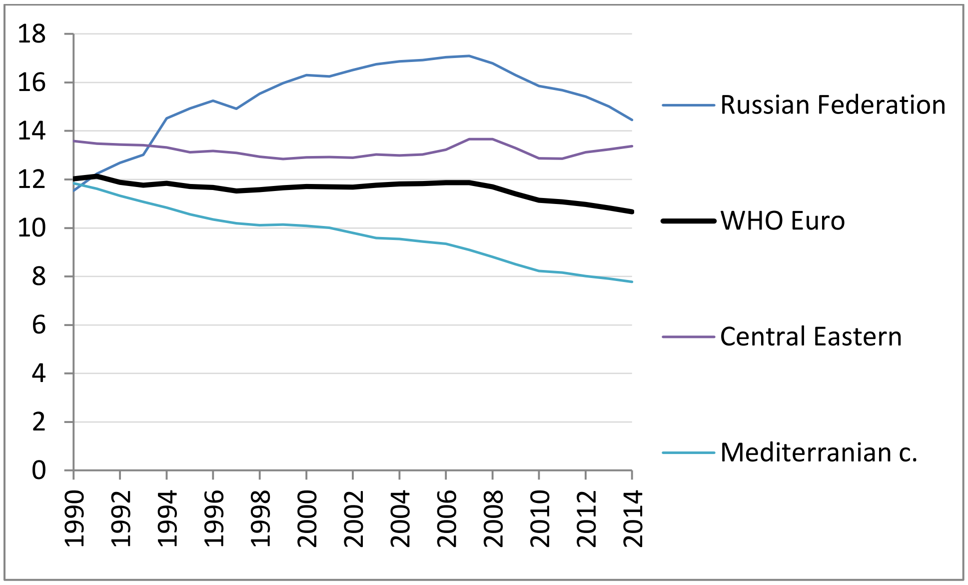


Figure 7: Trends in adult per capita *alcohol consumption for the Russian Federation with several compactor regions, 1990-2014 (in litres of pure alcohol per year)*

Russia is the most populous country in the Eastern Europe, and has a long history of heavy drinking associated with considerable alcohol-attributable harm, which persists into the present.[6,54-56] here Figure 7 shows that in the last two and a half decades, consumption levels have continued to be high (and in 2014 higher than the Central Eastern EU countries). There is good indication, however, that over the last 7 years, consumption decreased in Russia. This decrease may have been due to recent changes in alcohol policies.[57,58]

We have contrasted the trends in alcohol consumption with two more regions (for definitions see above) to illustrate how different the trends in Russia have been. In 1990, shortly after the Gorbachev-era anti-alcohol campaign that had been initiated in 1985 alcohol consumption level in Russia was relatively low, under the WHO European Region average, slightly below the average of the Mediterranean countries and markedly under the average of the Central Eastern EU countries. In the following years, consumption levels increased markedly until 2007, when the Russia population consumed more than 3 litres *per capita* pure alcohol more than Central Eastern EU countries, more than 5 litres more than the average of the WHO European region, and 8 litres more than Mediterranean countries. In 2014, the three averages came closer together, with Russia decreasing their consumption level again, but there are still marked differences, as both the WHO European Region average and the average of the Mediterranean countries decreased as well.

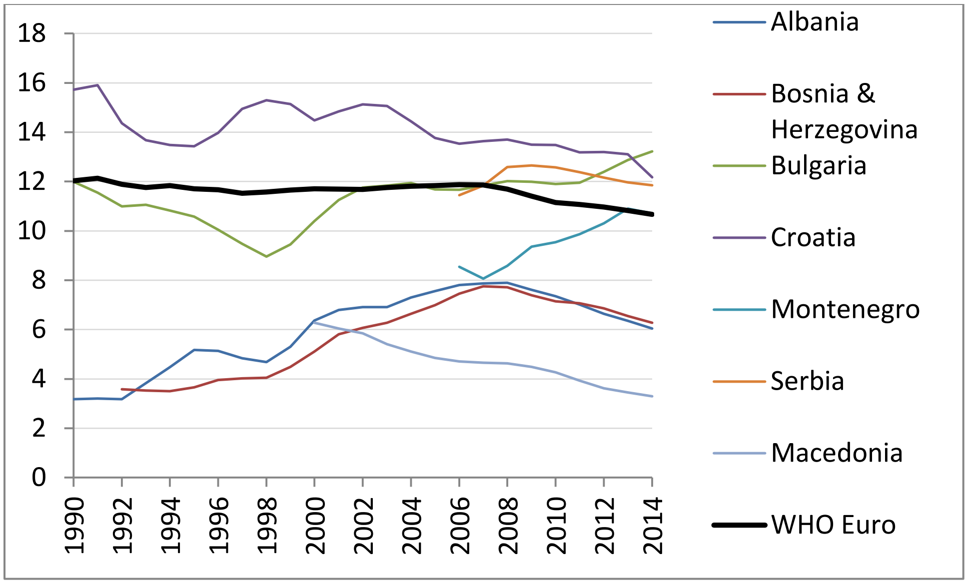


Figure 8: Trends in adult per capita *alcohol consumption for Albania, Bosnia & Herzegovina, Bulgaria, Croatia, Montenegro, Serbia, and TFYR Macedonia, 1990-2014 (in litres of pure alcohol per year)*

There is a considerable variation in the alcohol consumption levels of the countries in Central South Eastern Europe in Figure 8 over the past decades, both between and within countries, with no clear overall trend and no convergence. Many of these countries were part of the former Yugoslavia, and some of the observed variation may also reflect the establishment of national recording systems. Bulgaria, Croatia and Serbia have above WHO European Region average levels for almost a decade, whereas Bosnia & Herzegovina, Macedonia and Albania are clearly below the WHO European Region average levels of alcohol consumption. For the latter countries, there is a marked proportion of people with Muslim faith.[53]

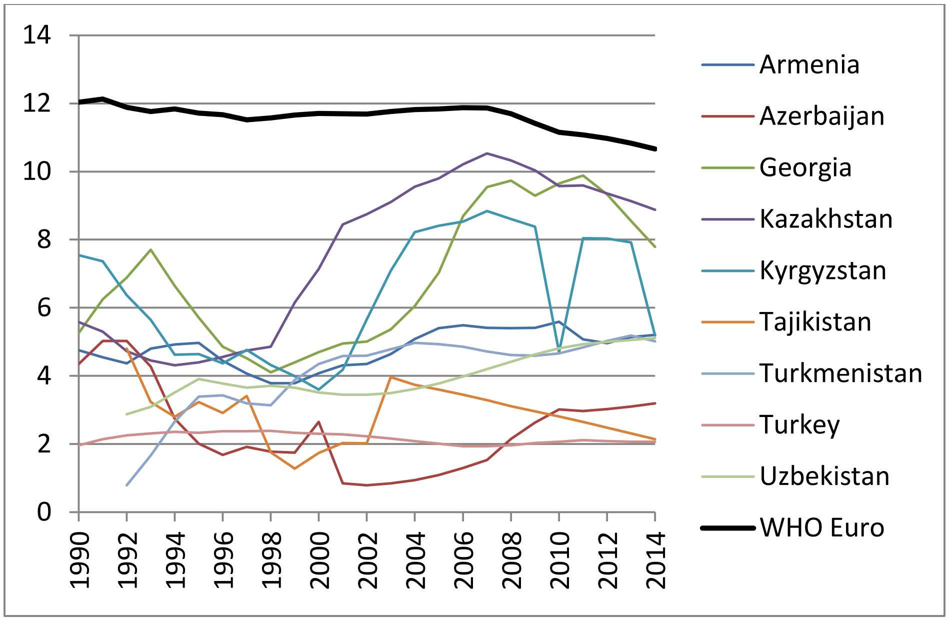


Figure 9: Trends in adult per capita *consumption for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Turkey, and Uzbekistan, 1990-2014 (in litres of pure alcohol per year)*

Alcohol consumption in countries of the South Eastern part of the WHO European Region, which are primarily geographically situated in Asia, showed marked variation within and between countries, often within a short time span. The exception is Turkey, where the adult *per capita* alcohol consumption has been stable at approximately 2 litres per year. The other countries show no clear pattern, except that all of them are considerably below the WHO European Region average. Most of the countries in this region have a marked proportion of people with Muslim faith, but operated under alcohol regulations influenced by prior Soviet Union laws in the first years of the period.

Regional trends in total adult *per capita* alcohol consumption

Figure 10 summarizes the trends of different sub-regions within the WHO European Region and for the region as a whole between 1990 and 2014.[FN9] There are clear differences in trend: consumption in the WHO European Region in the last 25 years has decreased by about 11%, with almost all of the decrease occurring since 2007. The economic recession may have played a role there, as during recession overall less money is spent on alcoholic beverages, despite a potential increase in unemployed people ([59,60]; for the relationship between unemployment and alcohol consumption:[61]) Such an effect would be most relevant for countries with lower economic wealth such as those in the Eastern part of the WHO European Region.

The decrease in alcohol consumption in the WHO European Region has also been fueled primarily by an almost linear decrease in the countries of the EU over the time span (approximately -18% based on the 1990 level). The countries in the Central Western EU region around Germany showed a very similar pattern as the EU as a whole (- 22%). Within the EU, consumption in the Mediterranean countries has decreased the most (-34% for all Mediterranean countries). This decrease in alcohol consumption in Mediterranean countries actually started earlier than 1990, and is primarily the result of a decrease in wine consumption in the traditional wine drinking countries of France, Greece, Italy, Portugal and Spain.[62-64]

[FN9] While the emphasis of this report is on the country level, and thus, the majority of Figures concerns all countries in comparisons to neighboring countries, the next section gives also some regional trends There is some overlap between regions, as the regions had been selected based on geography, economic wealth and drinking tradition (see above for details).

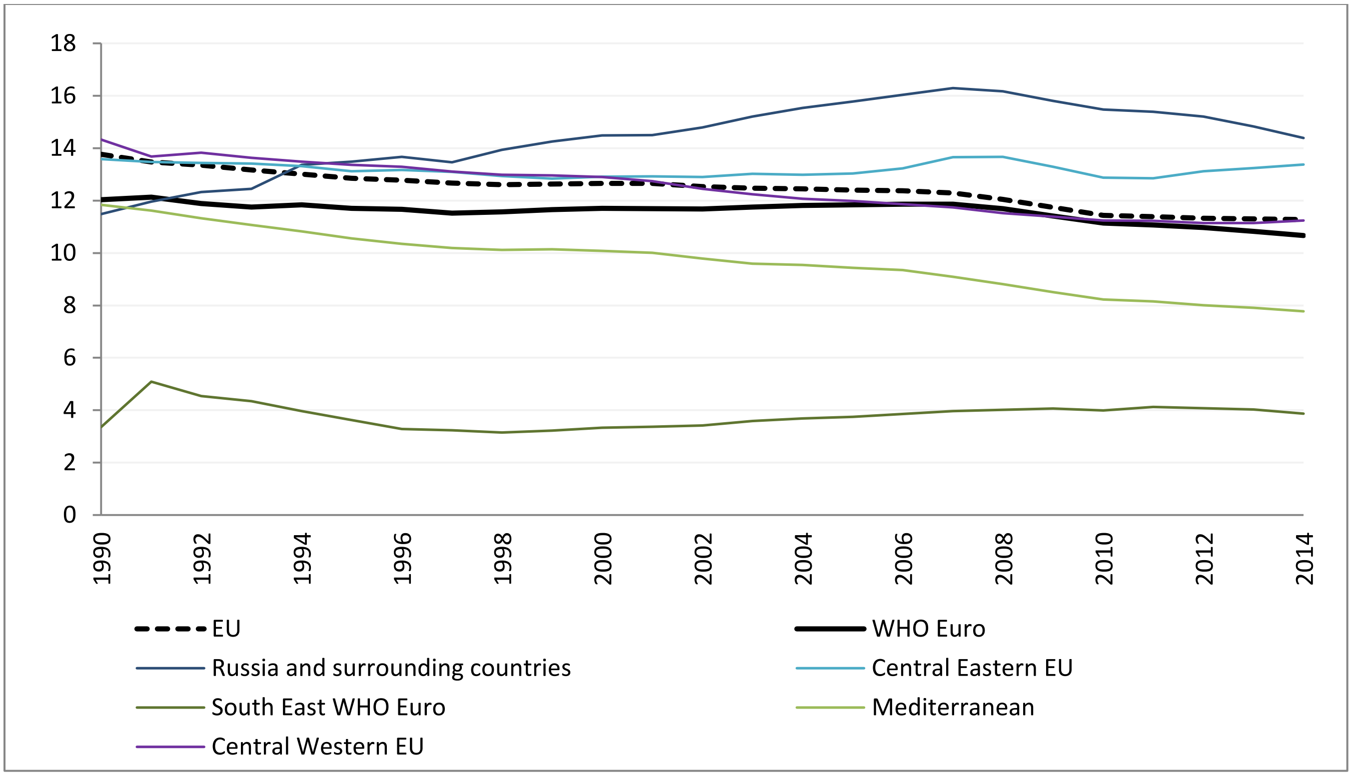


Figure 10: Trends in adult per capita *alcohol consumption in the WHO European Region and selected sub-regions, 1990-2014 (in litres of pure alcohol per year)*

However, not all regions of the EU showed a decrease in alcohol consumption. The Central Eastern part of the EU had almost stable consumption over the observation period. Russia and surrounding countries in 1990 had consumption levels which were below the EU and below Mediterranean countries, and now their consumption exceeds the consumption in these regions by far: in 2014, Russia and surrounding countries had 3.1 (28%) and 6.6 (85%) litres *per capita* higher consumption than the average of the EU or Mediterranean countries, respectively.

While in most parts of the WHO European Region alcohol consumption is higher than the global average (see below for a quantification), this is not the case for its South Eastern part. Alcohol consumption levels are markedly lower here, in part because a considerable proportion of the population is of the Muslim faith.[53] The sharp increase to 1991 in the South Eastern part, followed by a decrease in 1992 is partly due to the different composition of the region in these years and the methodology of using three year averages (see footnote [FN10]).

[FN10] The time series for countries like Turkmenistan and Uzbekistan start in 1991, as they became independent in that year. Moreover, for many countries in this region the data source changed in 1990 (for data sources for each country and year see [2]), resulting in some changes between 1990 (= average 1989-1991, i.e., one year with a different data source) and 1991 (average 1990-1992; all years from the same data source).

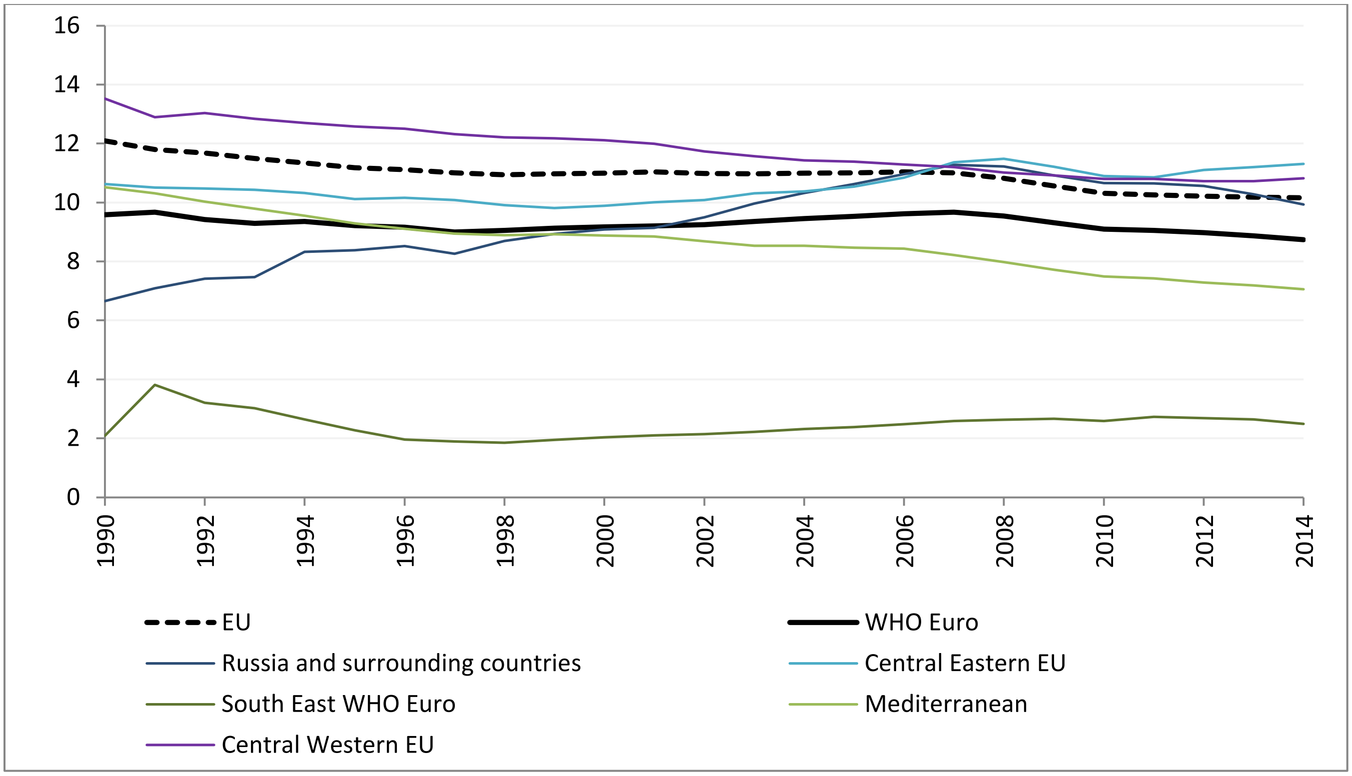


Figure 11: Trends in recorded adult per capita *alcohol consumption in the WHO European Region and selected sub-regions, 1990-2014 (in litres of pure alcohol per year)*

Most of the changes in alcohol consumption levels were driven by changes in recorded consumption (see Figure 11). The traditionally high consuming countries in the Central Western part of the EU decreased their consumption by 2.7 litres *per capita* (about 20%), with EU decreasing by 16% and the Mediterranean countries by 33%. In 2014, the Central Western part of the EU no longer had the highest level of recorded adult *per capita* alcohol consumption, as Central Eastern EU countries consumed slightly more recorded alcohol *per capita.*

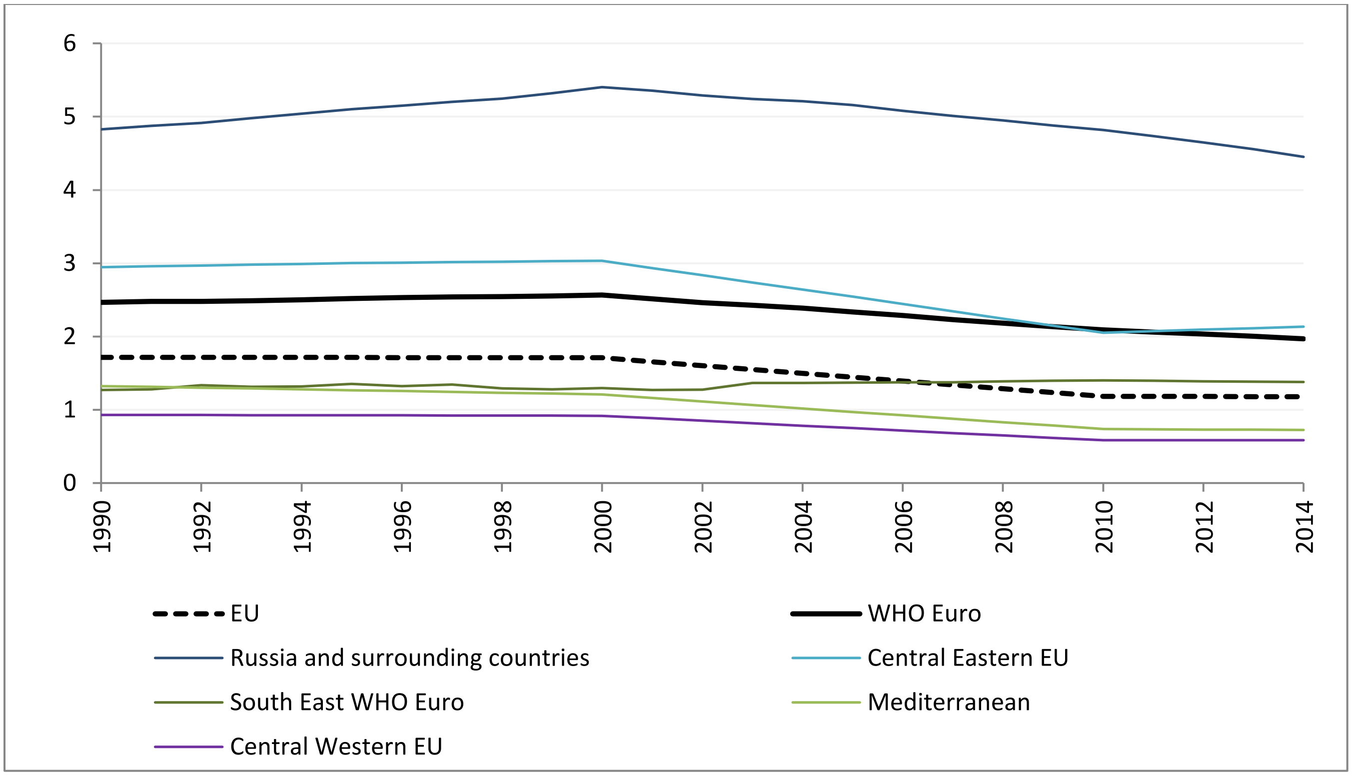


Figure 12: Trends in unrecorded adult per capita *alcohol consumption in the WHO European Region and selected sub-regions, 1990-2014 (in litres of pure alcohol per year)*

Unrecorded consumption in the WHO European Region and in most of its composite parts, as estimated periodically, was stable or decreased (see Figure 12). The only exception seems to be the South Eastern part of WHO European Region, where some countries increased their unrecorded consumption, albeit at a relatively low level. Countries in the Central Western region of the EU decreased their unrecorded consumption even further. The largest absolute level and relative impact of unrecorded consumption was found in Russia and surrounding countries.[22]

Prediction of adult *per capita* consumption of alcohol for 2020

Table 1 gives an overview of the predicted values of adult *per capita* consumption for 2020 and the changes from 2014. 31 countries are predicted to change their consumption for more than half a litre, 13 downwards and 18 upwards; the rest of the countries would remain stable (19 countries).

Country	**Predicted APC* 2020**	**Trend****	**Country**	**Predicted APC* 2020**	**Trend****
Albania	8.06	↑	Latvia	13.36	↑
Armenia	5.46	->	Lithuania	19.69	↑
Austria	9.03	↓	Luxembourg	10.48	↓
Azerbaijan	2.41	↓	Malta	7.17	->
Belarus	17.66	->	Montenegro	13.06	↑
Belgium	14.37	↑	Netherlands	9.52	->
Bosnia-Herzegovina	4.36	↓	Norway	8.42	↑
Bulgaria	12.65	↓	Poland	13.51	->
Croatia	12.22	->	Portugal	11.86	->
Cyprus	14.15	->	Republic of Moldova	17.83	↑
Czech Republic	13.98	->	Romania	12.45	↓
Denmark	10.89	->	Russian Federation	15.34	↑
Estonia	16.37	↑	Serbia	12.33	->
Finland	11.24	->	Slovakia	11.01	↓
France	10.71	↓	Slovenia	9.99	↓
Georgia	9.84	↑	Spain	9.62	->
Germany	10.34	↓	Sweden	10.20	↑
Greece	9.89	↑	Switzerland	8.79	↓
Hungary	11.59	↓	Tajikistan	1.92	->
Iceland	7.66	↑	TFYR Macedonia	3.16	->
Ireland	9.90	->	Turkey	2.18	->
Israel	3.52	->	Turkmenistan	6.27	↑
Italy	6.04	↓	Ukraine	14.20	↑
Kazakhstan	9.82	↑	United Kingdom	13.68	↑
Kyrgzystan	6.58	↑	Uzbekistan	5.45	->

* APC: adult *per capita* alcohol consumption (i.e., sum of recorded, unrecorded and tourist consumption) **Arrows point upwards or downwards denote respective changes of more than 0.5 litres from the 2014 value.

Table 1: Predicted adult per capita *consumption of alcohol (in litres of pure alcohol) and changes from 2014*

For the WHO European Region as a whole, this resulted in stability, with the different increases and decreases balancing each other out (Table 2). As Tables 1 and 2 show, the increases are mainly due to Russia and other countries in the Eastern part of the WHO European region (from North to South). The decreases are expected by a continuation of the trend for the Central Western and Mediterranean countries of the EU.

Region	**2020**	**2014**	**Trend***
WHO European Region	10.73	10.67	->
EU	10.96	11.28	->
Russia and surrounding countries	15.34	14.39	↑
Central Eastern EU	13.07	13.37	->
South East WHO Euro	4.15	3.87	->
Mediterranean	7.10	7.77	↓
Central Western EU	10.36	11.24	↓

Arrows point upwards or downwards denote respective changes of more than 0.5 litres from the 2014 value.

Table 2: Predicted adult per capita *consumption of alcohol (in litres of pure alcohol) for 2020 and changes from 2014 for the WHO European Region and selected sub-regions*

Trends in alcohol consumption per drinker

Figures 13 and 14 give an overview of average alcohol consumption per adult drinker separate by sex. For men, most of the regions are clustering around the WHO European average (see Figure 13), including even the countries from the South Eastern part of the region, indicating again, that once sub-populations start using alcohol, they often tend to drink at similar levels, almost independent of culture[65,66] (see also footnote [FN11]). However, Russia and surrounding countries are markedly higher in this regard, which helps explain, why this region has experienced proportionally more alcohol-attributable burden.[2,6,67] The lowest per-drinker consumption was in the Central Western part of the EU, where the abstinence rates has traditionally been very low.

[FN11] A corollary of this statement is that drinking level in different countries of markedly determined by the proportion of abstainers in the respective country. For 2010, based on data of the Global Status Report on Alcohol and Health,[2] the Pearson correlation between the proportion of current abstainers (defined as 12-month abstainers) and adult *per capita* consumption was -0.82 (n= 190 countries; 95% confidence interval: -0.86, -0.77; t=19.6; p<0.001); and for WHO European Region was -0.61 (n=51 countries; 95% confidence interval: -0.76, -0.40; t=5.4; p<0.001).

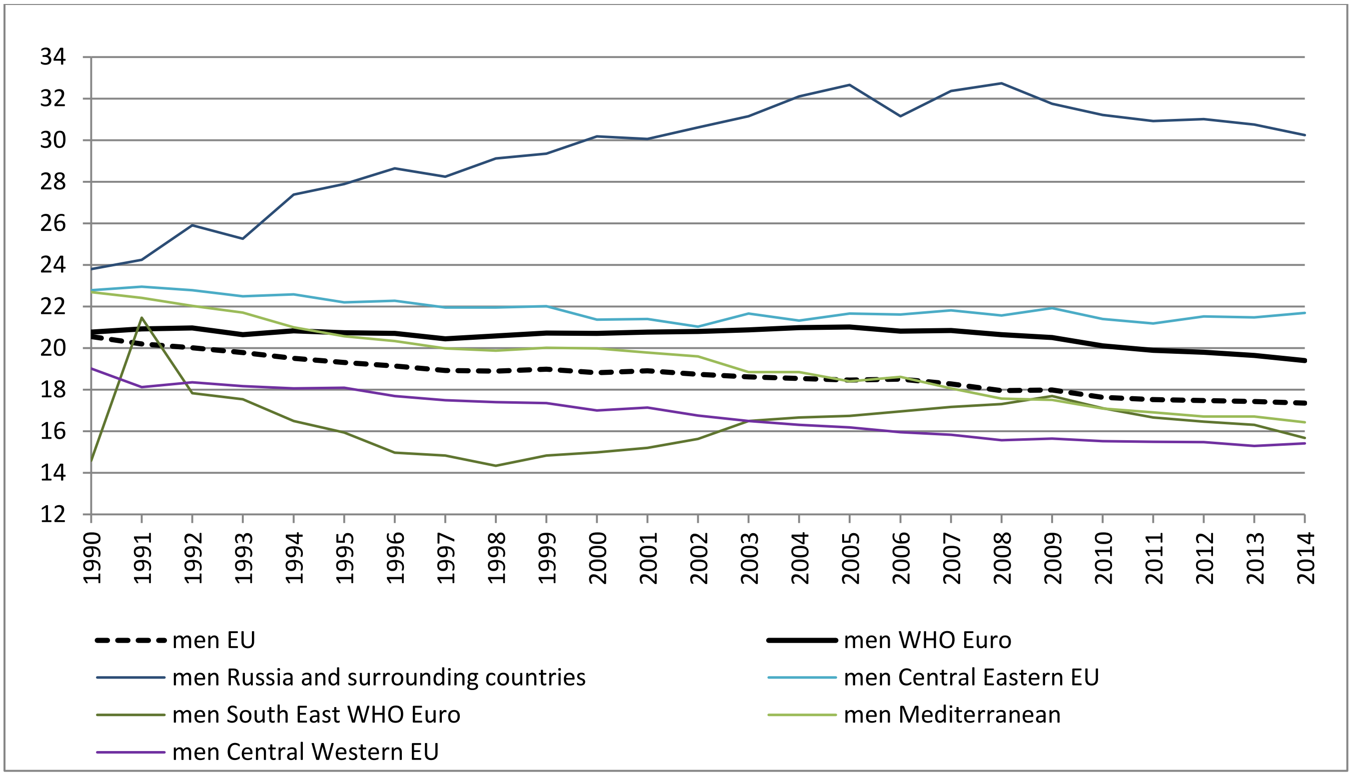


Figure 13: Trends in adult per drinker per capita *alcohol consumption for men in the WHO European Region and selected sub-regions, 1990-2014 (in litres of pure alcohol per year)*

For women, we have a largely similar picture as for men at a lower level, but women from the South East WHO Euro region consume markedly less compared to the other regions and to the WHO European Region as a whole (Figure 14).

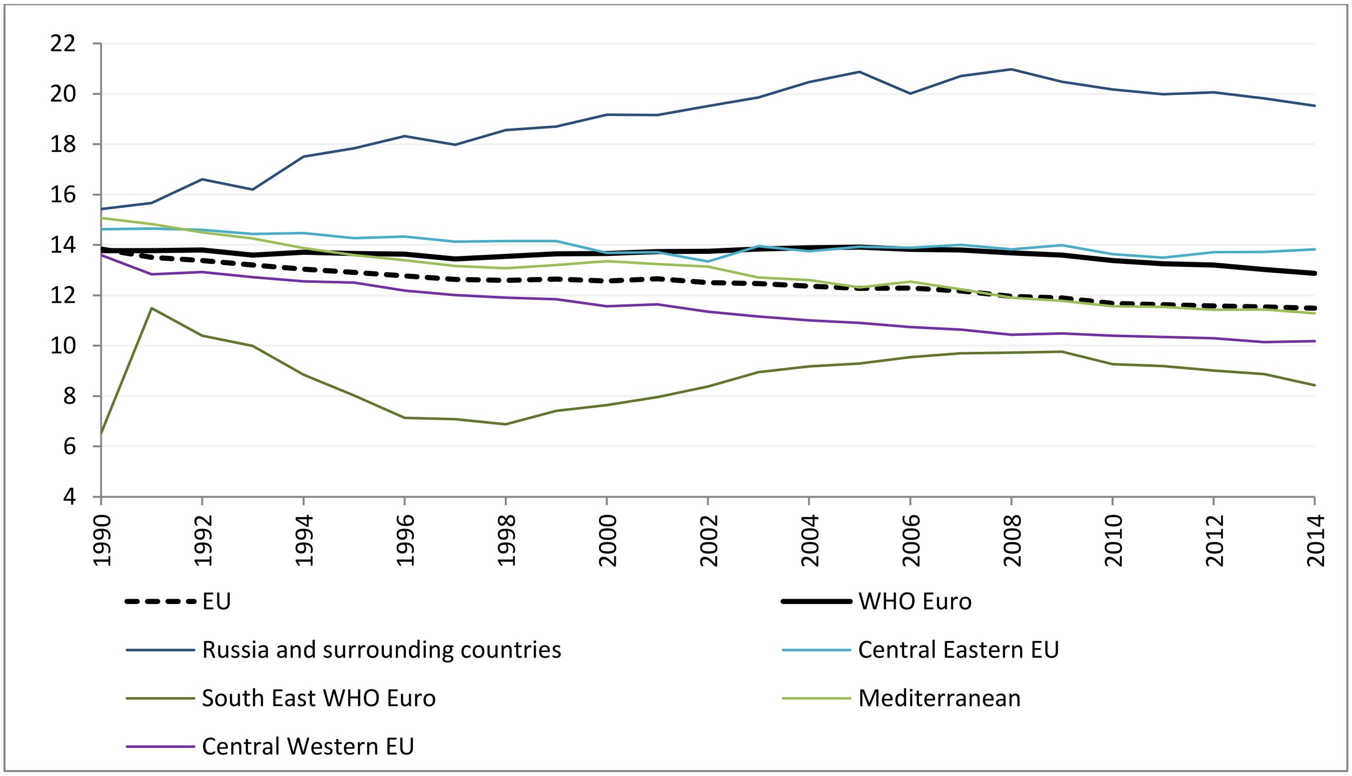


Figure 14: Trends in adult per drinker per capita *alcohol consumption for women in the WHO European Region and selected sub-regions, 1990-2014 (in litres of pure alcohol per year)*

Conclusion: alcohol consumption trends over the past 25 years in the WHO European Region

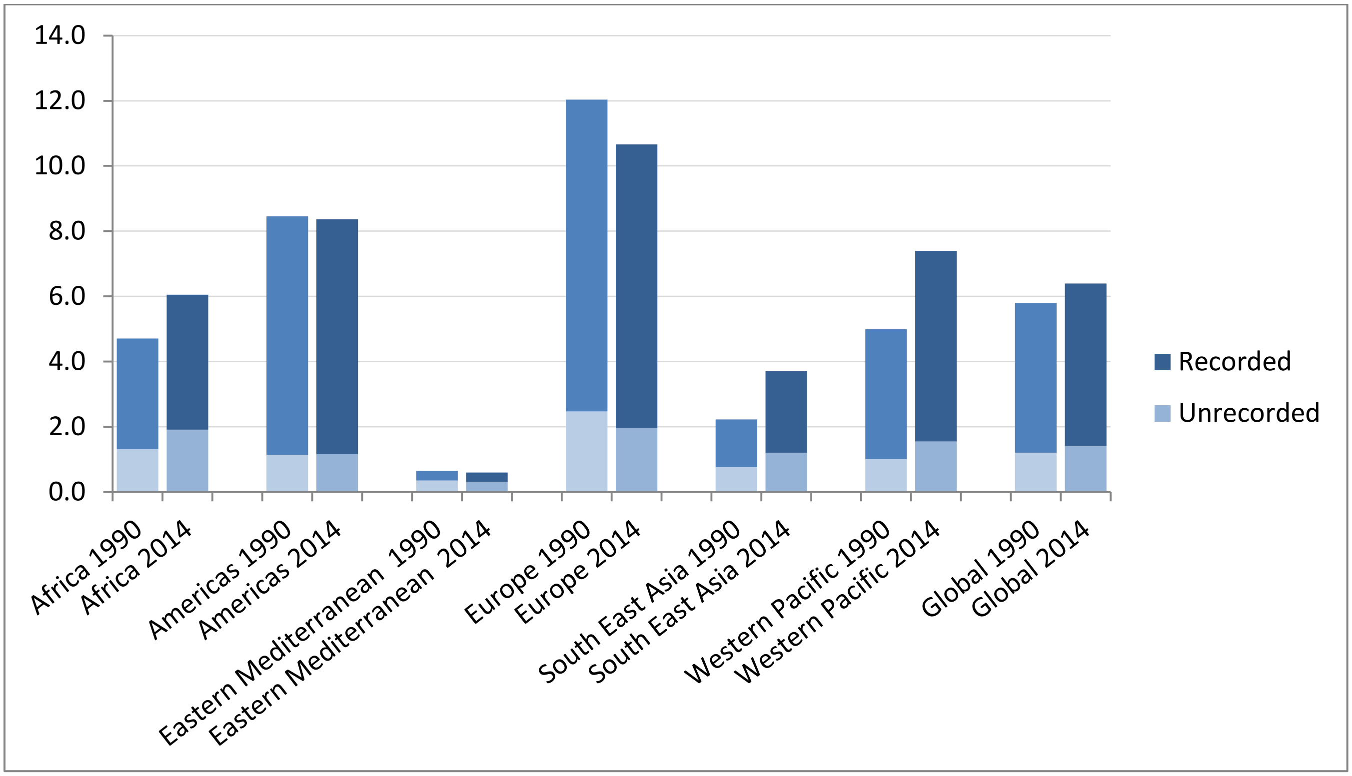
Adults in the WHO European Region decreased their alcohol consumption over the past 25 years. This decrease was fueled by trends in countries with the highest economic wealth in the EU, and there in particular by the wine-drinking countries in the Mediterranean region. However, if the countries in the Eastern parts of the WHO European Region further increase their consumption, the NCD goals for a reduction of the harmful use of alcohol (-10%) could be threatened for region (see also Tables 1 and 2; for more general considerations on reaching the NCD goal to reduce the harmful use of alcohol in the region see[68]). At this point it should be mentioned that the NCD goal for alcohol was not too ambitious for the WHO European region.

Despite the overall positive trend in reducing the level of alcohol consumption in the WHO European Region, the enormous variation between countries, even between neighboring countries, should be pointed out. Another crucial point are the current and projected increases in adult *per capita* alcohol consumption in several countries, especially in the Eastern part of the region. More efforts should be undertaken to counter such developments by the respective countries and by the WHO European Region as whole. Second, even after the overall decrease in alcohol consumption, the region is still the highest consuming in the world. From a broader public health perspective, the average consumption per adult in the WHO European Region is high, with comparatively more risk associated as with other voluntary activities or other forms of substance use.[69-71] This argues for a special effort to reduce alcohol consumption well beyond 10% in the European region.

More general conclusions will be given after describing the health burden attributable to alcohol consumption.

Comparisons between WHO European Region and other WHO regions

Figures 15 to 16 show the main components of *per capita* consumption 1990 and the percentage changes in the 25 years by WHO region (for the composition of WHO regions by countries see Web Appendix 7).



Slightly darker shades refer to 2014

Figure 15: Adult per capita *alcohol consumption in WHO regions 1990 and 2014 (in litres of pure alcohol per year)*

The following general statements can be made:

- Adult *per capita* alcohol consumption in WHO regions increased by about 10% over the last 25 years, and the rank order of regions remained stable, with the WHO European Region consuming the most alcohol, followed by the Americas, the Western Pacific region, Africa, Southeast Asia and the Eastern Mediterranean Region.
- Over this time period, the two regions with the highest consumption, the WHO European Region and the Americas, decreased their consumption by 11% and 1%, respectively.
- Most of the increase in consumption was in the Asian regions, fueled by marked increases in consumption in China (Western Pacific Region; see [72]) and India (South East Asian Region; for more details see [73]). Africa also increased its alcohol consumption markedly (for more details on the WHO African region see [74]).

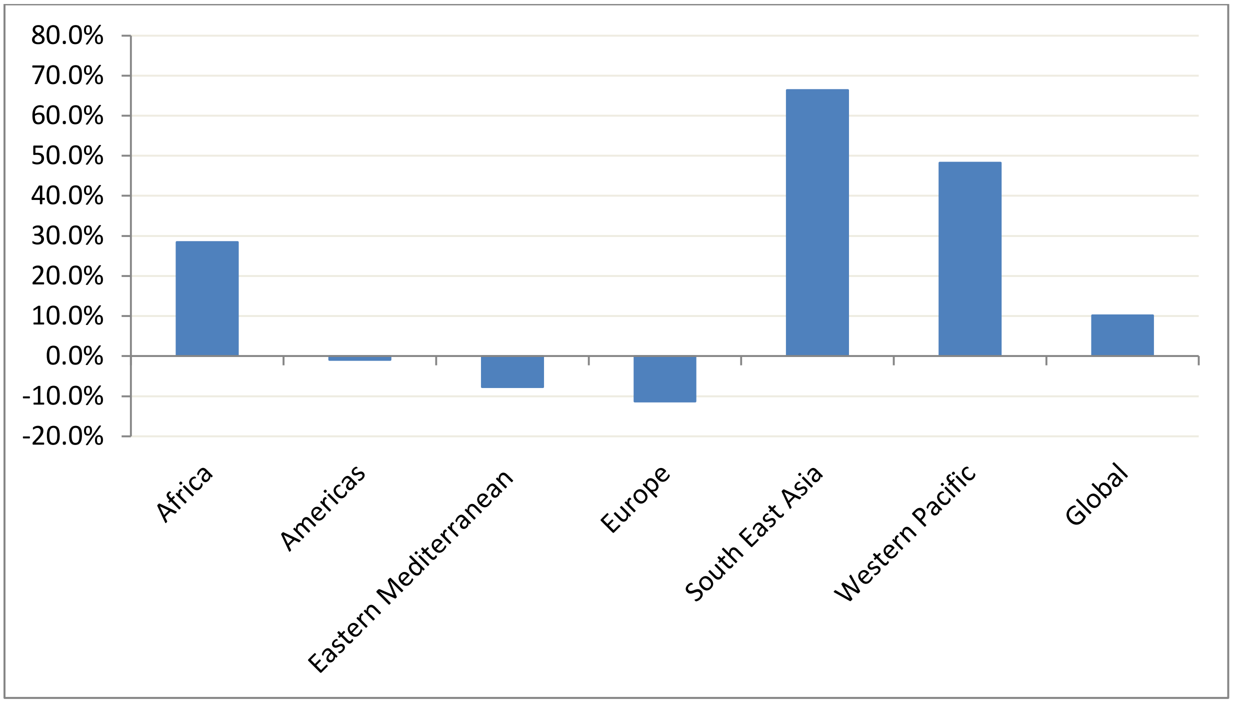


Figure 16: Proportional changes (in %) in adult per capita *alcohol consumption in WHO regions between 1990 and 2014*

The overall trends are not only heterogeneous between WHO regions, but also within regions between countries. Figure 17 gives an overview of this variability.

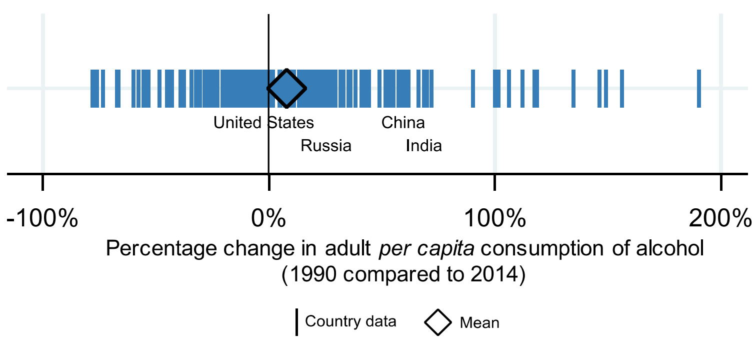


Figure 17: Country level data on change of adult per capita *alcohol consumption between 1990 and 2014*

Alcohol-attributable mortality burden in the WHO European Region, 1990-2014

On the selection of mortality as main outcome

Mortality is clearly the most severe health consequence of alcohol consumption. It has other advantages as well: it more comparable and has less measurement bias than non-fatal health measures.[75] However, there are also limitations: progress in medicine and other factors may lead to a prolongation of life,[7] and thus, some effects of alcohol on health may be disguised by using only mortality as an outcome. Supporting this hypothesis, there is some indication that trends diverged for alcohol-attributable mortality and other health indicators caused by alcohol including but not limited to hospitalizations.[15,76,77]

Main categories of alcohol-attributable causes of death

Alcohol consumption has causal impact in over 200 ICD 10 three digit categories.[78-80] However, the overwhelming majority of alcohol-attributable mortality burden, especially in Europe,[81,82] is in the chronic categories of liver cirrhosis, cancer and cardiovascular deaths, and in the acute categories of unintentional and intentional injury. According to the most recent Global Status Report on Alcohol and Health,[2] globally 88% of all alcohol-attributable mortality burden in 2012 was due to these five broad cause of death categories reported here (90% in women; 87% in men), with cardiovascular deaths being the largest contributor, followed by unintentional injuries and liver cirrhosis (see[2] Table 7). The rest of alcohol-attributable mortality was due to infectious disease (TB, HIV, and pneumonia), neuropsychiatric conditions (epilepsy, alcohol use disorders) and neonatal conditions (FAS).

The five categories are not only most relevant for alcohol-attributable death; they also made up 76% of all-cause mortality in the WHO European Region (same proportion in both sexes), most in cardiovascular diseases, followed by cancer, injury, and liver cirrhosis (own calculations based on the Global Burden of Diseases 2013 iteration[83]).

Details on the cause of death categories and their links to alcohol consumption are listed below:

- **Liver cirrhosis**: liver cirrhosis, although not identified as part of the NCDs within the WHO NCD Global Action Plan,[13] is one of the more important single causes of death globally and in Europe.[84-86] Alcohol consumption has been identified as a causal factor for liver disease in general, and liver cirrhosis in particular, for centuries.[87] There is a clear dose-response relationship, which starts with slow and then increasing acceleration.[88] Overall, the relative risks of heavy drinking are substantial,[88,89] and consequently, the alcohol-attributable liver cirrhosis mortality constitutes a major part of mortality as a whole,[84,90] especially in Europe.[91]
- **Cancer**: alcohol consumption has been identified as carcinogenic by the International Agency for Research on Cancer.[92-94] The following cancers have been identified to be partially attributable to alcohol: nasopharyngeal cancer, esophageal cancer, laryngeal cancer, pancreatic cancer, liver cancer, colon/rectal cancer, female breast cancer.[95] Dose response relationships are close to linear on the relative risk scale,[96,97] with no apparent lower threshold; even light drinking has

been shown to increase cancer risk.[97,98] Thus, alcohol consumption has been consistently shown to be a major risk factor for cancer, and given the high level of consumption in Europe, this is in particular true for the WHO European Region.[99,100]

- **Cardiovascular disease:** cardiovascular diseases have a complex relationship with alcohol consumption.[101,102] On the one hand, light to moderate regular drinking has been shown to be linked to decreases in morbidity and mortality in ischemic disorders,[103,104] with heavy drinking, both episodic and chronic, being linked to detrimental effects.[105-107] For most other cardiovascular causes of death, the impact is detrimental with a clear dose-response relationship (hypertension:[108]; hemorrhagic stroke:[104]; atrial fibrillation:[109]). As a result, the overall impact of alcohol on cardiovascular causes of death has been negative in most countries,[2,102] while the net impact attributed to death of ischemic diseases has been beneficial for many countries with the exception of countries with pronounced episodic or chronic heavy drinking patterns.[110,111]

Box 3: On the limitations of estimating population health effects on cardiovascular causes of death from epidemiological studies

As indicated in the methods section below, the alcohol-attributable fractions which underlie the estimates of standardized rates presented here for various cause of death categories, have been derived from meta-analyses of large cohort studies, which is the technical term for studies, where people are followed about some time, with exposure like alcohol consumption usually measured in the beginning of the study and outcomes years later, then estimated the association between exposure and different outcomes.

However, there are some indications that the beneficial effects of alcohol consumption on ischemic heart disease and ischemic stroke as derived from usual epidemiological studies are overestimated. There are a number of selection biases which had been found in the underlying studies;[29,112] results from Mendelian randomization studies, another type of study with stricter control, seem to contradict the results ([113], but also see[114]); and finally aggregate level studies also found conflicting results.[115]

While the current evidence suggests there may be an overestimation of beneficial effects of alcohol on cardiovascular disease outcomes, there are still good biological reasons for the beneficial effect based on experimental evidence for surrogate markers of ischemic diseases.[116-118] Moreover, it is hard to quantify the overestimation, and thus we will have to continue to use the best available estimates from meta-analyses on individual-level studies, even if they overestimate the beneficial effect.

- **Injury:** alcohol has causal impact on almost all categories of injury, both intentional and unintentional injury.[79,119,120] For some kind of injury such as traffic injury and violence, there is both the impact on the drinker [121] and the impact on others.[14,122] All levels of alcohol consumption have some impact on injury, as alcohol impacts the central nervous system already at low to moderate doses;[123,124] however, the dose response relationship is accelerating with higher levels of consumption.[125,126]

We will report burden for these cause of death categories separately for each country from 1990 to 2014, for injuries also separately by major sub-category, i.e., unintentional and intentional injury. Our main calculations will be restricted to drinkers harming themselves, but we will give some indication on alcohol consumption's harm to others.

Methodology to estimate alcohol-attributable burden

We will use standard methodology as used in the WHO Global Status Report on Alcohol and Health (last iteration 2014: [2]) and the Global Burden of Disease, Injury and Risk Factor studies (last iteration 2013:[3] to estimate alcohol attributable burden. While the methodology has been described in detail elsewhere,[2,3,127] the main steps will be listed below as an overview:

- Average level of alcohol exposure was estimated yearly as a continuous variable, separately by sex and age,[34] based on a triangulation of adult *per capita* consumption of alcohol data and survey data (for data sources see above; for detailed methodology:[127,128]). Survey data are necessary to distribute *per capita* consumption information, mostly derived from taxation, production, export and import figures, into drinking by different groups as defined by sex and age. Heavy drinking occasions, used for the calculation of ischemic and injury causes of death, were taken from surveys (see Appendix 61 for a listing of all sources for heavy drinking occasions).
- For all countries except Russia and surrounding countries with similar patterns of drinking (Belarus, Moldova, Ukraine), risk relations were taken from meta-analyses (for liver cirrhosis:[88]; for all alcohol-attributable cancer sites: [129]; for the various categories of cardiovascular diseases: hypertensive disease:[108]; ischemic heart disease and ischemic stroke:[102, see also 105]; other stroke types:[104]; atrial fibrillation: [109]; for injury:[129]). For Russia and surrounding countries with similar patterns of drinking we used country-specific estimates for risk relations from Russia from a large prospective study ([55,110]; see[67] for further reasoning).
- For injury, we used relative risks from the meta-analysis of Corrao and colleagues[129], modified to incorporate the effects of binge drinking. While we did not explicitly include risk to others [FN12] in general, we did include some of the effect of alcohol use on traffic injury. Thus, we used the WHO Global Status Report on Road Safety[134] to determine the sex of driver, and the number of passengers per car to add to the alcohol-attributable injury (for general considerations on harm to others see[14,122]).

[FN12] Thus, therefore we did neither include the effects of pregnant women's drinking on the newborn (such as on Fetal Alcohol Syndrome or Fetal Alcohol Spectrum Disorders;[130,131] or the sequelae of low birth weight,[132]) or the effect of alcohol on aggression towards others.[133]

- Exposure and risk relations were combined using standard formulas for attributable risk ([127]; for foundation see[135-137]) to derive alcohol-attributable fractions by sex and age (the usual age groups for comparative risk assessments characterizing alcohol exposure (15-34; 35–64; and 65+).
- The alcohol-attributable fractions were then applied to the cause of death statistics (Source: [138]) divided by the respective population to derive rates per 1,000,000. To achieve comparability, we age-standardized the rates using the standard population of the International Agency for Research on Cancer.[139]

Alcohol-attributable mortality burden in 2014 in the WHO European region (age-standardized rates per 1,000,000 population)

Country (ranking by overall AA mortality rate)	**Liver cirrhosis**	**Liver cirrhosis AA**	**Cancer**	**Cancer AA**	**Cardio-vascular disease**	**CVD AA**	**Injury**	**Injury AA**	**Unintent. Injury**	**Unintent. Injury AA**	**Intent. Injury**	**Intent. Injury AA**
Belarus	207.8	120.4	1300.8	108.5	4183.6	1214.4	1060.1	637.9	641.4	353.7	418.6	284.2
Ukraine	252.4	130.7	1118.5	85.3	3909.8	926.2	722.6	379.2	436.9	203.2	285.7	176.0
Russian Federation	203.7	108.1	1177.5	78.7	3571.0	674.9	921.5	478.8	523.9	235.8	397.6	242.9
Moldova	484.9	273.3	946.4	86.0	3299.3	810.3	523.1	265.8	343.1	150.8	180.1	115.0
Kazakhstan	343.0	232.9	1268.7	92.3	4258.7	200.3	971.8	323.5	523.9	159.7	447.9	163.7
Lithuania	197.1	157.8	1156.2	94.5	2411.5	79.5	729.9	351.7	425.8	200.9	304.0	150.8
Kyrgyzstan	475.4	285.3	827.1	41.2	3957.7	241.9	583.7	115.0	397.1	74.2	186.7	40.8
Romania	254.0	190.6	1093.3	86.5	2568.8	97.9	384.2	156.3	273.2	106.0	111.0	50.3
Estonia	126.1	98.0	1168.6	80.4	2115.1	65.6	477.4	203.5	290.5	119.4	186.9	84.1
Hungary	240.3	183.1	1578.8	131.6	2146.7	30.8	401.0	147.8	220.5	76.1	180.6	71.8
Turkmenistan	325.1	174.2	946.6	70.4	4373.3	141.7	564.6	121.7	411.4	81.7	153.2	39.9
Georgia	203.9	129.3	945.8	52.1	3681.7	137.8	438.8	148.1	350.4	113.2	88.4	34.9
Poland	138.4	106.2	1300.7	82.6	1827.3	68.2	439.7	177.5	271.3	105.4	168.4	72.1
Slovakia	185.2	140.0	1308.4	116.3	2304.4	43.1	358.9	139.2	229.7	85.6	129.2	53.7
Uzbekistan	353.6	193.4	617.0	37.1	3881.8	128.2	534.1	102.8	401.3	71.2	132.7	31.6
Bulgaria	134.7	102.4	1124.0	77.7	3018.7	164.5	335.0	109.0	223.6	70.2	111.4	38.8
Latvia	112.6	81.8	1145.7	71.4	2601.2	-12.6	566.3	199.7	355.7	121.0	210.7	78.6
Slovenia	155.7	113.5	1165.6	77.6	1200.1	23.8	410.7	145.1	243.1	79.8	167.7	65.3
Croatia	152.4	112.9	1331.1	94.2	1795.7	33.4	377.3	105.4	240.0	64.2	137.3	41.2
Montenegro	42.8	31.3	1121.1	57.8	2917.5	144.2	395.8	100.6	206.3	49.4	189.4	51.1
Armenia	205.9	104.4	1244.5	46.3	2545.8	57.5	385.9	112.0	277.2	76.3	108.6	35.7
France	91.5	64.1	1177.6	80.9	739.0	17.2	366.8	132.8	224.3	74.8	142.6	58.0
Czech Republic	121.1	93.6	1268.7	90.1	1785.5	-4.7	343.1	124.0	221.1	75.8	122.0	48.2
Belgium	85.3	60.7	1133.2	69.0	953.0	8.6	376.7	137.7	219.1	74.9	157.6	62.8
Denmark	114.2	76.2	1093.9	58.9	1017.1	-2.1	257.4	86.8	150.9	50.8	105.7	37.3
Portugal	117.1	81.2	1078.7	74.6	988.3	49.5	301.4	79.6	192.2	47.9	109.2	31.7

Austria	119.3	76.0	1075.8	53.3	1139.2	12.8	284.8	110.4	164.3	62.2	120.5	48.2
Germany	108.1	73.6	1106.2	67.0	1154.7	13.6	231.8	103.0	134.6	57.1	97.2	45.9
Finland	121.4	84.1	897.8	44.2	1200.4	-5.8	366.0	117.7	196.2	60.6	169.8	57.1
Ireland	50.2	33.2	1075.5	56.3	1103.8	35.7	232.2	97.3	133.1	51.8	99.1	45.4
Azerbaijan	260.0	106.5	766.4	28.1	3129.2	63.0	319.6	59.2	248.7	43.8	70.9	15.5
Greece	46.1	28.7	1068.4	42.5	1483.4	39.5	250.6	96.4	209.8	79.4	40.8	17.0
Spain	85.5	55.5	1016.5	59.4	825.9	25.2	204.9	75.1	143.3	50.4	61.6	24.7
Serbia	59.3	43.6	1141.5	73.8	2081.4	67.6	322.2	50.8	179.3	26.1	142.9	24.6
United Kingdom	80.7	57.3	1110.4	63.8	971.1	10.1	176.9	74.2	112.9	44.9	63.9	29.3
Tajikistan	251.8	101.5	676.5	22.4	3565.8	105.3	425.3	24.2	333.5	17.8	91.8	6.4
Sweden	49.6	31.3	943.3	40.9	1129.7	14.8	251.8	89.8	131.1	44.2	120.7	45.6
Bosnia & Herzegovina	71.3	43.3	1134.4	44.8	2001.3	59.8	227.0	52.4	121.2	25.1	105.7	27.2
Netherlands	47.8	29.9	1301.3	62.4	894.5	5.7	217.8	72.5	127.6	39.5	90.2	33.0
Italy	80.1	44.9	1057.6	47.2	880.0	14.8	211.7	68.0	154.9	48.5	56.8	19.5
Malta	41.9	25.1	876.6	39.4	1037.9	36.0	156.6	57.4	107.4	37.3	49.2	20.0
Albania	8.8	4.5	1000.1	32.1	2588.3	44.1	446.4	66.3	313.1	45.2	133.3	21.1
Switzerland	50.5	31.8	949.0	50.1	816.6	-19.0	256.3	70.2	135.3	35.6	121.0	34.6
Cyprus	33.9	22.1	664.8	28.5	944.7	19.6	188.9	66.1	157.8	54.2	31.1	11.9
Norway	36.4	20.3	1033.6	34.7	914.9	-32.8	266.2	73.5	159.7	42.4	106.5	31.2
Macedonia	58.8	25.0	1115.3	32.7	2776.6	21.8	257.3	39.1	164.8	24.1	92.6	14.9
Iceland	13.0	6.6	924.4	24.3	888.2	-22.6	209.2	74.6	110.2	37.3	99.1	37.3
Israel	48.6	17.7	912.9	23.6	747.1	1.7	238.8	41.5	155.0	23.1	83.8	18.4
Turkey	54.7	14.7	1161.0	15.0	1707.5	36.0	302.8	21.8	230.2	16.2	72.5	5.6

AA: alcohol-attributable; CVD: cardiovascular disease; green highlighted countries have the lowest age-standardized alcohol-attributable mortality rates (5 lowest rates); red highlighted countries have the highest standardized alcohol-attributable mortality rates for the respective categories (10 highest rates)

Table 3: Standardized mortality of alcohol-attributable disease and injury categories in 2014 (overall age-standardized rate and rate of alcohol-attributable causes of death per 1,000,000)

Table 3 gives an overview of standardized mortality rates of major alcohol-attributable disease categories for the year 2014. While the countries with the highest overall alcohol-attributable mortality rates from the Eastern part of the WHO European Region tend to be the highest in many of the six sub-categories of cause of death reported here (i.e., liver cirrhosis, cancer, cardiovascular disease, injury, unintentional injury, intentional injury), the results are differentiated by country and region-specific specificities:

- Like any other alcohol-attributable mortality, alcohol-attributable liver cirrhosis mortality rates are mainly impacted by two factors: the overall mortality rate of liver cirrhosis in the country/region under consideration and the level of consumption. For the European countries with high alcohol-attributable liver cirrhosis rates, these two causal factors determine three clusters of countries [FN13]: first, the Central Asian countries of Kazakhstan, Kyrgyzstan, Turkmenistan and Uzbekistan have high overall liver cirrhosis prevalence and mortality, in large parts driven by Hepatitis B and C infections.[85] The role of alcohol use may be overestimated by the standard formulas for these countries (see above). On the other hand, alcohol plays a crucial role in liver cirrhosis mortality, independently of the original cause for incidence of this disease category, as even relatively small amounts of alcohol may lead to mortality in people with the disease present irrespective of its etiological pathway ([88] for the difference in risk curves between morbidity and mortality;[91,140]).[FN14]
  Second, countries such as Hungary, Moldova, Romania and Slovakia have higher liver cirrhosis rates than expected by volume of alcohol consumption alone. There is some speculation that specific kinds of fruit spirits, where pits (stones) were not separated in the production process, may play a role here.[142] Finally, countries like Lithuania or the Ukraine would be typical for countries with a high liver cirrhosis rate more or less in line with their high level of overall consumption. It should be noted that overall tissue exposure seems to be the causal determinant,[143,144] and that more variable drinking of the same amount of alcohol does not infer additional risks for liver cirrhosis mortality, as abstinence days are favourable for liver regeneration (so called liver holidays;[145,146]).
- Of all causes, alcohol-attributable cancer shows by far the least variation between countries and by time. Part of the phenomenon may be due to the long and varying lag-time between exposure and onset of disease.[147] Another reason is that alcohol is not causally or only weakly related to the most numerous cancers. As a result, the level of alcohol consumption is the main determinant for alcohol-attributable cancer mortality, which accounts for less than 10% of all the cancer mortality in any region of the world. However, the variation in Europe between 1% (Turkey) and 9% (Moldova) in 2014 for alcohol-attributable fractions for cancer mortality in the

[FN13] We mention only countries with the 10 highest age-standardized rates for alcohol-attributable liver cirrhosis and the other disease and injury causes of death mortality.
[FN14] It should also be noted, that alcohol use is associated with increased risk of so-called non-alcoholic liver diseases.[141]

WHO European Region is still very important [FN15] given the overall impact of cancer on mortality in the region.

- As described above, alcohol-attributable cardiovascular disease mortality is a heterogeneous category based on the different effects (beneficial and detrimental) of different dimensions of alcohol use (average volume of consumption; patterns of drinking) on different causes of cardiovascular death.[101] Some countries have slight protective effects on balance, and for many countries the protective effect of light to moderate drinking on ischemic disease deaths, and the detrimental effect of chronic and episodic heavy drinking occasions on all cardiovascular causes of death, balance more or less out (Table 3). Several elements are important here:
    - The distribution between ischemic and other causes of death (mainly ischemic heart disease vs. cerebrovascular disease (stroke),[148] and within stroke between ischemic stroke vs. hemorrhagic stroke[149]);
    - The distribution of drinking levels in the respective populations as well as patterns of drinking,[118] in particular the prevalence of episodic and chronic heavy drinking occasions;
    - Misclassification of cause of death ([150]; for the specific misclassification of alcohol poisoning as cardiovascular causes of death see below);
    - Competing causes of mortality.

  Unfortunately, the exposure data necessary on pattern of drinking are not of the same quality as the adult alcohol *per capita* data,[151] and thus, the current estimates include considerable measurement error. Moreover, while current epidemiology has started to use country specific relative risk estimates,[2,152] currently and for this report only two sets of relative risk estimates are available: the global one,[79] and the Russia-specific one.[110] The global estimates from meta-analyses are based mainly on cohorts from a limited number of high income countries with rather favorable and stable drinking patterns, resulting in lower estimates of risk relations compared to Russian estimates. One may speculate that countries like the Baltic countries may have risks in between the global and Russian estimates, given the high amount of episodic heavy drinking,[36] which plays such an important role for CVD causes of death (see above and [101]). However, as we do not have good epidemiological studies on alcohol and CVD death from most countries, we have to use the global estimates, which will result in underestimating the real burden for many countries with more detrimental drinking patterns; i.e. patterns including a high proportion of heavy drinking occasions.

- Injury mortality is one of the major categories of alcohol-attributable mortality,[2] and alcohol is one of the major risk factors for injury morbidity and mortality.[3] Alcohol has a relatively high impact on injury mortality burden, from around 5-8% (Tajikistan, Turkey) to over 60% (Belarus, Moldova, Russia, and the Ukraine) for intentional injury; and to over 45% for unintentional injury (Belarus, Lithuania, Russia, and the Ukraine; see Table 3). Most European countries have

[FN15] We based these comparisons of alcohol-attributable fractions rather than on the rate itself, as we focus on the role of alcohol in explaining mortality rather than on the level of standardized rates.

alcohol-attributable fractions around 30% to 40% for intentional injury, and about 5% lower attributable fractions for unintentional injury. In standardized mortality, the differences between different countries in the WHO European Region are huge, more than over 20-fold. Given, that all alcohol-attributable injury mortality is in principle entirely avoidable from one day to another,[153,154] and can be substantially reduced in short time, these differences between countries in one region are hard to tolerate (see also conclusions below).

Alcohol-attributable liver cirrhosis mortality burden

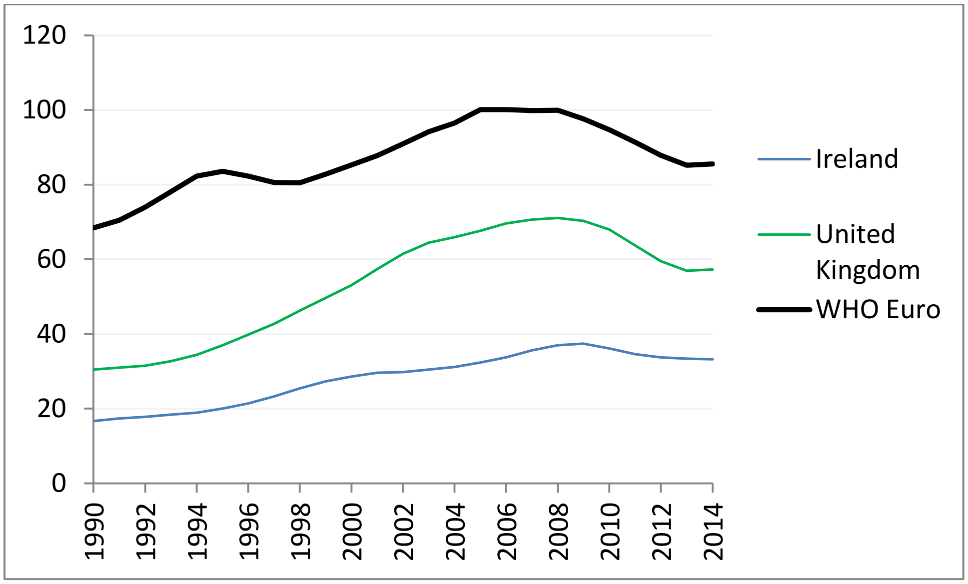


Figure 18: Trends in age-standardized alcohol-attributable adult liver cirrhosis mortality for Ireland and United Kingdom, 1990-2014 (rates per 1,000,000)

Figure 18 shows that Western European countries in 2014, along with most continental EU countries (except for countries in the Central Eastern part (see below Figure 21) and the Baltic countries), have a lower liver cirrhosis rate than the WHO European Region. Consistent with the trends in consumption (see Figure 1 above), standardized alcohol-attributable liver cirrhosis rates increased in the first decade of the observation period, and decreased in the later years. The rise of liver cirrhosis mortality in the UK from historically comparatively low levels to now being the third most important cause of death for people under 65 years of age has led to discussion and policy action, especially since other chronic disease rates have been on the decrease in this country ([155], see footnote [FN16]).

[FN16] As will be discussed below in more detail, trends in liver cirrhosis mortality rates, especially if they go contrary to other mortality trends, have been identified as important tools for monitoring and surveillance of substance use and as an important indicator for inefficient substance use policies also in other countries of the world, such as the US.[156,157]

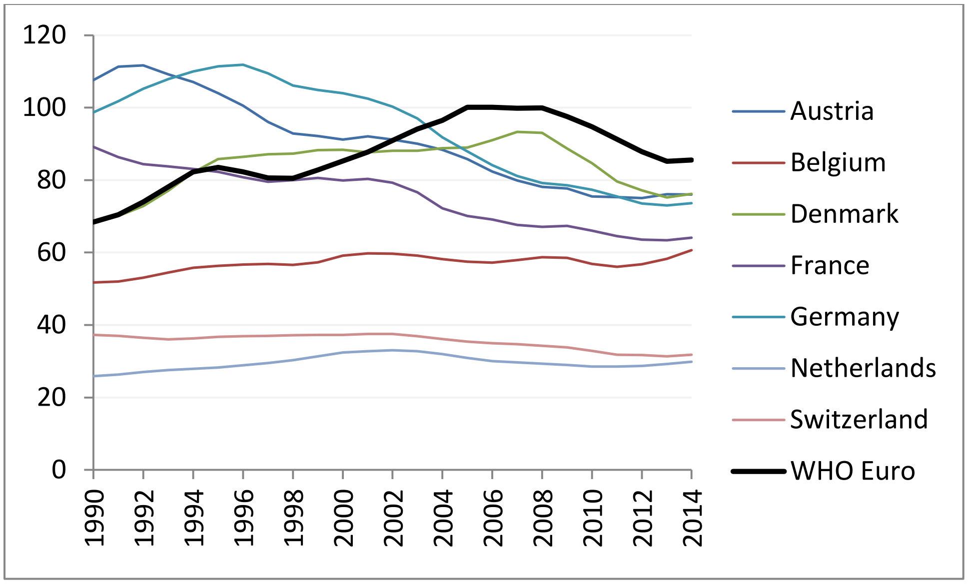


Figure 19: Trends in age-standardized alcohol-attributable adult liver cirrhosis mortality for Austria, Belgium, Denmark, France, Germany, Netherlands, and Switzerland, 1990-2014 (rates per 1,000,000)

Since early in the 21st century, all countries in Central Western Europe have lower liver cirrhosis rates than the WHO region as whole (Figure 19). Austria, Denmark, France and Germany which all had higher rates in earlier years of the observation period, have all reduced their alcohol-attributable liver cirrhosis mortality, consistent with their consumption levels (for consumption levels see Figure 2 above).

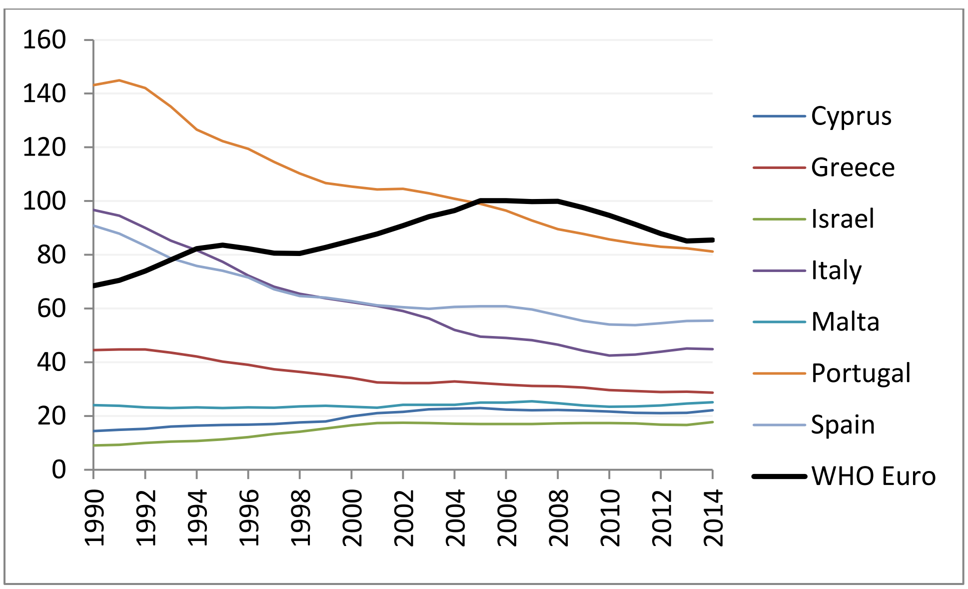


Figure 20: Trends in age-standardized alcohol-attributable adult liver cirrhosis mortality for Cyprus, Greece, Israel, Italy, Malta, Portugal, and Spain, 1990-2014 (rates per 1,000,000)

After 2005, all Mediterranean countries had lower liver cirrhosis mortality rates than the WHO European Region average. In 1990, Italy, Portugal and Spain had higher rates, but with the continuous decline of adult *per capita* consumption in these traditionally wine drinking countries, the liver cirrhosis rates also declined, starting more than a decade before 1990.[158]

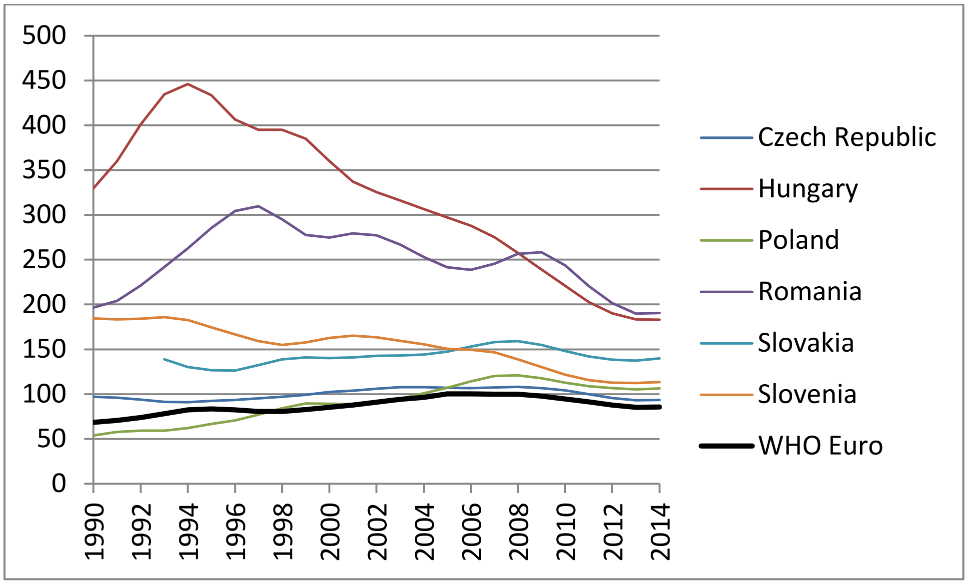


Figure 21: Trends in age-standardized alcohol-attributable adult liver cirrhosis mortality for Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia, 1990-2014 (rates per 1,000,000)

All countries from the Central Eastern EU region have higher liver cirrhosis mortality rates than the WHO European region average, albeit to different degrees. Highest are the countries where spirits made of fruits with pits have some market share (Hungary, Romania, Slovakia and Slovenia; see above on the pit fruit hypotheses; also [91,142]). However, there are some indications that the highest rates have been coming down in the past 5 years (see Figure 21).

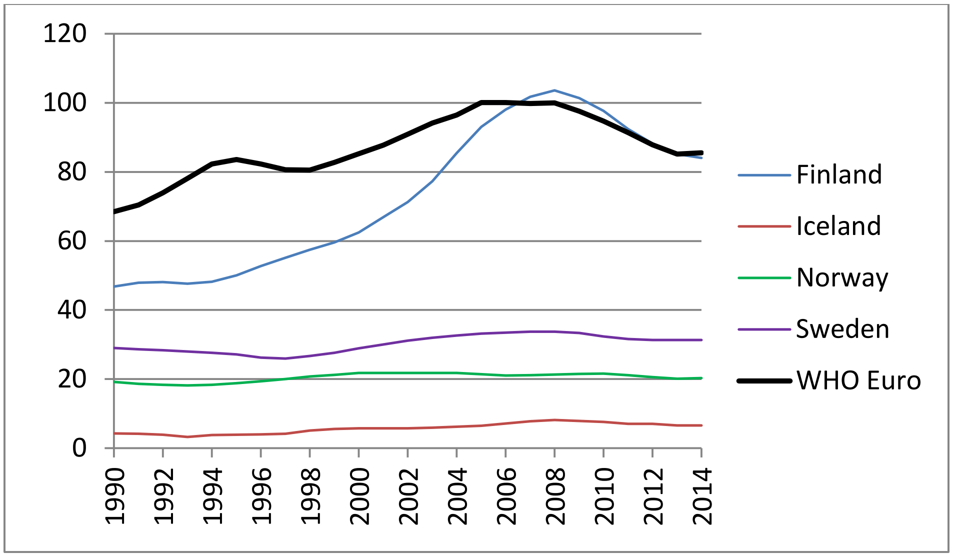


Figure 22: Trends in age-standardized alcohol-attributable adult liver cirrhosis mortality for Finland, Iceland, Norway, and Sweden, 1990-2014 (rates per 1,000,000)

As with level of consumption (see Figure 5), alcohol-attributable liver cirrhosis mortality in Finland has been close to the average rate of WHO European region in recent years. The other Nordic countries are still markedly below this rate, despite slight increases (see Figure 22). Iceland is among the countries with the lowest liver cirrhosis mortality rates not only in Europe but globally.

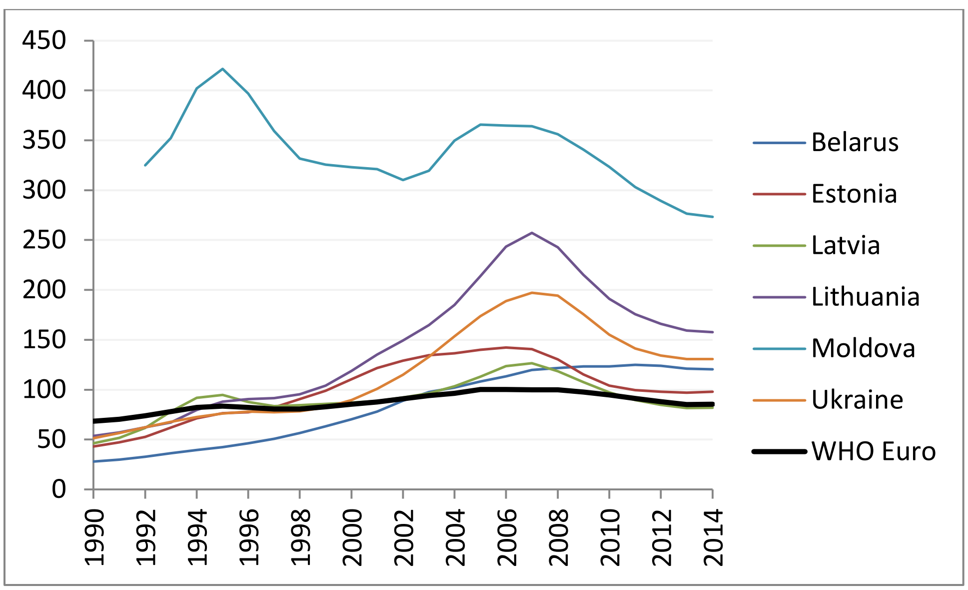


Figure 23: Trends in age-standardized alcohol-attributable adult liver cirrhosis mortality for Belarus, Estonia, Latvia, Lithuania, Moldova, and Ukraine, 1990-2014 (rates per 1,000,000)

Although all Eastern European countries displayed in Figure 22 except Moldova started with alcohol-attributable liver cirrhosis rates below the average of the WHO European region, since the turn of the century, their rates are considerably higher. For the past few years, liver cirrhosis rates have been going down in most of these countries, and in consequence, alcohol attributable rates have been going down as well. There is no clear reason for this phenomenon in the countries in Figure 23, but the rates seem to go down when economic recession started, and for the countries in Figure 23 were hit very hardly by recession. Economic recession is linked to consumption in a complex way,[59] but overall evidence supports a causal effect that due to tighter budget constraints, less money is spent on alcoholic beverages. Such an effect would be most relevant for countries with lower economic wealth such as those in the Eastern part of the EU (at least within Europe). However, while consumption levels in these countries in the Central and Eastern part of WHO European region, went up again after the recession (Figure 6), liver cirrhosis rates continued to decline.

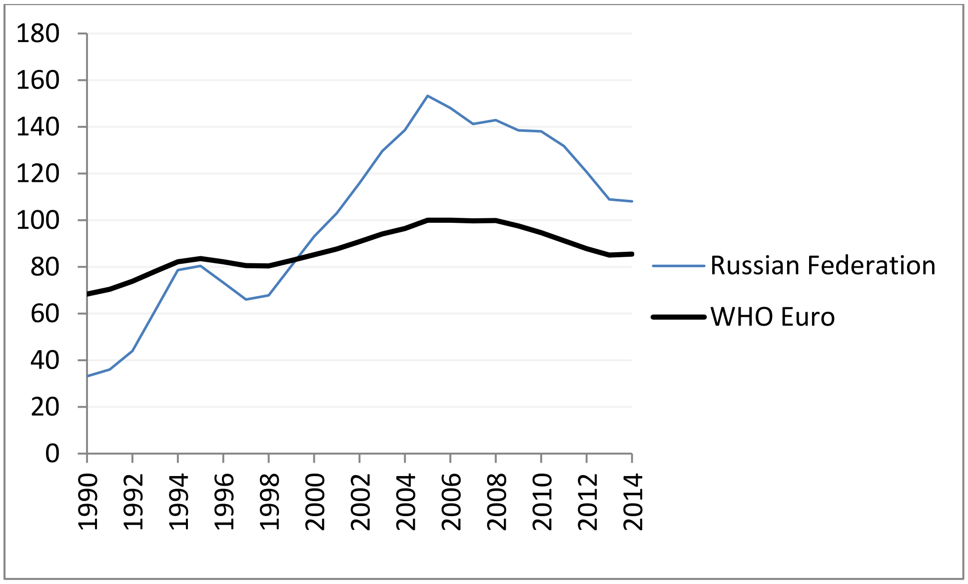


Figure 24: Trends in age-standardized alcohol-attributable adult liver cirrhosis mortality for Russia, 1990-2014 (rates per 1,000,000)

Russia seems to follow the trend of other Eastern European countries with increases in liver cirrhosis rates over the past 25 years, surpassing the WHO European Region average around the year 2000, and decreasing again for the past few years, albeit to back to the level of the region (compare Figure 24 in comparison to Figure 23).

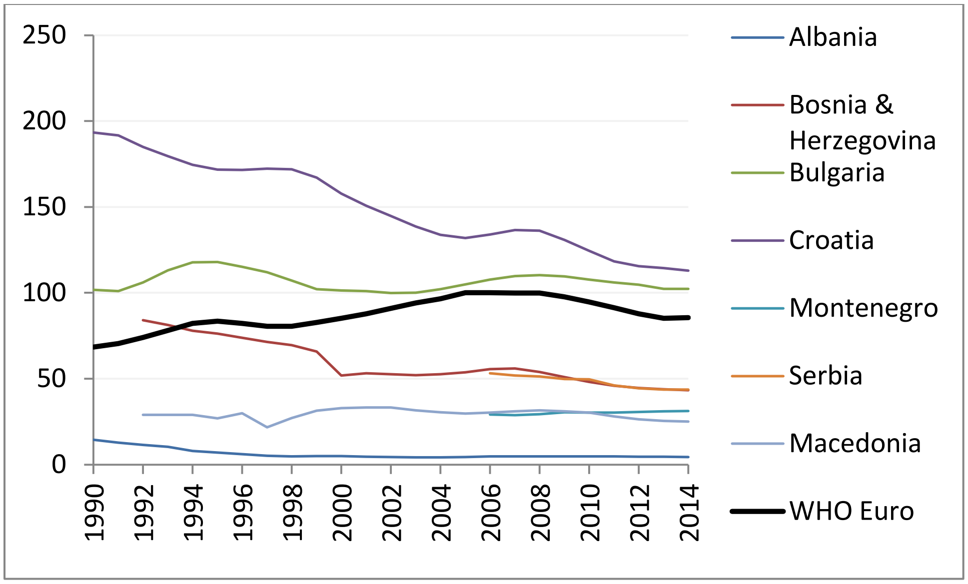


Figure 25: Trends in age-standardized alcohol-attributable adult liver cirrhosis mortality Albania, Bosnia & Herzegovina, Bulgaria, Croatia, Montenegro, Serbia, and TFYR Macedonia, 1990-2014 (rates per 1,000,000)

As with consumption (see Figure 8), countries in Central South Eastern Europe are both below and above the WHO European Region average for alcohol-attributable liver cirrhosis mortality (Figure 25). Croatia has the highest rate, and has a relatively high production of spirits from fruits with stones (see above).

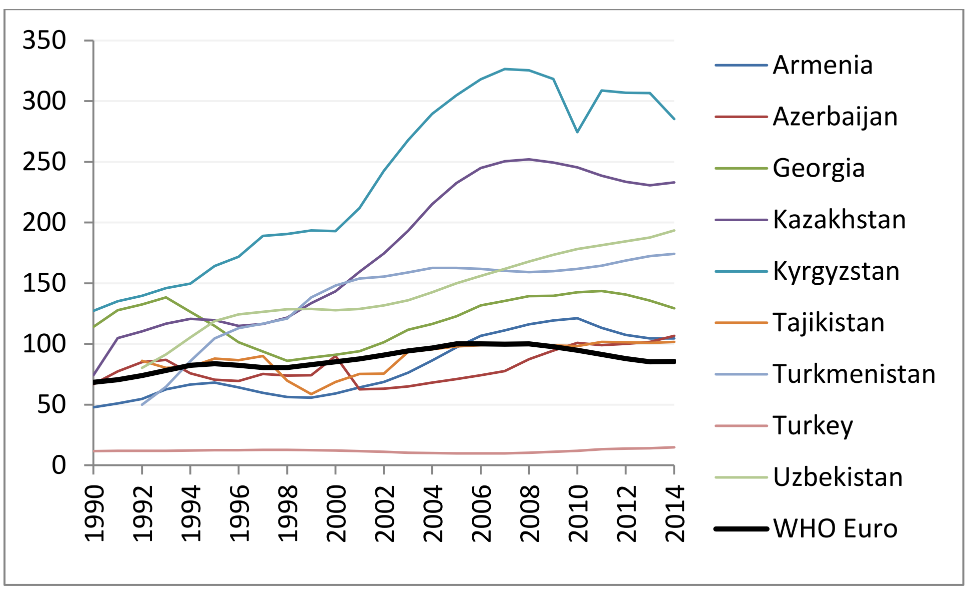


Figure 26: Trends in age-standardized alcohol-attributable adult liver cirrhosis mortality for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Turkey, and Uzbekistan, 1990-2014 (rates per 1,000,000)

In 2014, all of the countries in the South Eastern part of the WHO European Region with the exception of Turkey had higher alcohol-attributable liver cirrhosis mortality rates (Figure 26), even though their consumption was lower than the regional average (Figure 9). As already mentioned, this phenomenon can be partly explained by liver cirrhosis incidence due to risk factors accompanying the alcohol, with the alcohol also playing a role in the mortality. Also, it should be also noted that the used methodology for comparative risk assessment contributed to this finding by not adequately controlling for other risk factors.

Alcohol-attributable cancer mortality burden

Figures 27 to 35 show the age-standardized alcohol-attributable cancer mortality rates for the various clusters of countries. As indicated above, the overall variability of cancer mortality rates both within and between countries is much lower than for other cause of death categories; thus, the variation in alcohol-attributable cancer morality is mainly based on differences in the level of overall alcohol exposure (as expressed in adult *per capita* consumption of alcohol; see above). As a result, despite the overall limited variation, the following regional tendencies can be distinguished: most Mediterranean, Nordic, Central Western EU and South East WHO European Region countries were below the WHO European region average, whereas most of the Central Eastern EU and Eastern European countries including Russia were above the EU average.

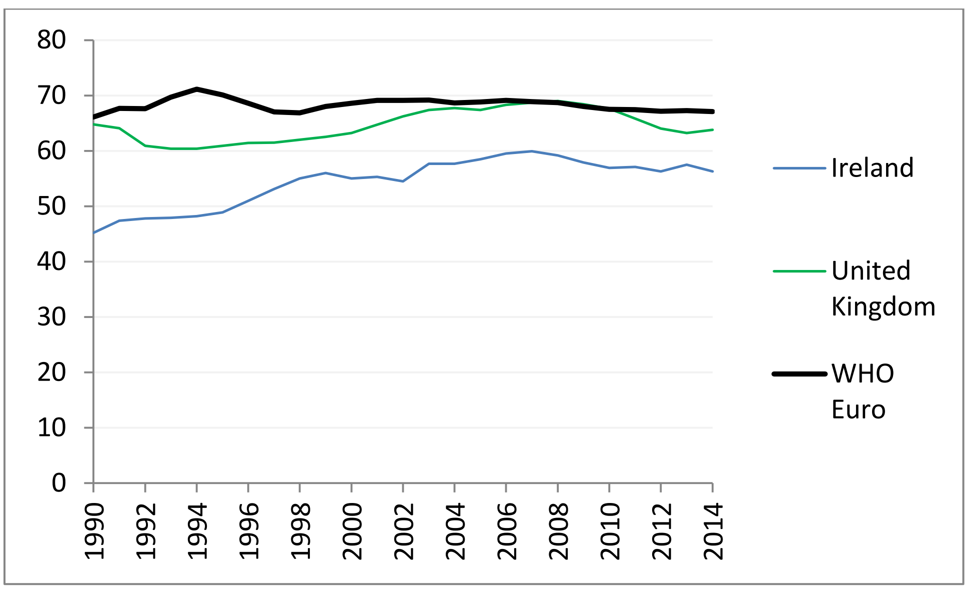


Figure 27: Trends in age-standardized alcohol-attributable adult cancer mortality for Ireland and United Kingdom, 1990-2014 (rates per 1,000,000)

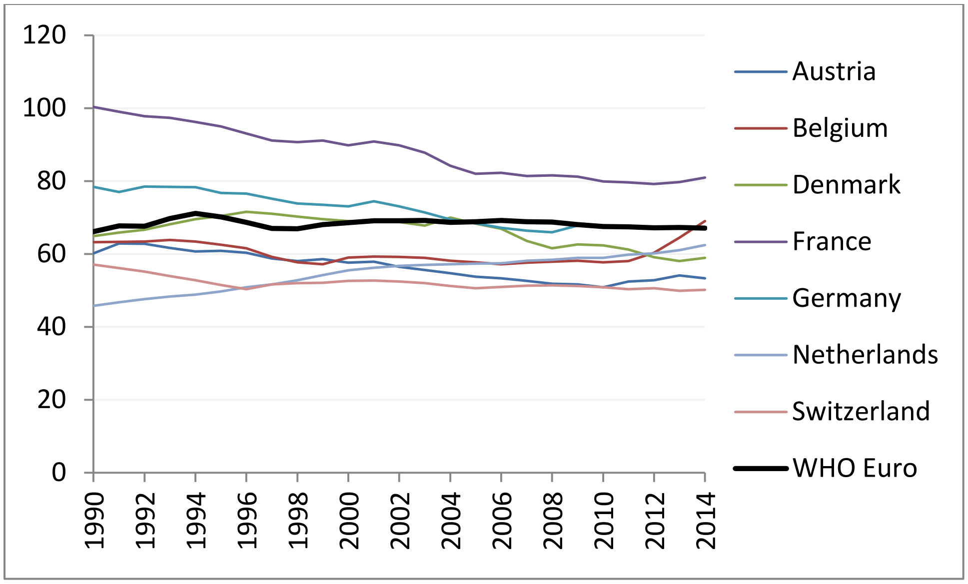


Figure 28: Trends in age-standardized alcohol-attributable adult cancer mortality for Austria, Belgium, Denmark, France, Germany, Netherlands, and Switzerland, 1990-2014 (rates per 1,000,000)

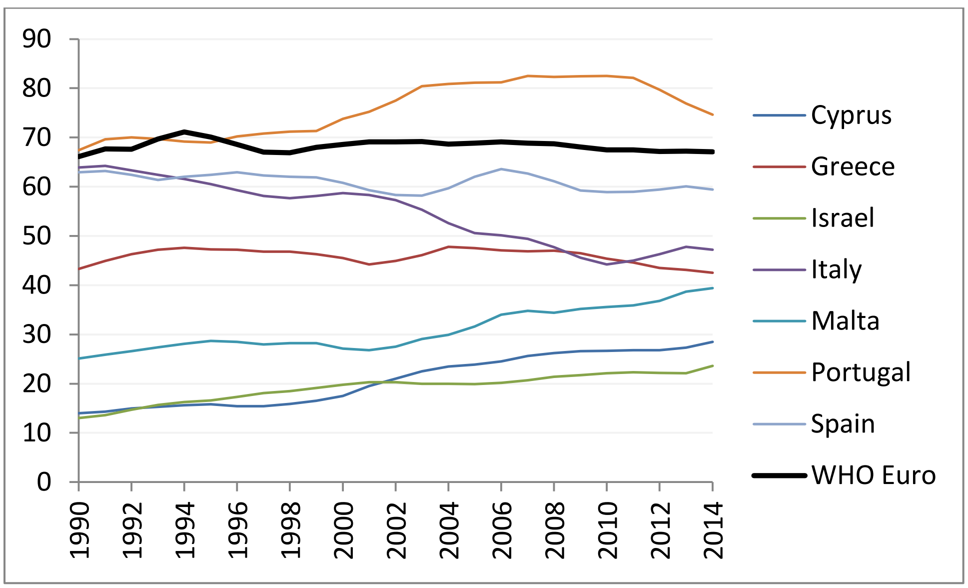


Figure 29: Trends in age-standardized alcohol-attributable adult cancer mortality for Cyprus, Greece, Israel, Italy, Malta, Portugal, and Spain, 1990-2014 (rates per 1,000,000)

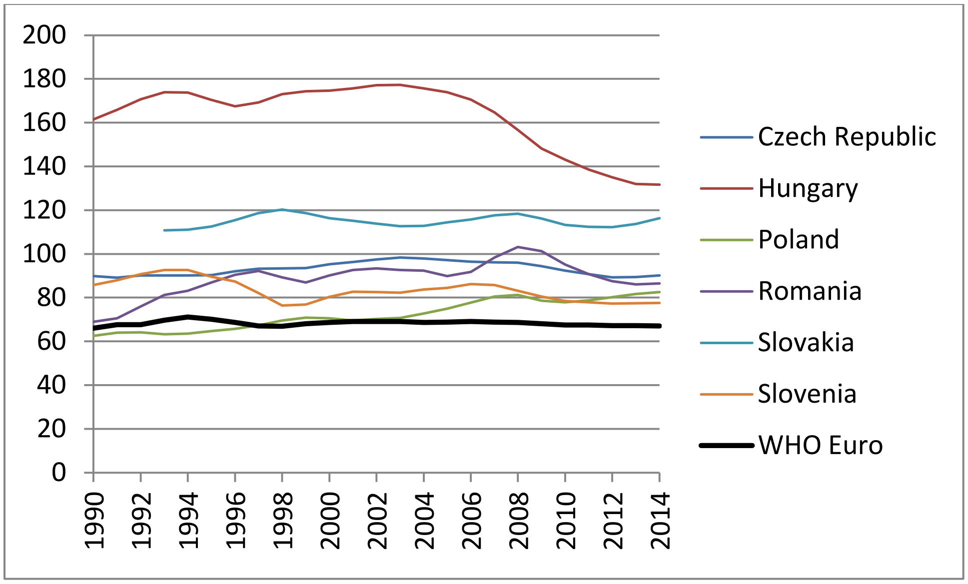


Figure 30: Trends in age-standardized alcohol-attributable adult cancer mortality for Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia, 1990-2014 (rates per 1,000,000)

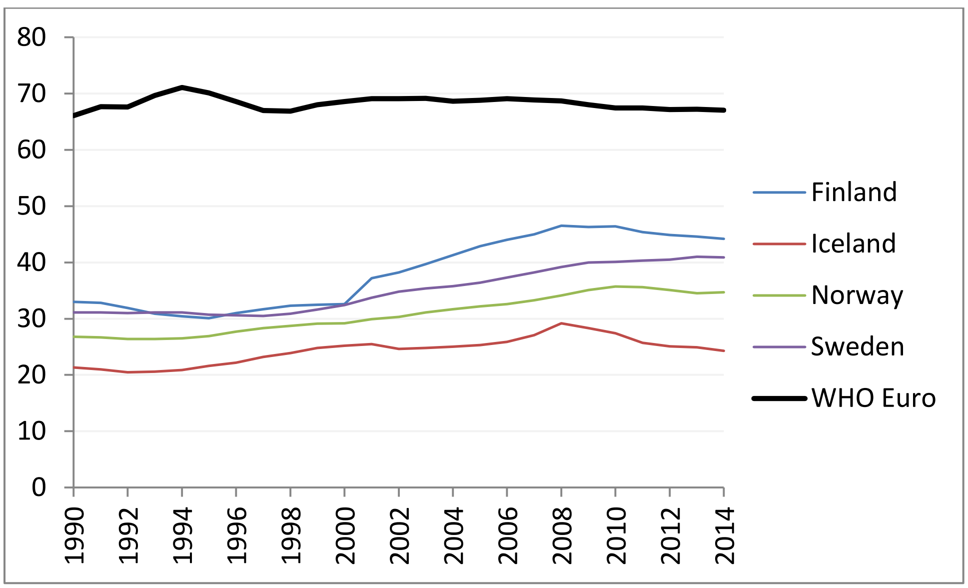


Figure 31: Trends in age-standardized alcohol-attributable adult cancer mortality for Finland, Iceland, Norway, and Sweden, 1990-2014 (rates per 1,000,000)

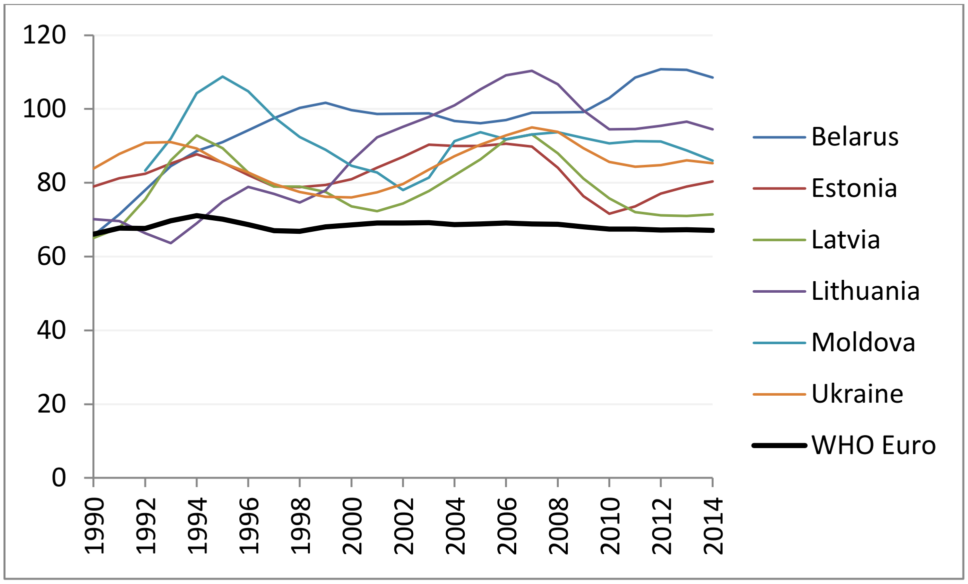


Figure 32: Trends in age-standardized alcohol-attributable adult cancer mortality for Belarus, Estonia, Latvia, Lithuania, Moldova, and Ukraine, 1990-2014 (rates per 1,000,000)

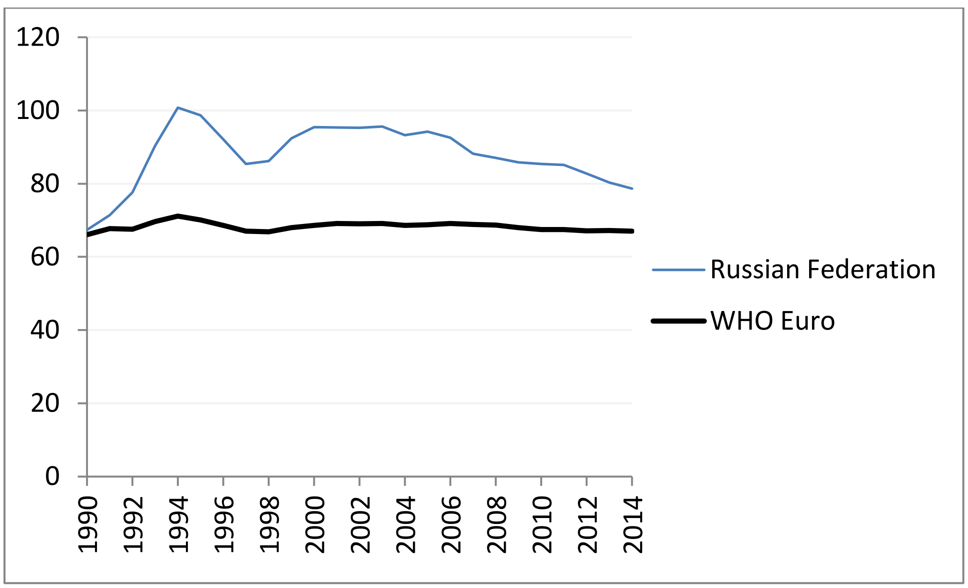


Figure 33: Trends in age-standardized alcohol-attributable adult cancer mortality for Russia, 1990-2014 (rates per 1,000,000)

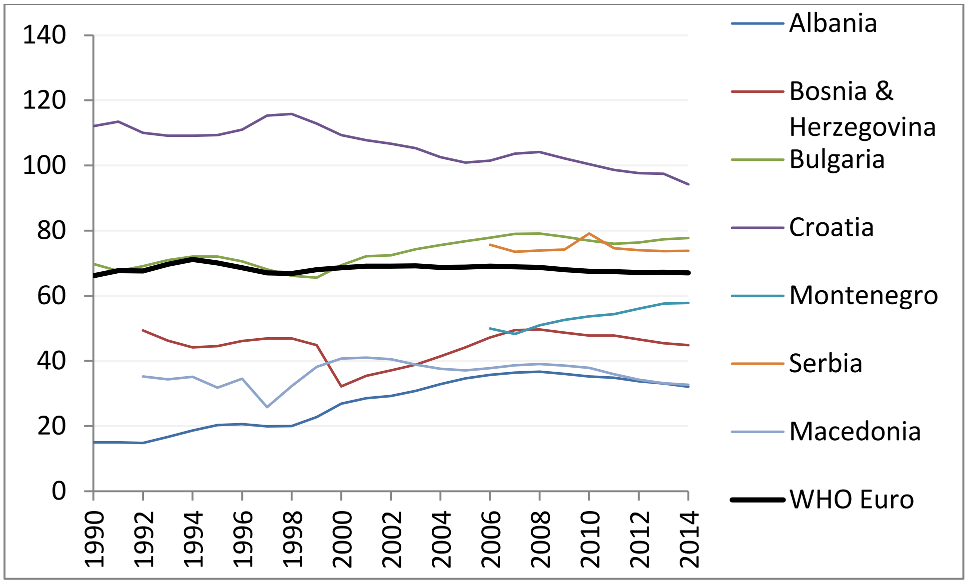


Figure 34: Trends in age-standardized alcohol-attributable adult cancer mortality for Albania, Bosnia & Herzegovina, Bulgaria, Croatia, Montenegro, Serbia, and TFYR Macedonia, 1990-2014 (rates per 1,000,000)

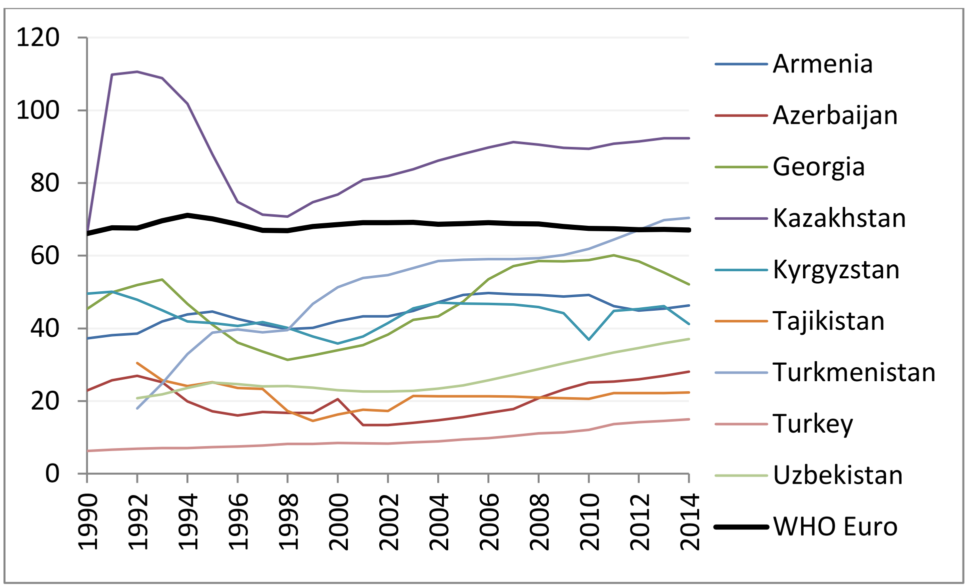


Figure 35: Trends in age-standardized alcohol-attributable adult cancer mortality for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Turkey, and Uzbekistan, 1990-2014 (rates per 1,000,000)

Alcohol-attributable cardiovascular mortality burden

Figures 36 to 44 shows alcohol-attributable cardiovascular mortality burden for the different clusters of countries. It shows basically a dichotomous picture: Russia and some surrounding countries (Belarus, Kazakhstan, Kyrgyzstan, Moldova, and Ukraine) are above the WHO European Region average, for some countries considerably, whereas most other countries are markedly below this average.

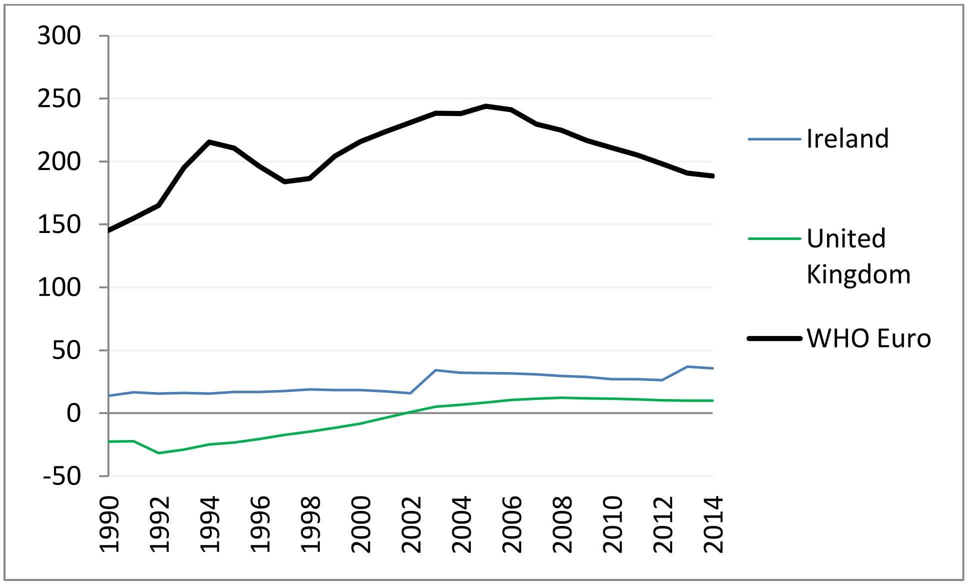


Figure 36: Trends in age-standardized alcohol-attributable cardiovascular mortality for Ireland and United Kingdom, 1990-2014 (rates per 1,000,000)

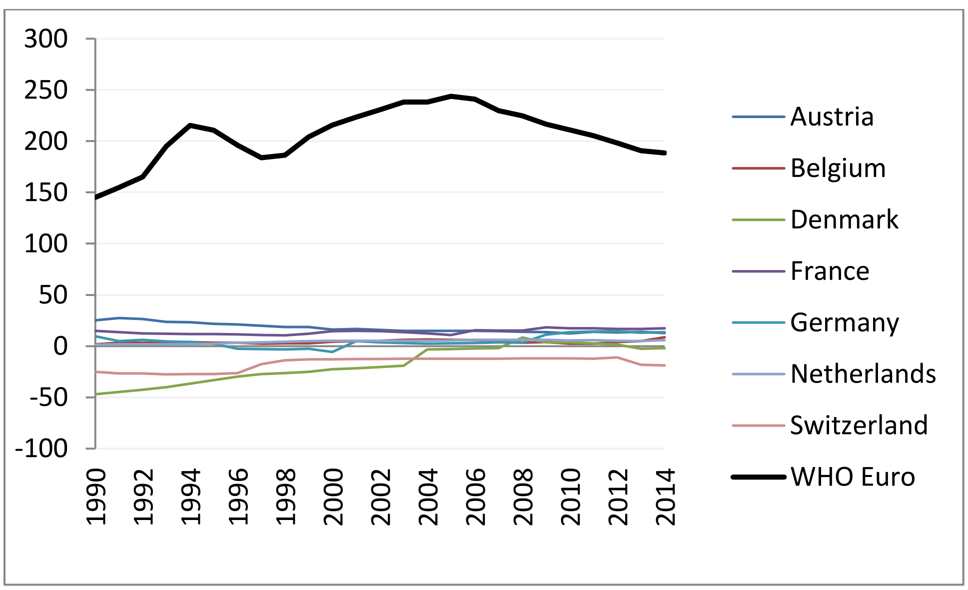


Figure 37: Trends in age-standardized alcohol-attributable adult cardiovascular mortality for Austria, Belgium, Denmark, France, Germany, Netherlands, and Switzerland, 1990-2014 (rates per 1,000,000)

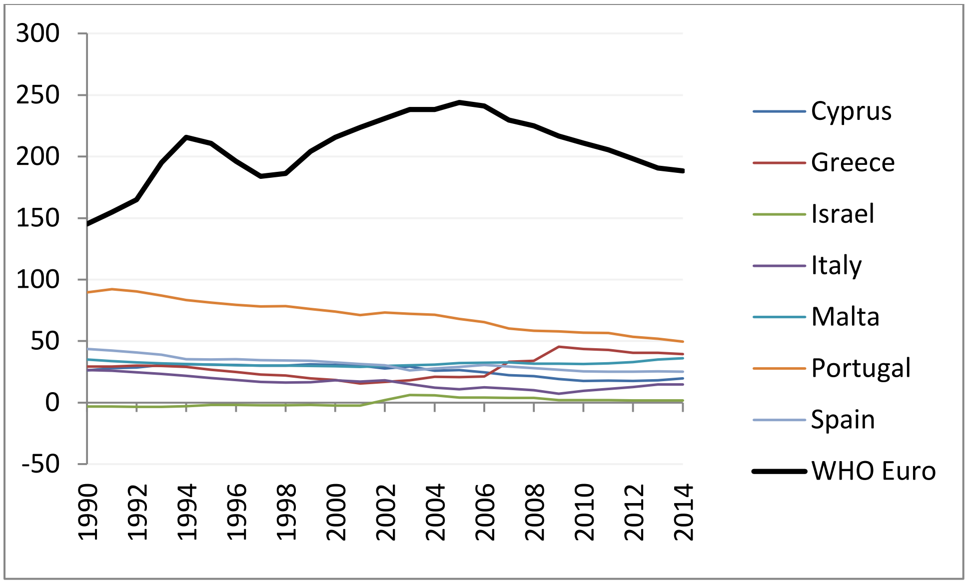


Figure 38: Trends in age-standardized alcohol-attributable adult cardiovascular mortality for Cyprus, Greece, Israel, Italy, Malta, Portugal, and Spain, 1990-2014 (rates per 1,000,000)

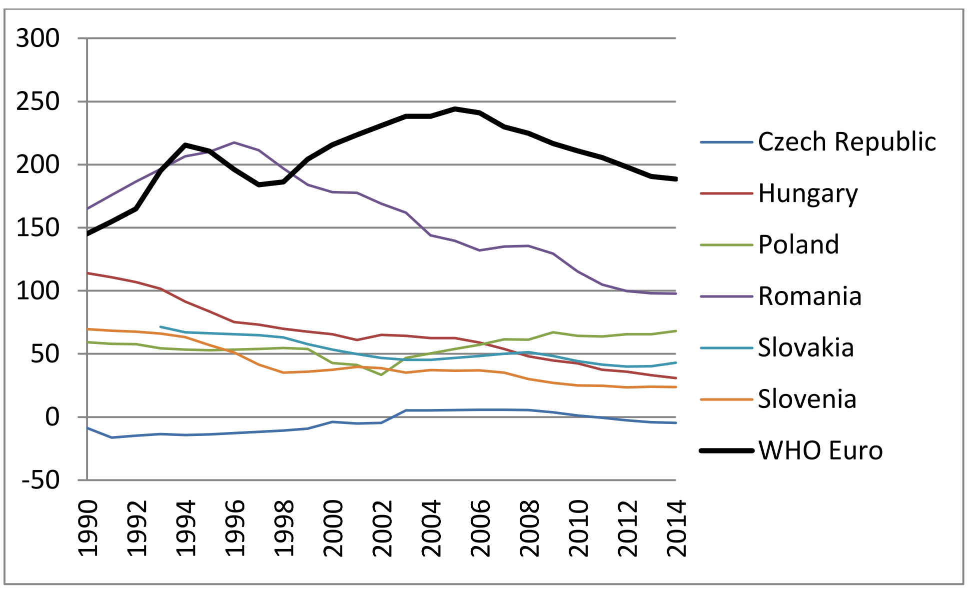


Figure 39: Trends in age-standardized alcohol-attributable adult cardiovascular mortality for Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia, 1990-2014 (rates per 1,000,000)

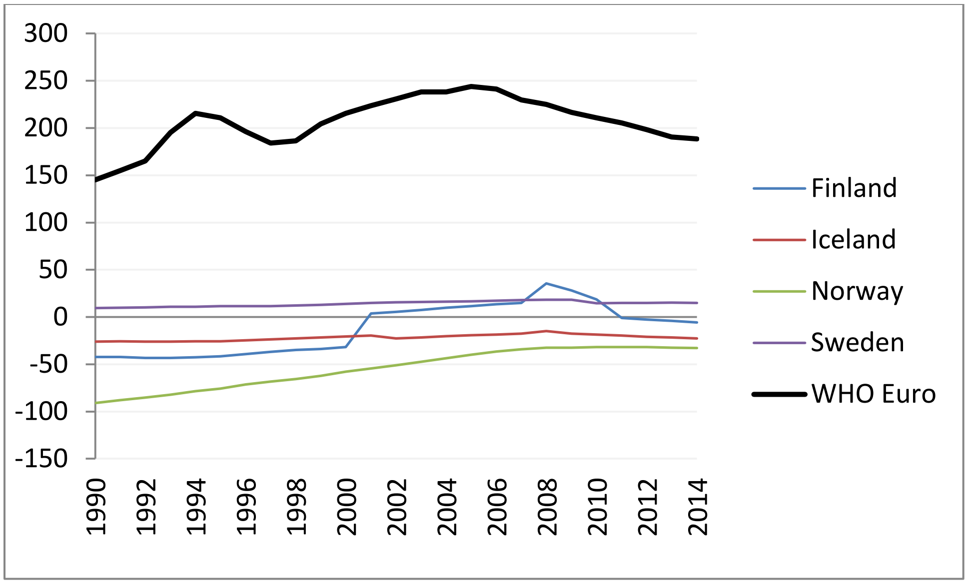


Figure 40: Trends in age-standardized alcohol-attributable adult cardiovascular mortality for Finland, Iceland, Norway, and Sweden, 1990-2014 (rates per 1,000,000)

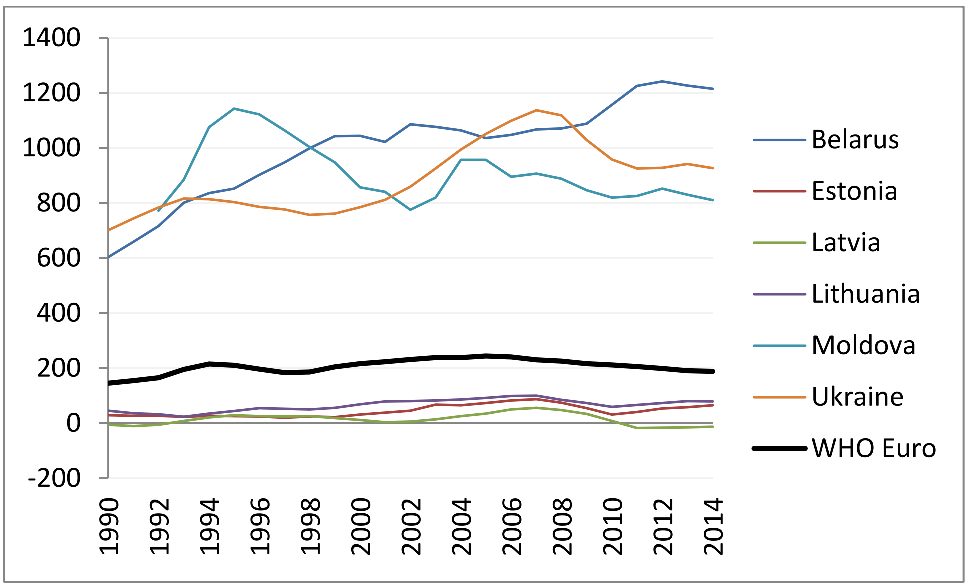


Figure 41: Trends in age-standardized alcohol-attributable adult cardiovascular mortality for Belarus, Estonia, Latvia, Lithuania, Moldova, and Ukraine, 1990-2014 (rates per 1,000,000)

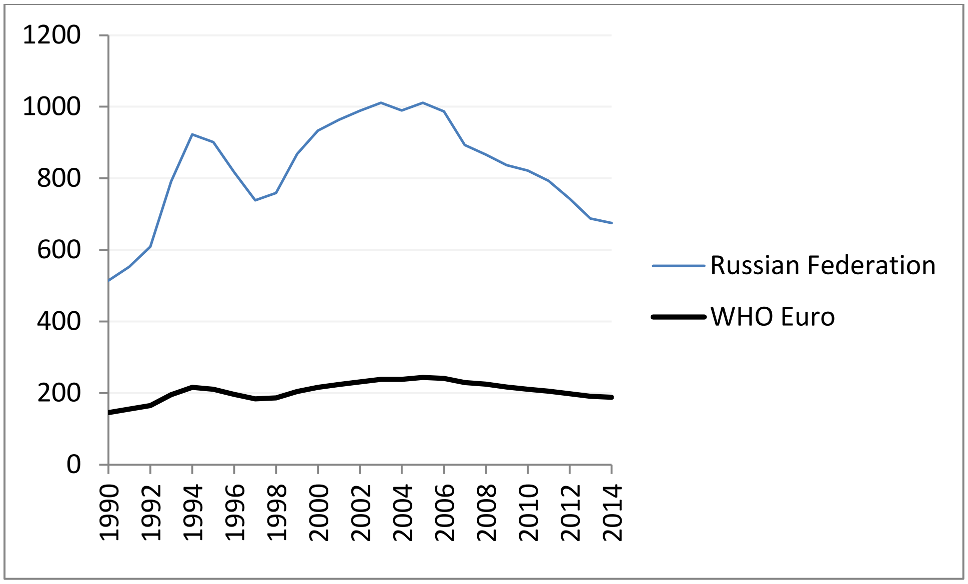


Figure 42: Trends in age-standardized alcohol-attributable adult cardiovascular mortality for Russia, 1990-2014 (rates per 1,000,000)

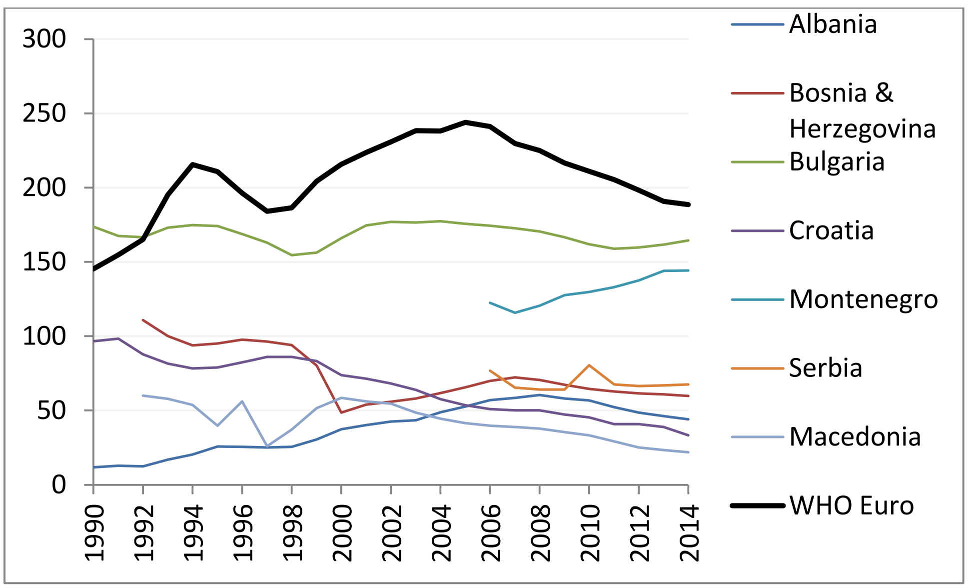


Figure 43: Trends in age-standardized alcohol-attributable adult cardiovascular mortality for Albania, Bosnia & Herzegovina, Bulgaria, Croatia, Montenegro, Serbia, and TFYR Macedonia, 1990-2014 (rates per 1,000,000)

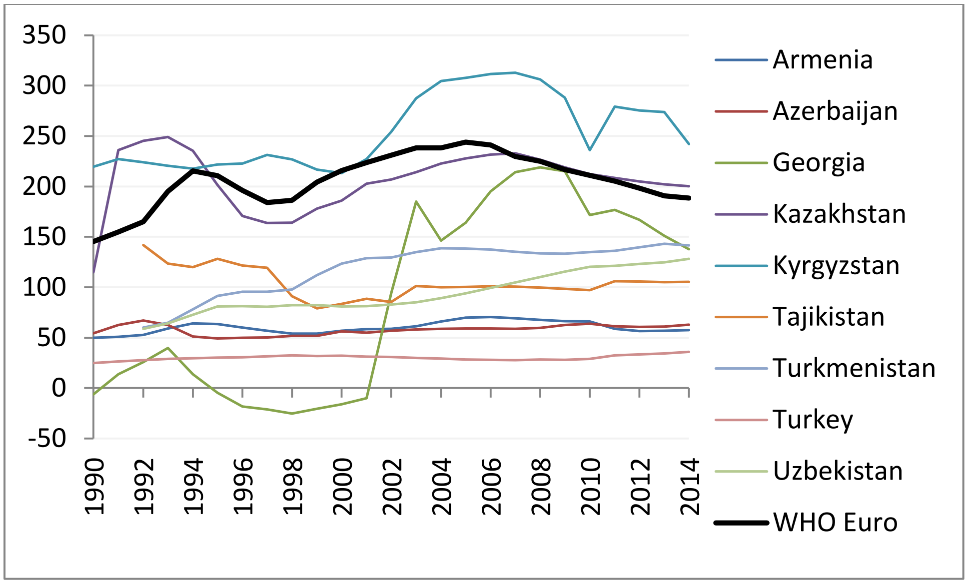


Figure 44: Trends in age-standardized alcohol-attributable adult cardiovascular mortality for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Turkey, and Uzbekistan, 1990-2014 (rates per 1,000,000)

Alcohol-attributable injury mortality burden

Injury burden has been decreasing over the past decades globally, and in Europe as well.[159] As Figures 45-53 show for all injuries, Figures 54-62 for intentional injury and Figures 63-71 for unintentional injury, the same is true for alcohol-attributable injury mortality [FN17], albeit to a substantially lower degree (decrease in age-standardized mortality rate for all injury: -25%; alcohol-attributable: -19%; for intentional injury: -9%, alcohol-attributable: -5%; for unintentional injury: - 33%; alcohol-attributable: -27%).

Moreover, it is striking that the countries with the highest alcohol-attributable injury mortality seem to reduce less (see also for regions below), and in some cases even increased their rates: for WHO European Region, the standardized mortality rate for all alcohol-attributable injury decreased by 19%, but of the 3 countries with the highest such mortality, one had a marked increase (Belarus: + 41%), one a slight decrease (Russia: -5%) and one about the average decrease (Ukraine: -17%). For intentional injury, the overall decrease was 5%, but all three countries increased their age-standardized alcohol-attributable intentional injury mortality (Belarus: +61%; Russia: +10%; Ukraine: +1%). Finally, for unintentional injury, the overall decrease was -27%, with a 27% increase in Belarus, and decreases of 17% and 28% in Russia and the Ukraine, respectively.

[FN17] The trend was characterized by an increase in age-standardized mortality first, with the decrease happening in the last decade.

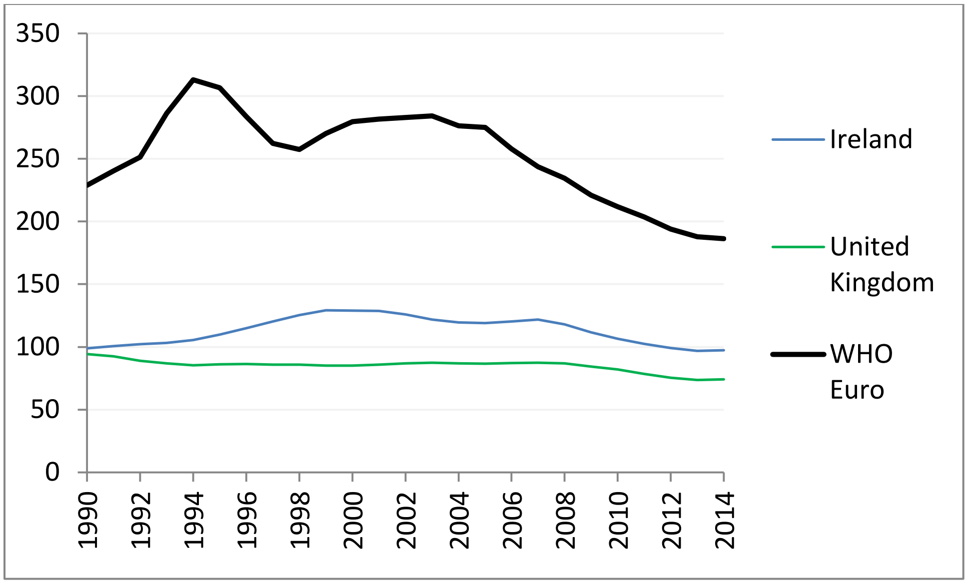


Figure 45: Trends in age-standardized alcohol-attributable adult injury mortality for Ireland and United Kingdom, 1990-2014 (rates per 1,000,000)

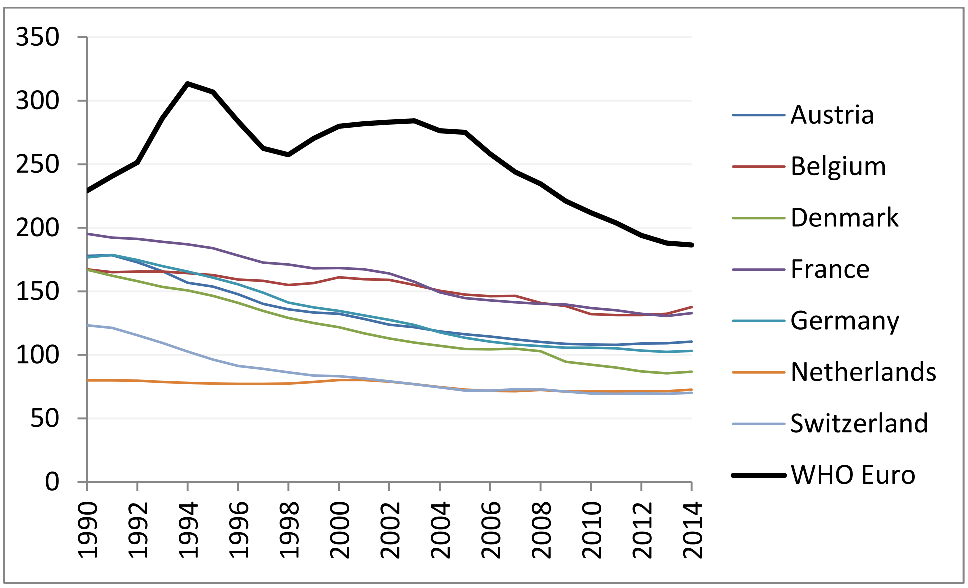


Figure 46: Trends in age-standardized alcohol-attributable adult injury mortality for Austria, Belgium, Denmark, France, Germany, Netherlands, and Switzerland, 1990-2014 (rates per 1,000,000)

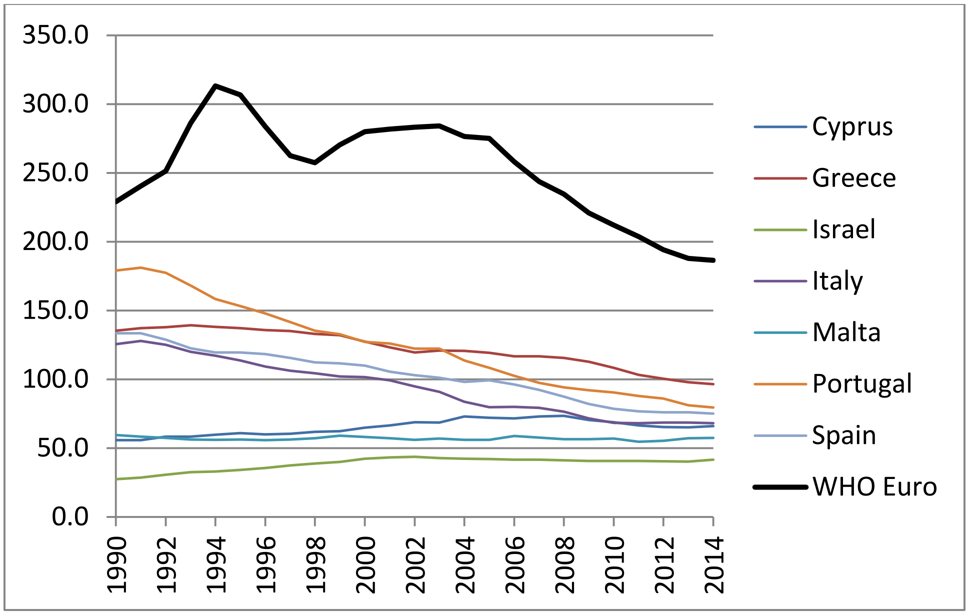


Figure 47: Trends in age-standardized alcohol-attributable adult injury mortality for Cyprus, Greece, Israel, Italy, Malta, Portugal, and Spain, 1990-2014 (rates per 1,000,000)

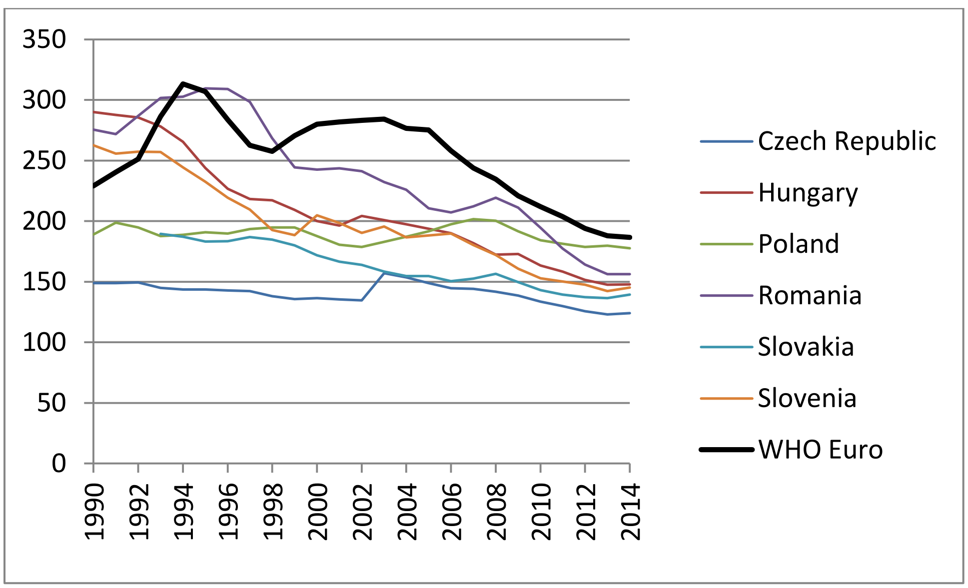


Figure 48: Trends in age-standardized alcohol-attributable adult injury mortality for Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia, 1990-2014 (rates per 1,000,000)

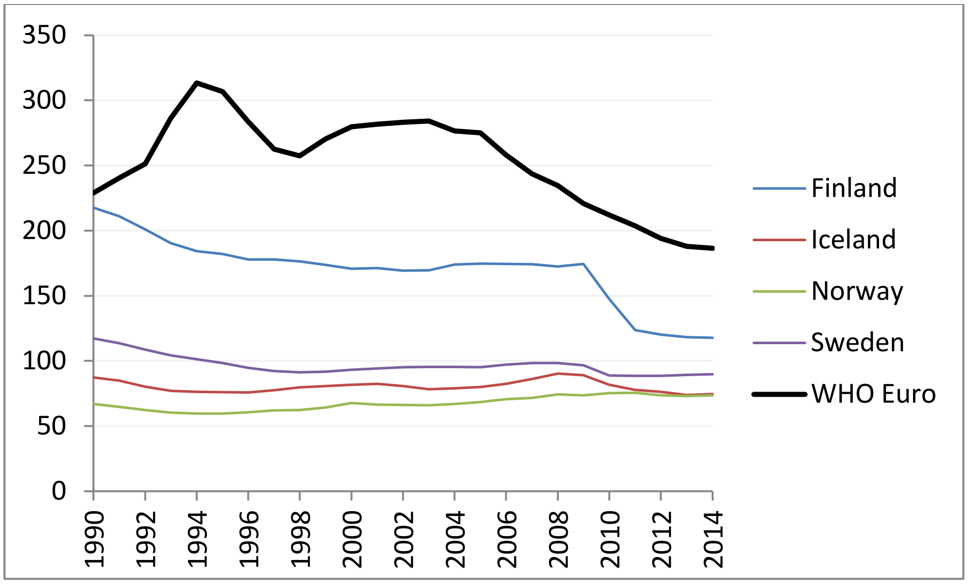


Figure 49: Trends in age-standardized alcohol-attributable adult injury mortality for Finland, Iceland, Norway, and Sweden, 1990-2014 (rates per 1,000,000)

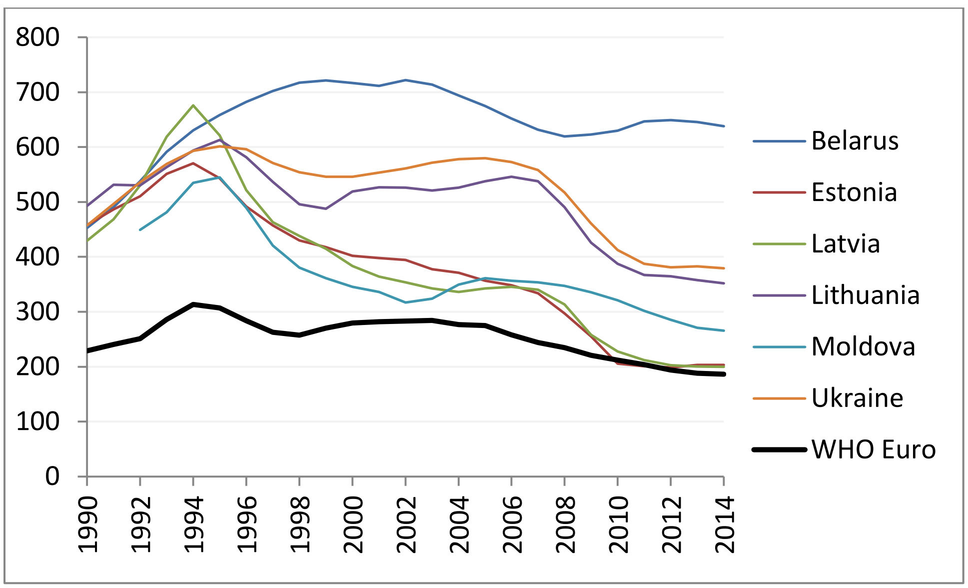


Figure 50: Trends in age-standardized alcohol-attributable adult injury mortality for Belarus, Estonia, Latvia, Lithuania, Moldova, and Ukraine, 1990-2014 (rates per 1,000,000)

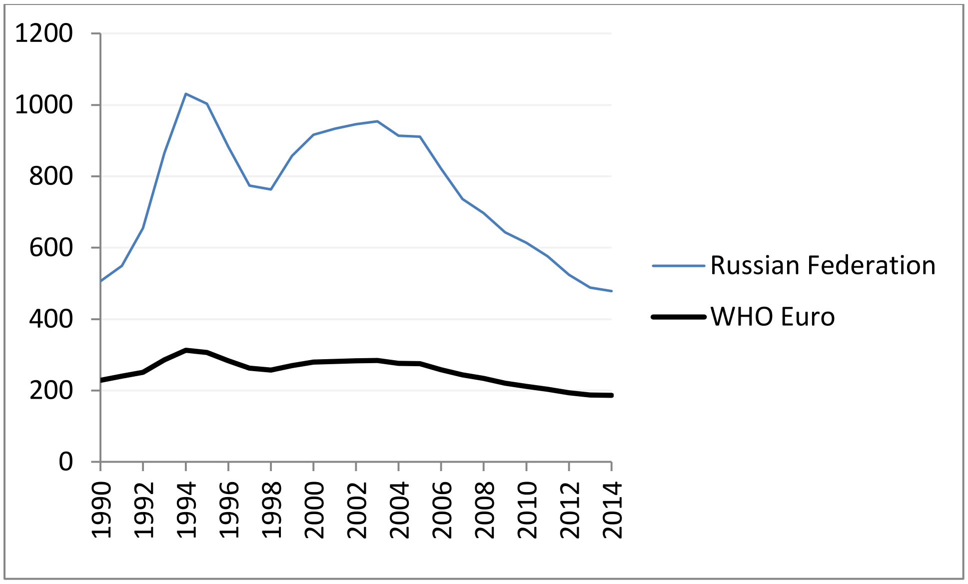


Figure 51: Trends in age-standardized alcohol-attributable adult injury mortality for Russia, 1990-2014 (rates per 1,000,000)

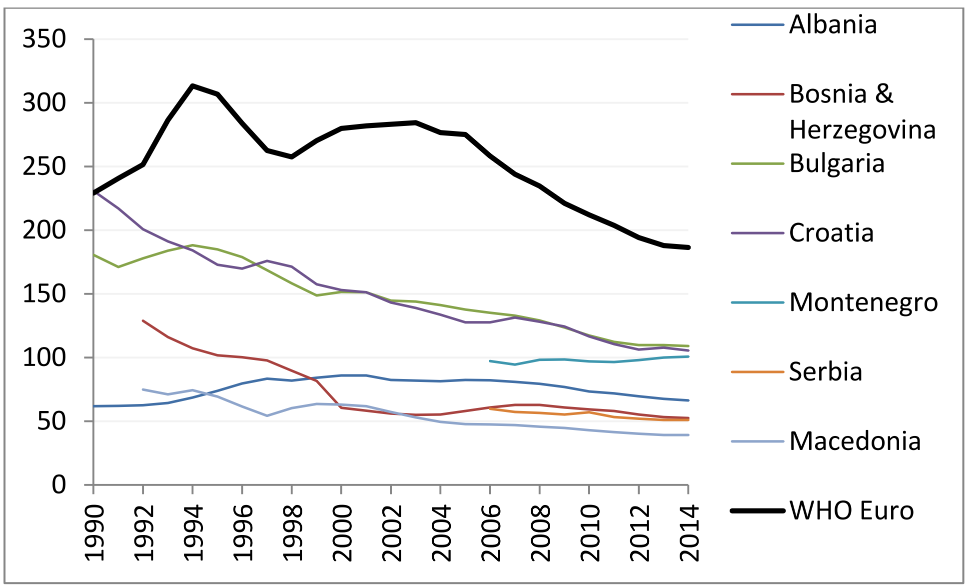


Figure 52: Trends in age-standardized alcohol-attributable adult injury mortality for Albania, Bosnia & Herzegovina, Bulgaria, Croatia, Montenegro, Serbia, and TFYR Macedonia, 1990-2014 (rates per 1,000,000)

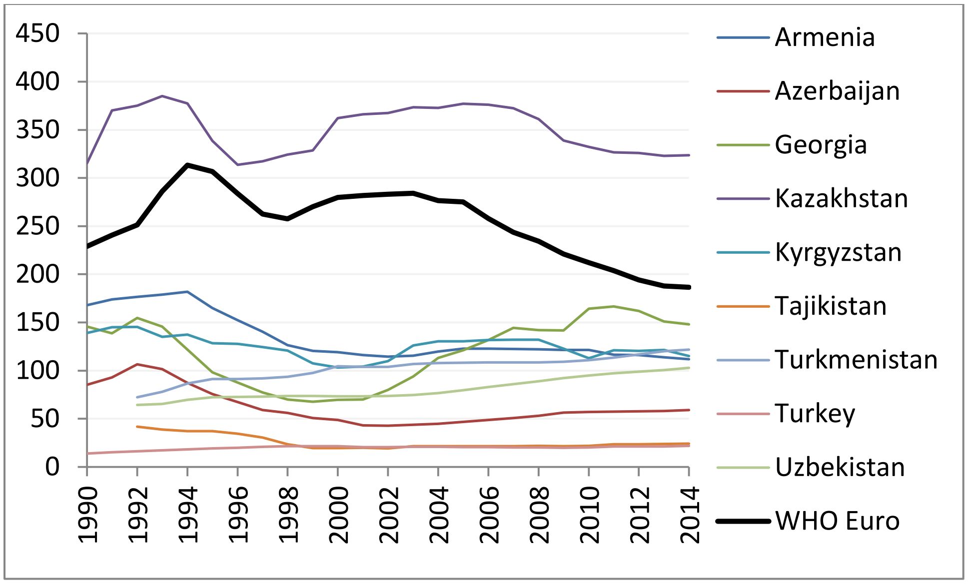


Figure 53: Trends in age-standardized alcohol-attributable adult injury mortality for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Turkey, and Uzbekistan, 1990-2014 (rates per 1,000,000)

Alcohol-attributable unintentional injury mortality burden

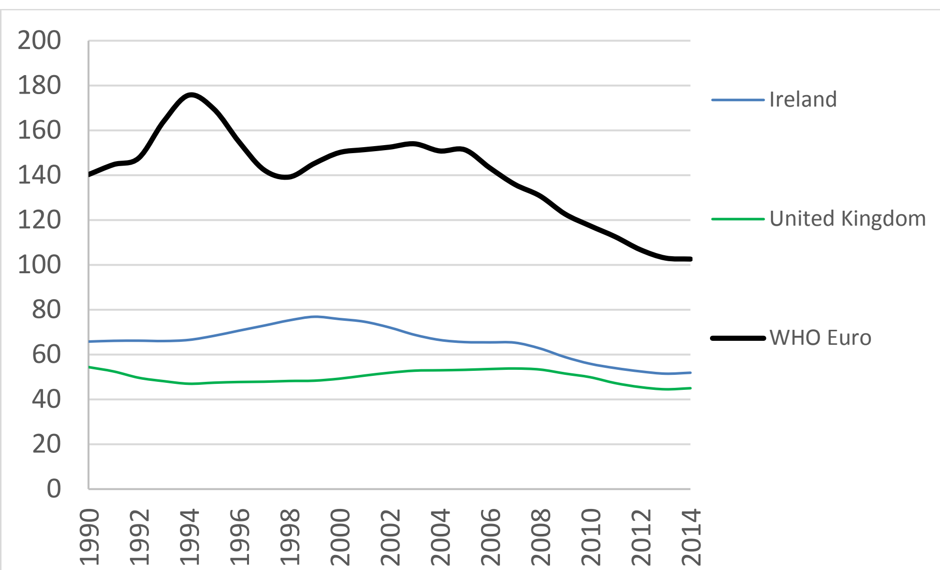


Figure 54: Trends in age-standardized alcohol-attributable adult unintentional injury mortality for Ireland and United Kingdom, 1990-2014 (rates per 1,000,000)

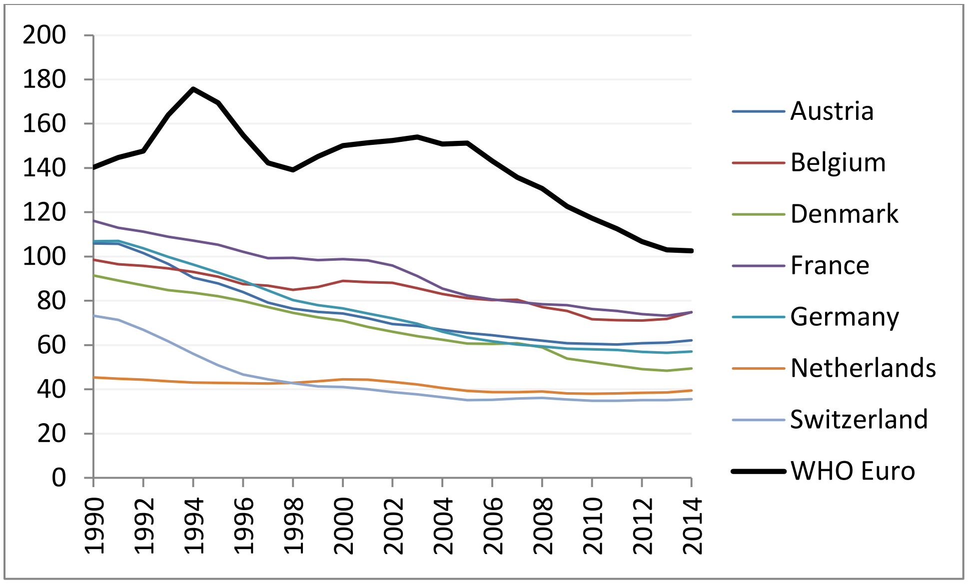


Figure 55: Trends in age-standardized alcohol-attributable adult unintentional injury mortality for Austria, Belgium, Denmark, France, Germany, Netherlands, and Switzerland, 1990-2014 (rates per 1,000,000)

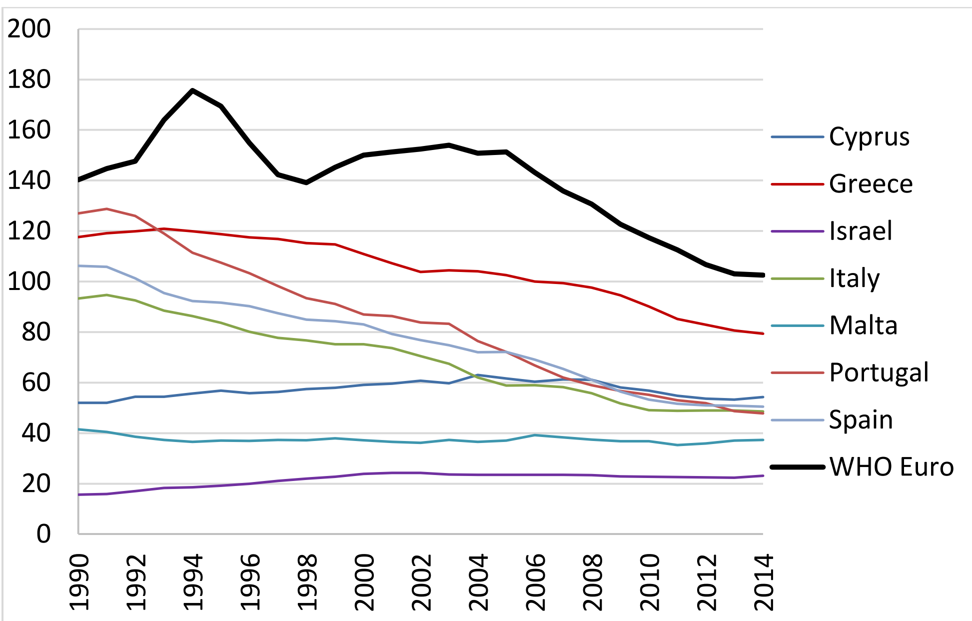


Figure 56: Trends in age-standardized alcohol-attributable adult unintentional injury mortality for Cyprus, Greece, Israel, Italy, Malta, Portugal, and Spain, 1990-2014 (rates per 1,000,000)

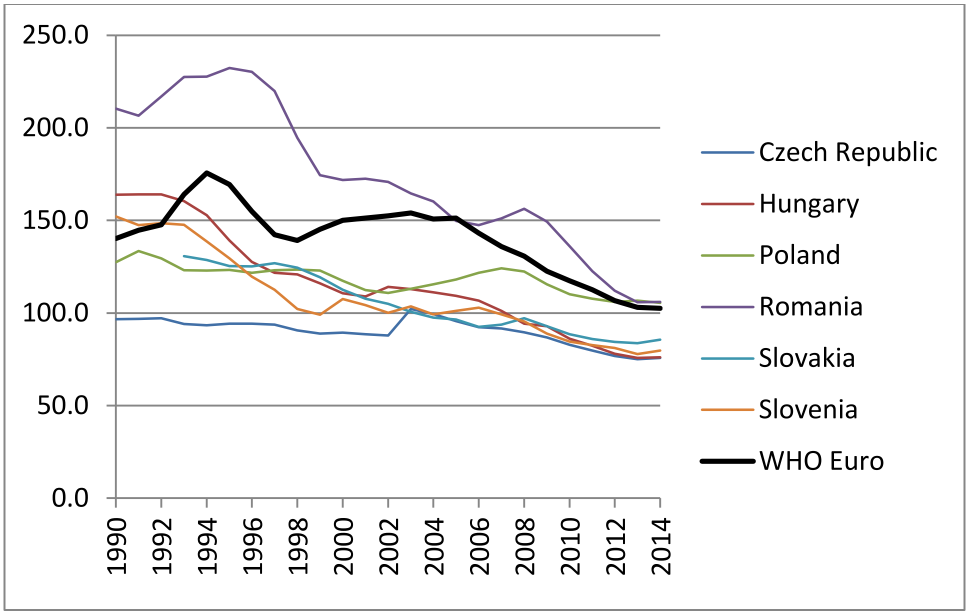


Figure 57: Trends in age-standardized alcohol-attributable adult unintentional injury mortality for Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia, 1990-2014 (rates per 1,000,000)

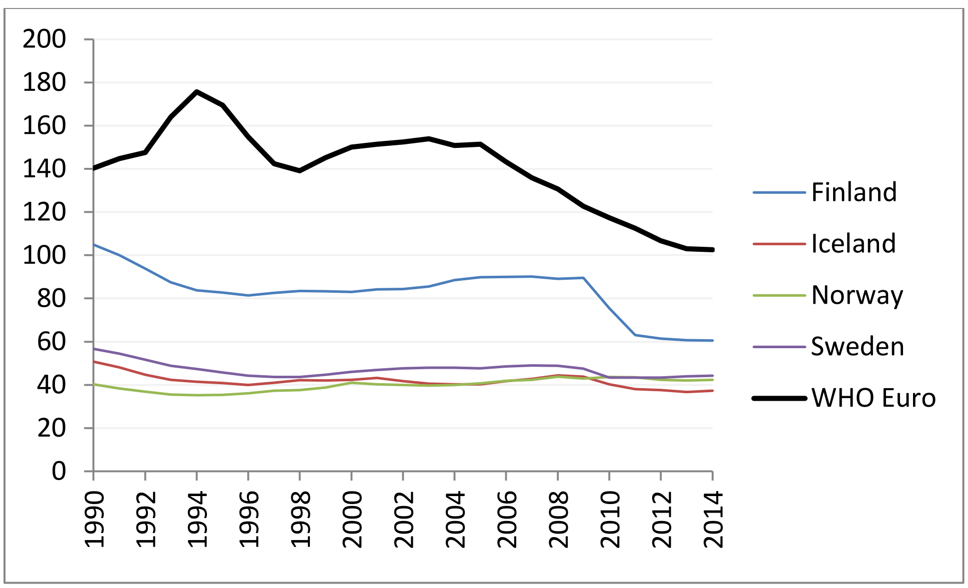


Figure 58: Trends in age-standardized alcohol-attributable adult unintentional injury mortality for Finland, Iceland, Norway, and Sweden, 1990-2014 (rates per 1,000,000)

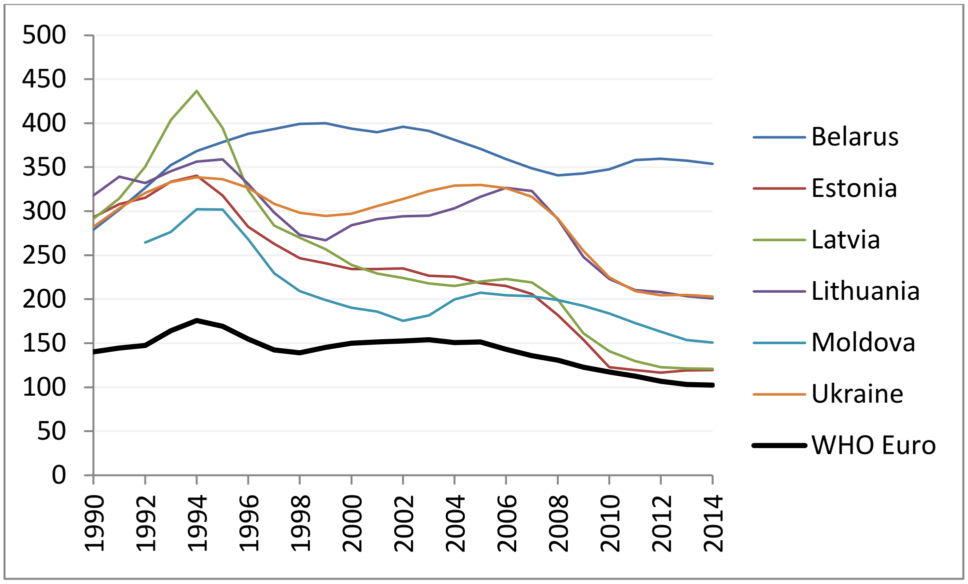


Figure 59: Trends in age-standardized alcohol-attributable adult unintentional injury mortality for Belarus, Estonia, Latvia, Lithuania, Moldova, and Ukraine, 1990-2014 (rates per 1,000,000)

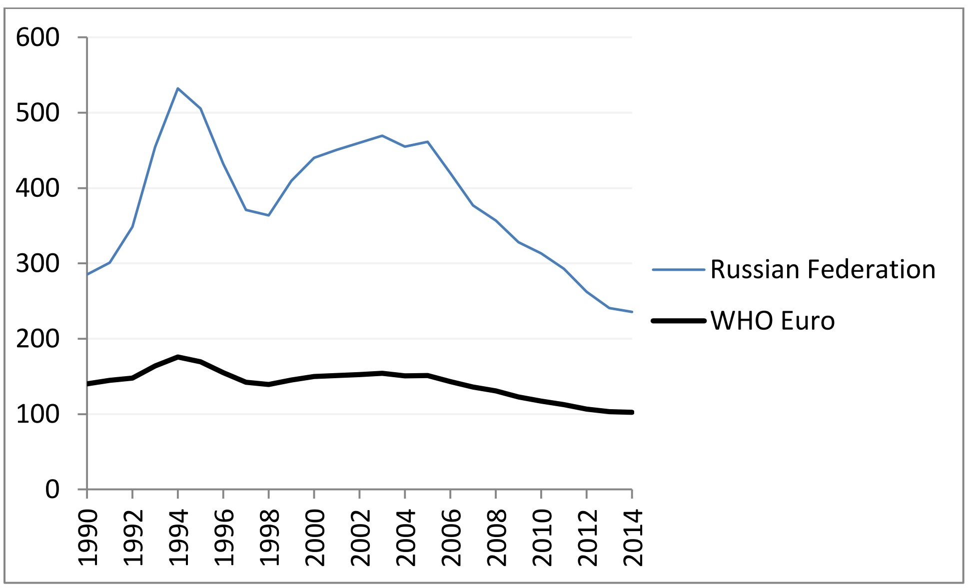


Figure 60: Trends in age-standardized alcohol-attributable adult unintentional injury mortality for Russia, 1990-2014 (rates per 1,000,000)

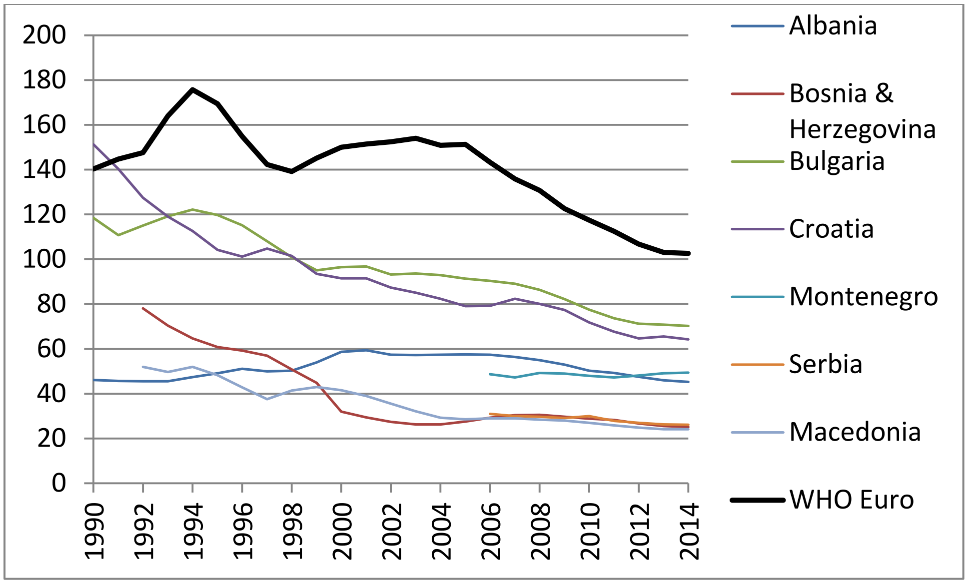


Figure 61: Trends in age-standardized alcohol-attributable adult unintentional injury mortality for Albania, Bosnia & Herzegovina, Bulgaria, Croatia, Montenegro, Serbia, and TFYR Macedonia, 1990-2014 (rates per 1,000,000)

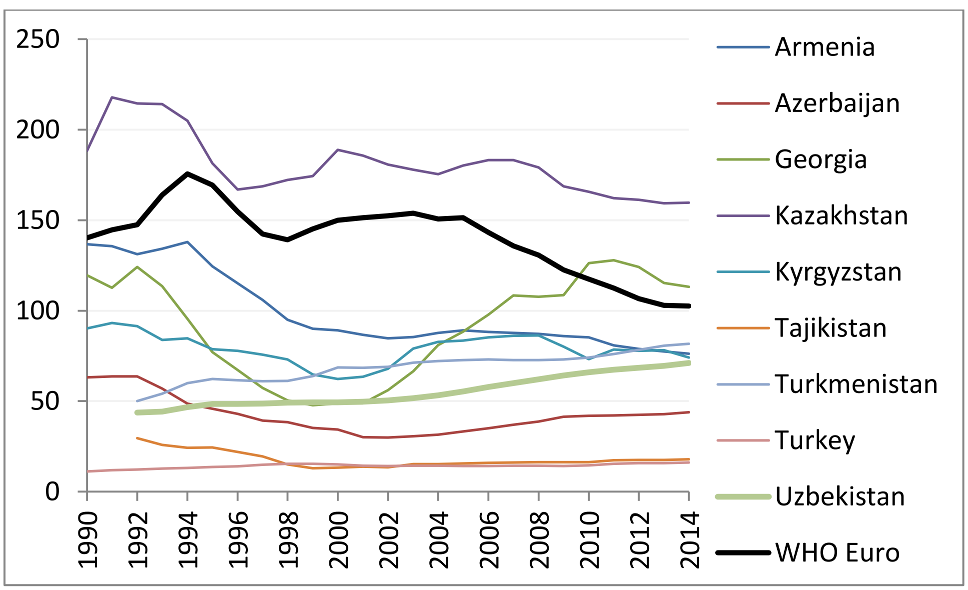


Figure 62: Trends in age-standardized alcohol-attributable adult unintentional injury mortality for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Turkey, and Uzbekistan, 1990-2014 (rates per 1,000,000)

Alcohol-attributable intentional injury mortality burden

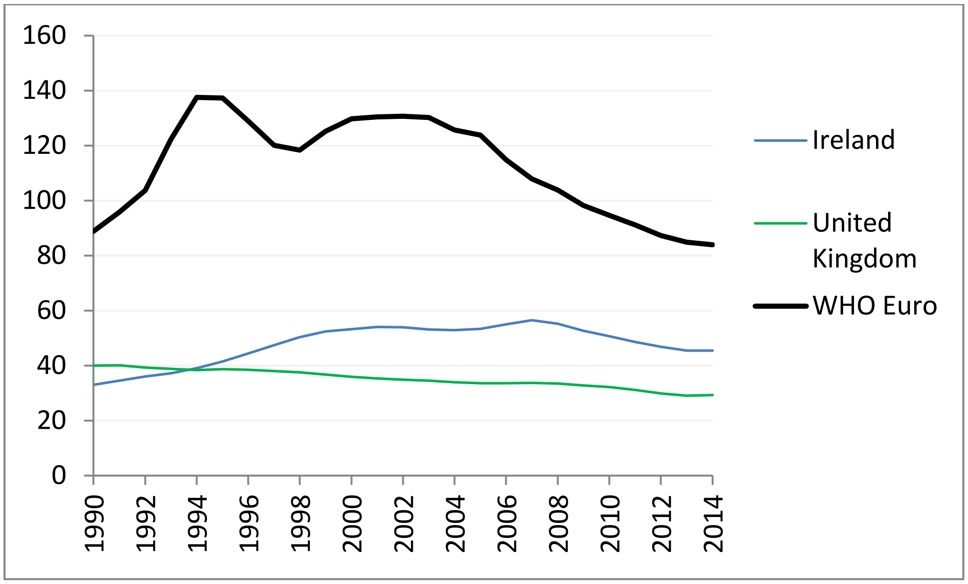


Figure 63: Trends in age-standardized alcohol-attributable adult intentional injury mortality for Ireland and United Kingdom, 1990-2014 (rates per 1,000,000)

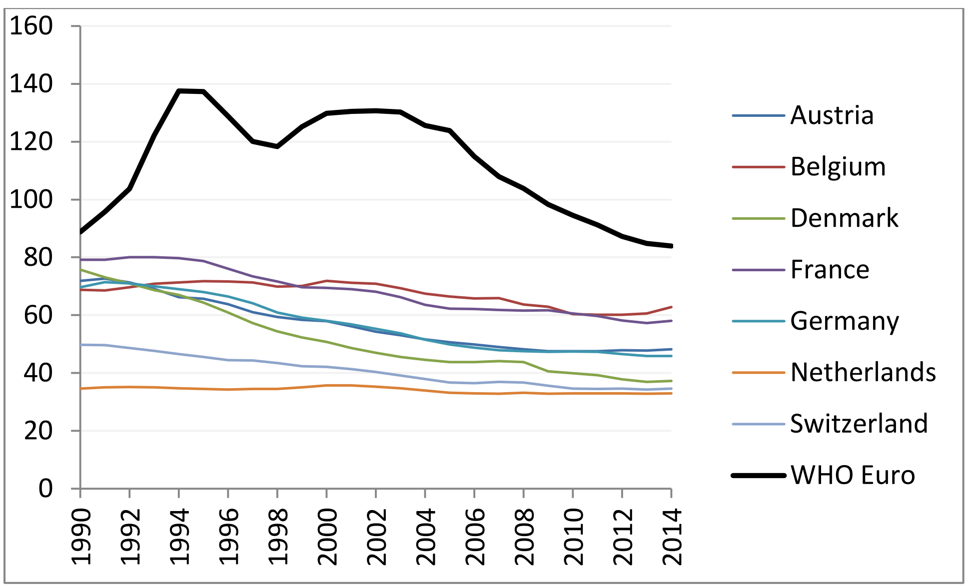


Figure 64: Trends in age-standardized alcohol-attributable adult intentional injury mortality for Austria, Belgium, Denmark, France, Germany, Netherlands, and Switzerland, 1990-2014 (rates per 1,000,000)

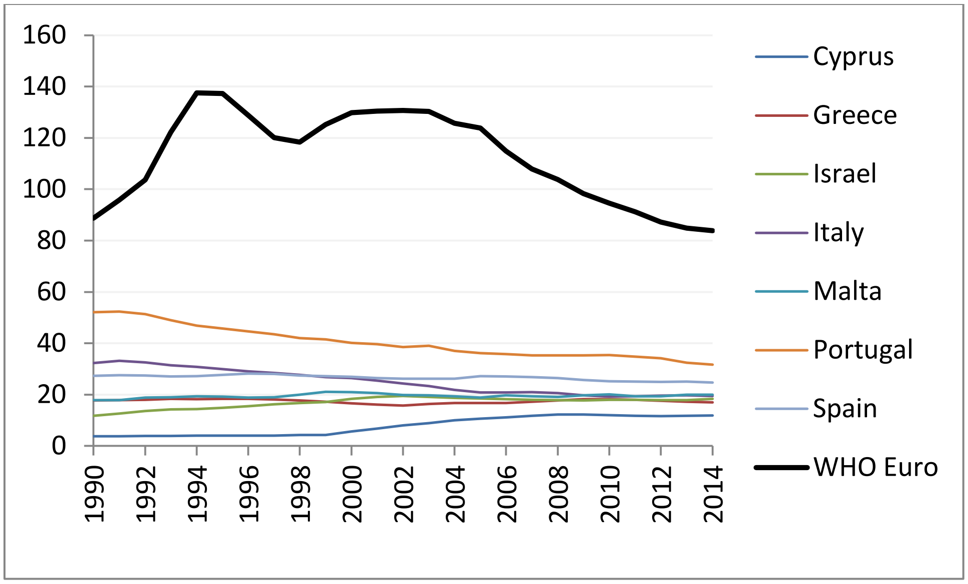


Figure 65: Trends in age-standardized alcohol-attributable adult intentional injury mortality for Cyprus, Greece, Israel, Italy, Malta, Portugal, and Spain, 1990-2014 (rates per 1,000,000)

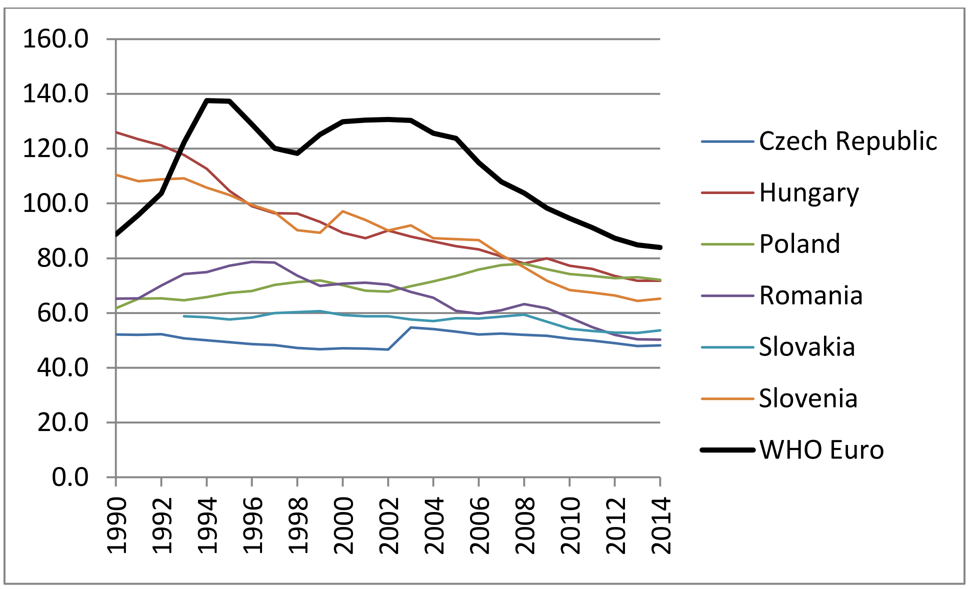


Figure 66: Trends in age-standardized alcohol-attributable adult intentional injury mortality for Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia, 1990-2014 (rates per 1,000,000)

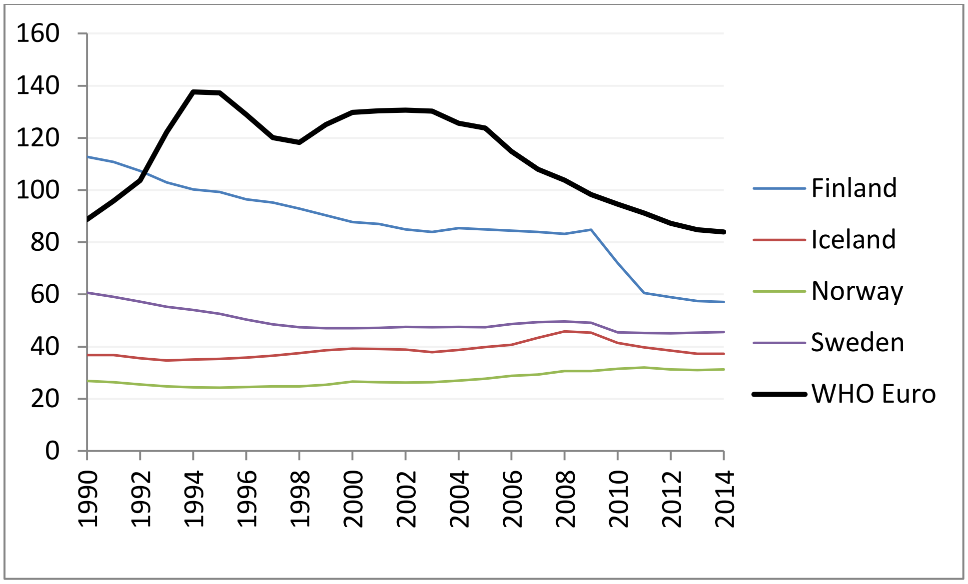


Figure 67: Trends in age-standardized alcohol-attributable adult intentional injury mortality for Finland, Iceland, Norway, and Sweden, 1990-2014 (rates per 1,000,000)

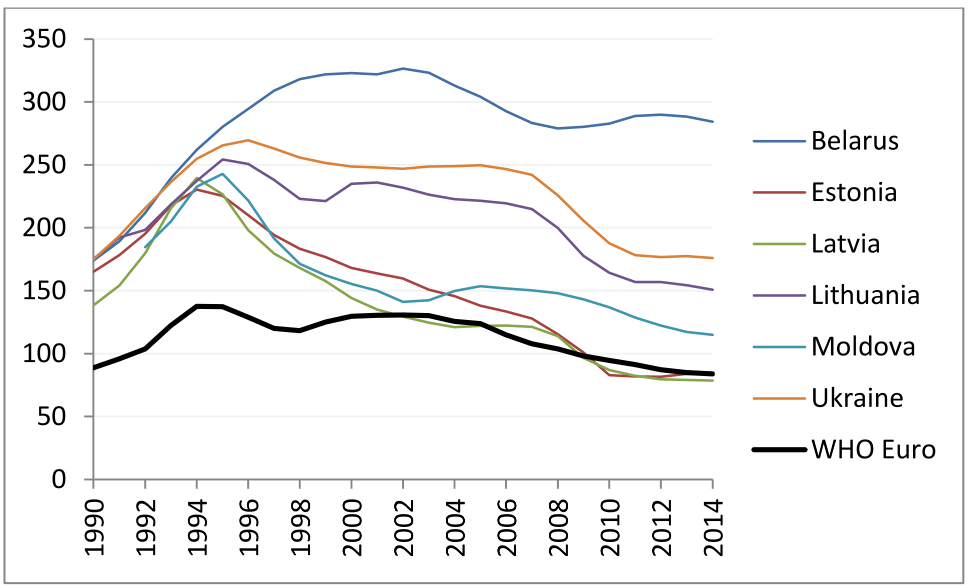


Figure 68: Trends in age-standardized alcohol-attributable adult intentional injury mortality for Belarus, Estonia, Latvia, Lithuania, Moldova, and Ukraine, 1990-2014 (rates per 1,000,000)

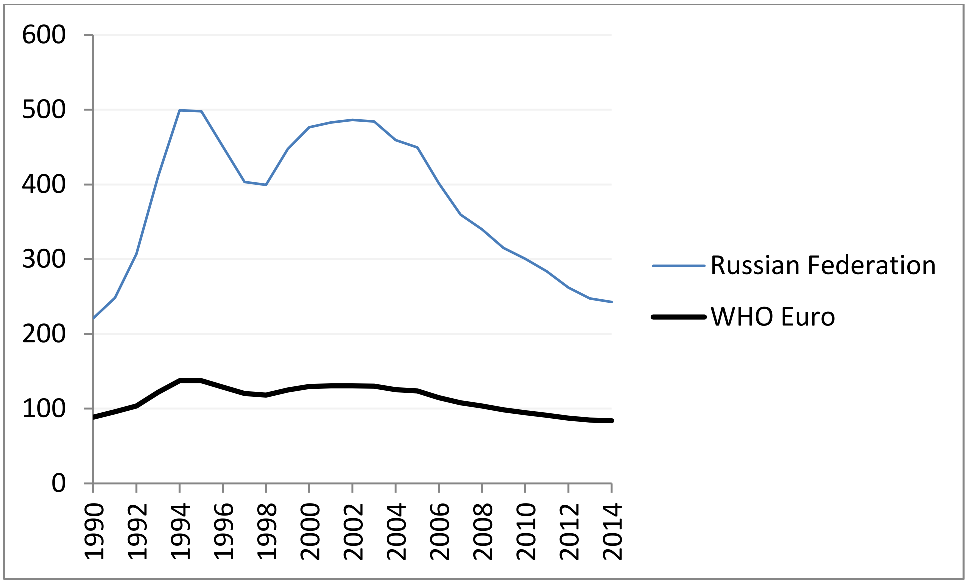


Figure 69: Trends in age-standardized alcohol-attributable adult intentional injury mortality for Russia, 1990-2014 (rates per 1,000,000)

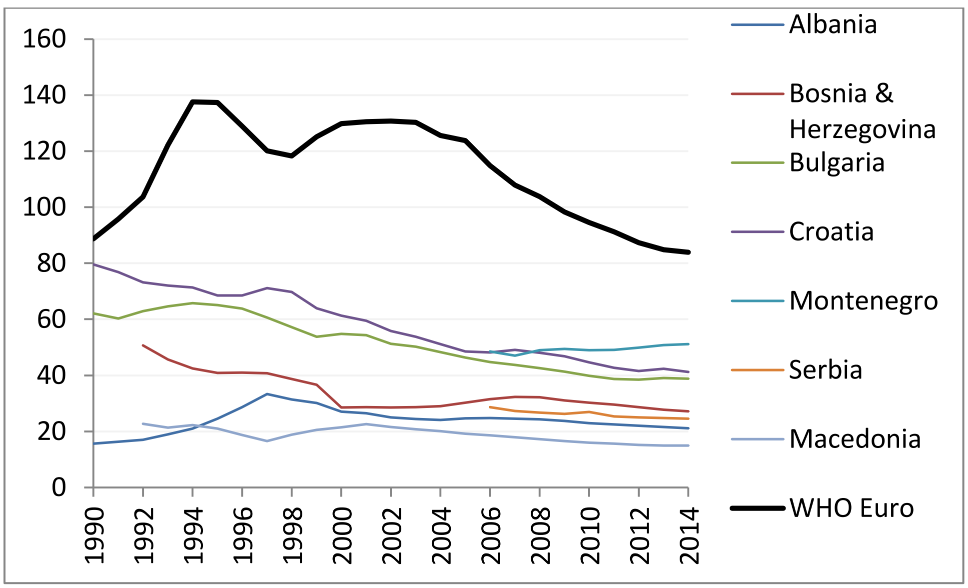


Figure 70: Trends in age-standardized alcohol-attributable adult intentional injury mortality for Albania, Bosnia & Herzegovina, Bulgaria, Croatia, Montenegro, Serbia, and TFYR Macedonia, 1990-2014 (rates per 1,000,000)

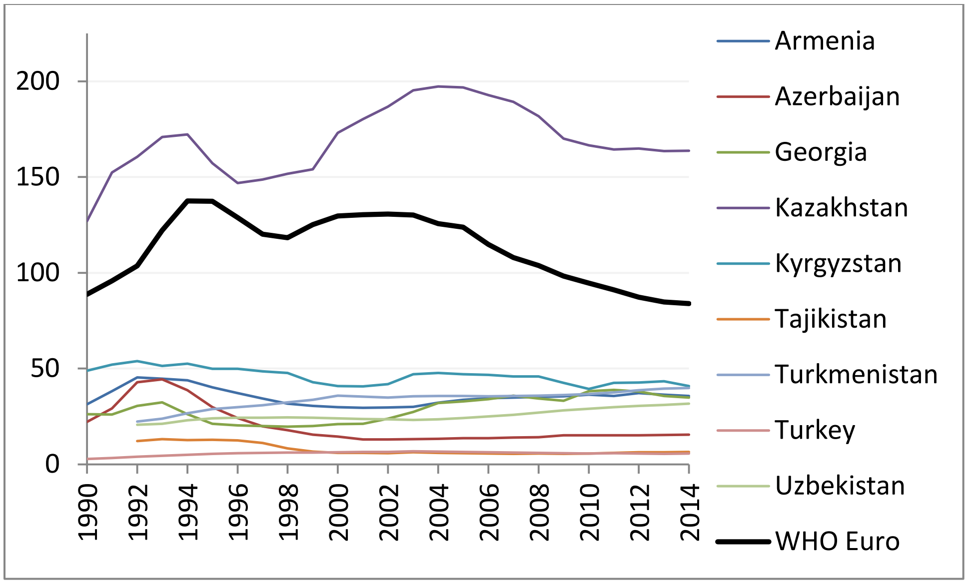
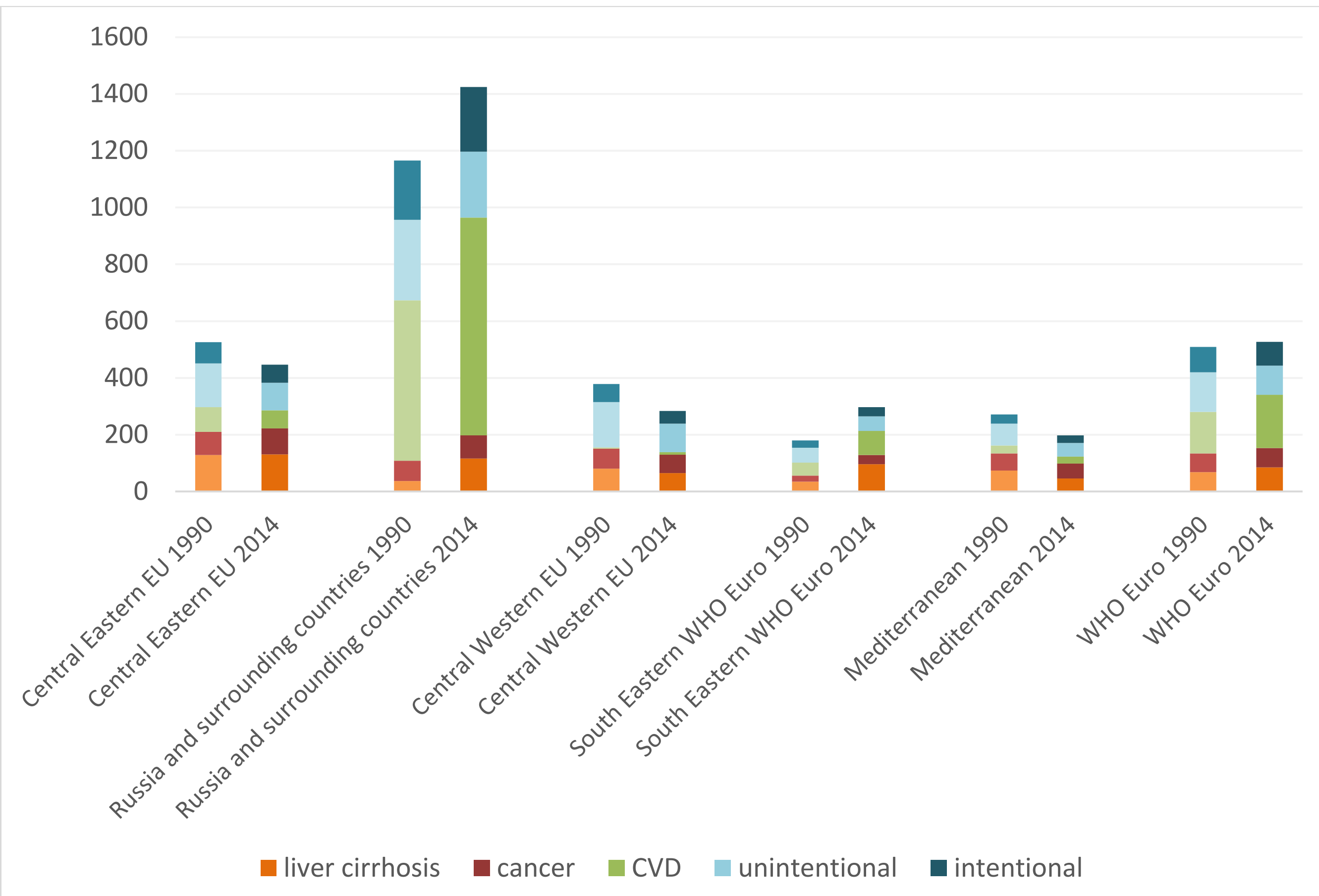


Figure 71: Trends in age-standardized alcohol-attributable adult intentional injury mortality for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Turkey, and Uzbekistan, 1990-2014 (rates per 1,000,000)

Regional differences in alcohol-attributable mortality

Overall trend in alcohol-attributable mortality between 1990 and 2014 by major cause of death categories

Figure 72 gives on overview of the age-standardized alcohol-attributable mortality rates per 1,000,000 by major categories of cause death at the beginning and the end of the observation period, i.e. 1990 and 2014. For the WHO European region as whole there was higher alcohol-attributable mortality in 2014 than in 1990 (+4%), even though overall consumption went slightly down in this time period (see Figure 10) above. The increase in attributable mortality burden was mainly driven by the development in Russia and surrounding countries with similar drinking patterns (+22%) and in the South Eastern part (+65%, albeit from a relatively small basis). On the other hand, more affluent countries such as most parts of the EU went down, more in the Mediterranean (-27%) and the Central Western regions (-25%) than in the Central Eastern (-15%).



Slightly darker shades refer to 2014

Figure 72: Comparisons of age-standardized alcohol-attributable mortality for major causes of death, 1990 vs. 2014, in the WHO European Region and selected sub-regions (rates per 1,000,000)

That increase of alcohol-attributable mortality burden in the WHO European region despite a small decrease in overall *per capita* consumption has a number of reasons: first and foremost, the exponential increase of mortality risk for many cause of death categories with increasing levels of average consumption[160-162] which led to a substantial increase in alcohol attributable mortality especially in the regions where already high consumption levels per drinker further increased (see Russia and countries with similar drinking patterns in Figures 13 and 14). Second and related to this, heavy drinking occasions have a specific detrimental role for cardiovascular and injury, over and above the level of drinking (see also next paragraph). Finally, Russia and surrounding countries can be characterized by an overall elevated adult mortality rate and low life-expectancy,[142,163] which had even led to an own mortality stratum in the WHO classification.[164,165]

The decrease in alcohol-attributable mortality in the Central Eastern EU countries was due to an overall decline in mortality rates in this region.[142,163] Even with stable alcohol-attributable fractions or slightly increasing alcohol-attributable fractions such a decline results in lower standardized rates.

In terms of composition of causes of alcohol-attributable death (see Figure 72), as indicated before, cancer seems to be the relatively stable rate, not surprisingly given the considerable and varying lag time of two decades, especially of cancer sites where acetaldehyde plays a key role.[166-169] While alcohol consumption plays an important factor in cancer mortality, any change in alcohol consumption and thus also the potential effects of alcohol policy measures will be long-term, as could be seen by major short-term policy changes such as the Gorbachev-era anti-alcohol campaign, which had no effect on cancer rates.[170,171]

Liver cirrhosis mortality moves predictably and almost instantly with changes in consumption,[91] and is a good indicator of harmful drinking in a society[172,173] and thus is policy relevant.[157] However, if liver cirrhosis is to be used for monitoring harm or alcohol, the impact of hepatitis B and C infections have to be taken into account as well,[174] and the indicator should reflect the net impact of alcohol.

The key to marked changes in alcohol attributable mortality burden in the WHO European Region are cardiovascular disease and injuries. As for cardiovascular mortality, alcohol consumption has no marked impact, as long as drinking is at moderate levels. The beneficial effects on ischemic diseases,[105,175] described above, almost cancel out with the detrimental effects on all other cardiovascular diseases.[97] As a result, in 2014, the proportion of alcohol-attributable cardiovascular of all alcohol-attributable mortality was lower than 5% of all alcohol-attributable mortality for the Central Western part of the EU, about 12% for the Mediterranean countries, and 14% for the Central Eastern part of the EU (for the EU it was 10%). This cause of death category comprised 54% of all alcohol-attributable morality in Russia and surrounding countries, and 36% in the WHO European Region as a whole. Both episodic and chronic heavy drinking cultures will experience mainly detrimental effects, obviously most pronounced when very heavy binges are the dominant patterns of drinking for a large part of the population such as in Russia or surrounding countries during the observation period (for individual large scale studies see[6,55,176,177] for discussion see[111,178]; for supporting aggregate level studies see[179-182]).

Injury morbidity and mortality rates have been decreasing globally including the European region.[159] The speed of this decline may be halted and even reversed by alcohol consumption (see Figure 72 and below; for a historical comparison of alcohol poisoning deaths in Russia see[183]). It needs to be mentioned that alcohol-attributable unintentional injury mortality (i.e., alcohol poisoning) may underestimated in countries with a high prevalence of heavy drinking occasions (e.g., Russia:[184-186]; Estonia:[187,188]; for a discussion[189,190]).

Sex-specific trends in alcohol-attributable mortality between 1990 and 2014 by major cause of death categories

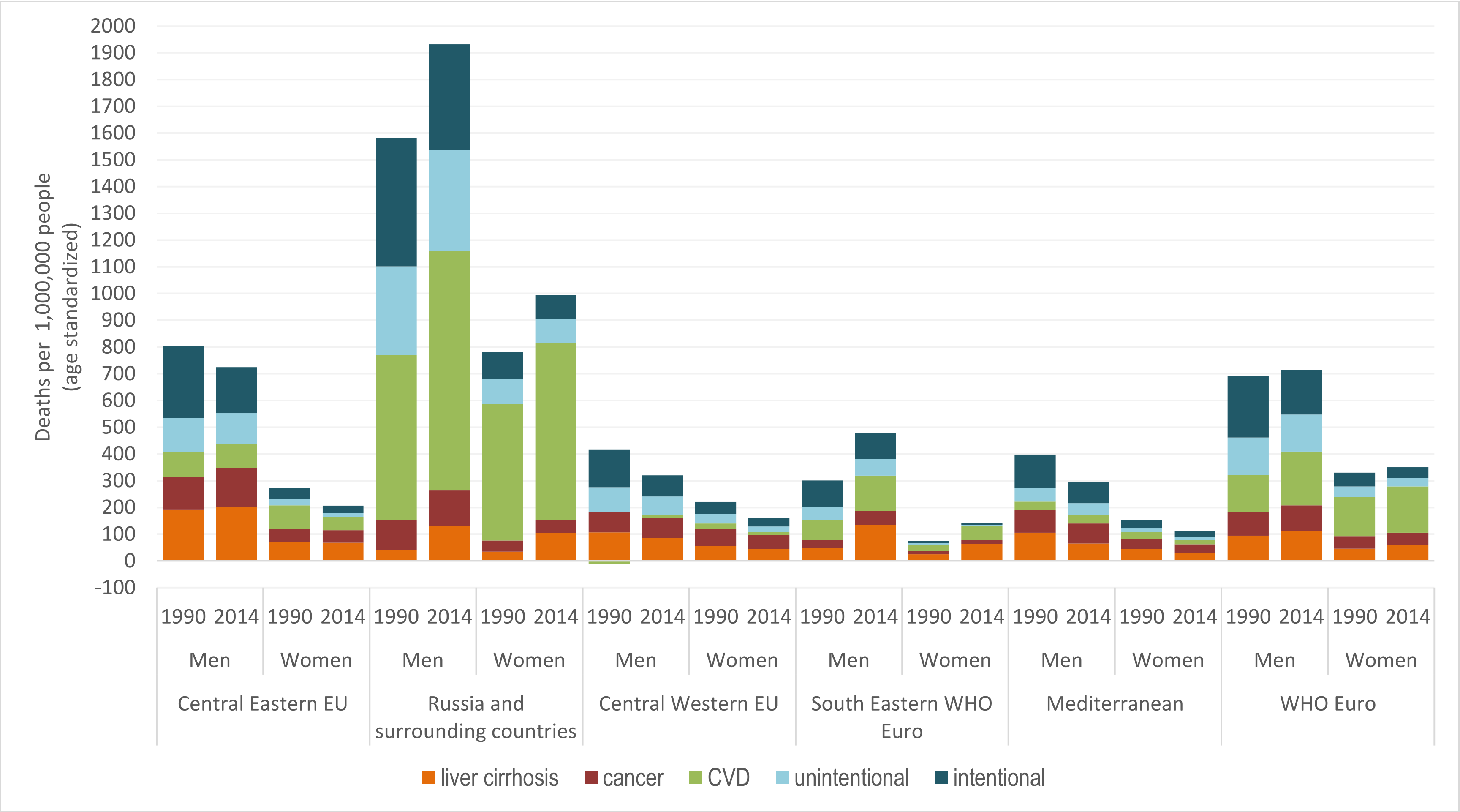


Figure 73: Comparisons of age-standardized alcohol-attributable mortality for major causes of death, 1990 vs. 2014, by sex in the WHO European Region and selected sub-regions (rates per 1,000,000)

Figure 73 shows the comparison of alcohol-attributable cause of death rates separate by sex. In all countries, more alcohol is consumed by men compared to women, as men abstain less and as male drinkers consumed more alcohol compared to female drinkers (see Figures 13 and 14 above for European regions). As a consequence, alcohol-attributable mortality is higher in men than in women. Overall, the ratio of male to female age-standardized alcohol-attributable mortality rates for the WHO European Region is about 2:1 and has not changed a lot over the past 25 years (1990: 2.1:1; 2014: 2.0:1). The ratio varies for different causes of death (see Figures 74 to 78 below), and by region, however. Whereas most regions vary around 2:1, the countries in the South-Eastern part of the European region and Mediterranean countries have higher ratios. Part of this reflects the correlation between gender inequality and proportion of alcohol consumed by women, which was -0.65 in 2010 for the WHO European Region (based on 44 countries with available data; 95% CI: -0.79—0.44; t=5.4; p<0.001); the higher the gender inequality, the lower the proportion of alcohol consumed by women). [FN18]

The proportional differences for men and women for 1990 versus 2014 are similar, albeit at a lower level for women. The same can be said for most of the full trend lines for sex-specific mortality rates, covering all years for the WHO European Region below (see Figures 74 to 78).

Figure 74 shows that standardized liver cirrhosis mortality rates fluctuate over time in concert, with male rates about 2 times higher than female rates, and a slight tendency for this ratio to decrease over time (from 2.1 in 1990 to 1.8 in 2014). This standardized rate ratio may seem low given the much higher average lifetime exposure to alcohol in men compared to women, and the exponential dose-response relationship (see[143] for lifetime exposure; and[88] for dose-response relationships between average drinking and liver cirrhosis mortality). However, there are also clear sex differences in the acceleration of the liver cirrhosis risks: women have much higher risks of liver cirrhosis mortality for the same amount of drinking.[88]

Overall, liver cirrhosis mortality increased to about 2007 for both sexes, and decreased thereafter, as did *per capita* consumption (see Figure 10 above), but the while the WHO European Region trends converge, the trends in different countries do not show a close association between consumption and liver cirrhosis rates (see for instance the discussion after Figure 23 for Eastern European countries).

[FN18] Own calculations based on data for the WHO Global Status Report on Alcohol and Health[8] and the UN Gender Inequality Index[191]).

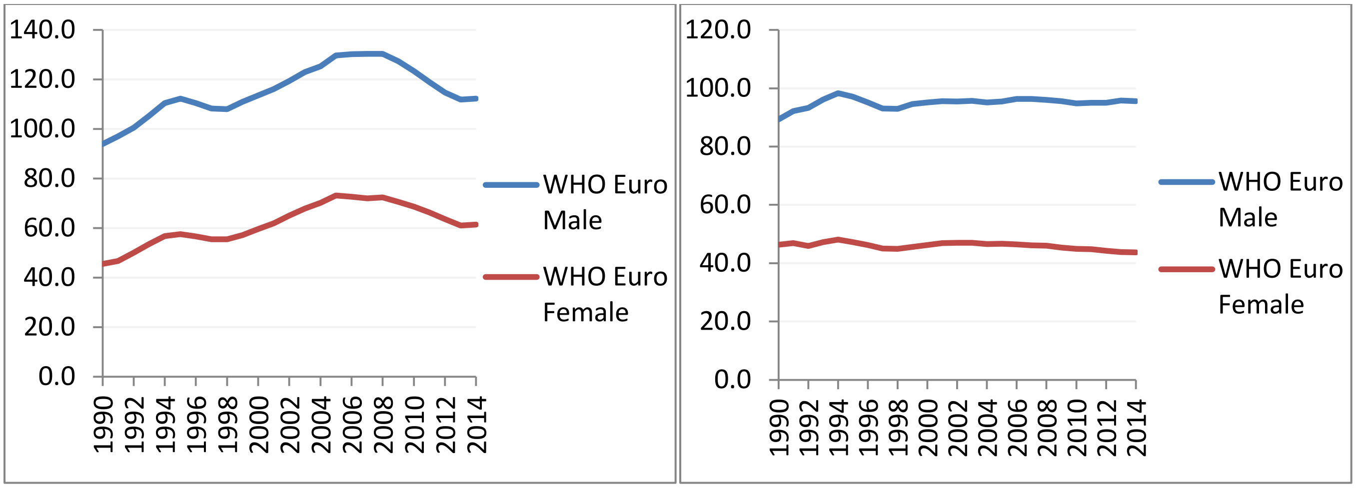


Figure 74 and Figure 75: Trends in age-standardized rates of alcohol-attributable adult liver cirrhosis (left hand side) and cancer mortality (right hand side) in WHO European Region, comparing men and women 1990-2014 (rates per 1,000,000)

For cancer (Figure 75) the ratio is almost the same (2:1), but the ratio slightly increased over the time period (from 1.9 in 1990 to 2.2 in 2014).

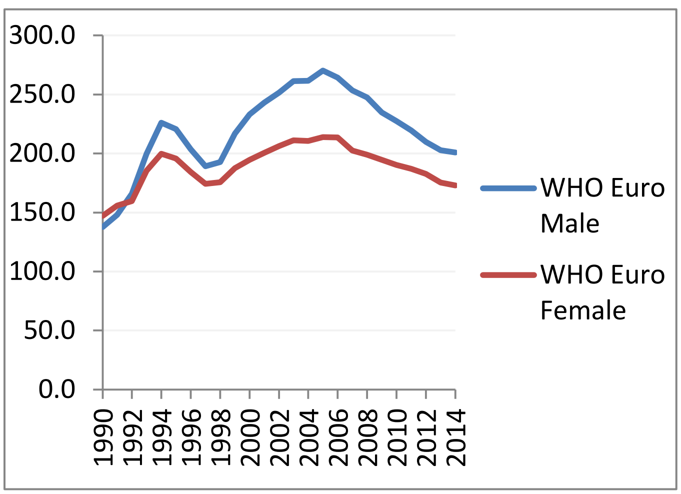


Figure 76: Trends in age-standardized rates of alcohol-attributable adult cardiovascular disease mortality in WHO European Region, comparing men and women, 1990-2014 (rates per 1,000,000)

For cardiovascular disease mortality, a completely different picture emerges, with the standardized mortality trend lines much closer together (Ratios varied between 0.9 and 1.3 with no consistent trend), and for some time in the beginning of the period, women having the higher cardiovascular mortality compared to men (Figure 76). As discussed before, the different level and patterns of drinking have different impact on cardiovascular mortality, and these impact also differ by sex. Thus, for the curvilinear shapes, the relative minimum (i.e., the largest beneficial effect) is at lower levels than for men for all (e.g.,[102,104]).

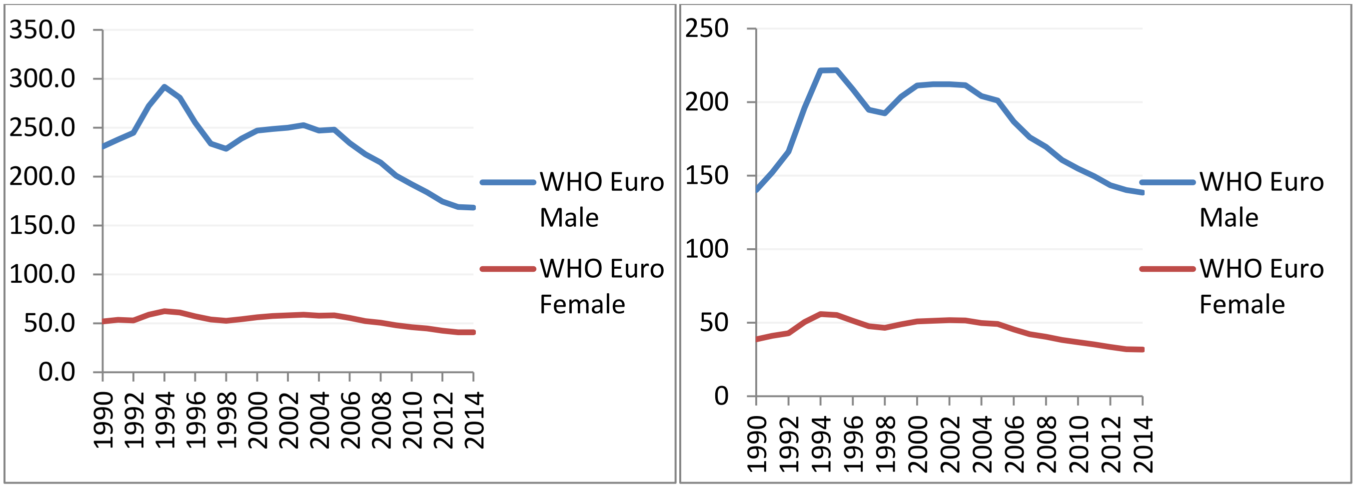


Figure 77 and Figure 78: Trends in age-standardized rates of alcohol-attributable unintentional (left hand side) and intentional injury mortality (right hand side) in WHO European Region, comparing men and women, 1990-2014 (rates per 1,000,000)

The final two slides to compare standardized mortality ratios by sex concern unintentional (Figure 77) and intentional injury (Figure 78). First, the ratios are much higher (unintentional between 4.1 and 4.7; intentional 3.6-4.4) compared to other causes of death, reflecting the overall higher injury risk for men compared to women, which had been consistent for some time in all countries and regions globally.[159,192]

Trends in alcohol-attributable fractions

Figure 79 gives an overview of temporal trends of overall alcohol-attributable fractions summed up over the different cause of death categories. Please note that these fractions are not fractions for all mortality; the denominator only comprises the deaths of the categories analyzed.

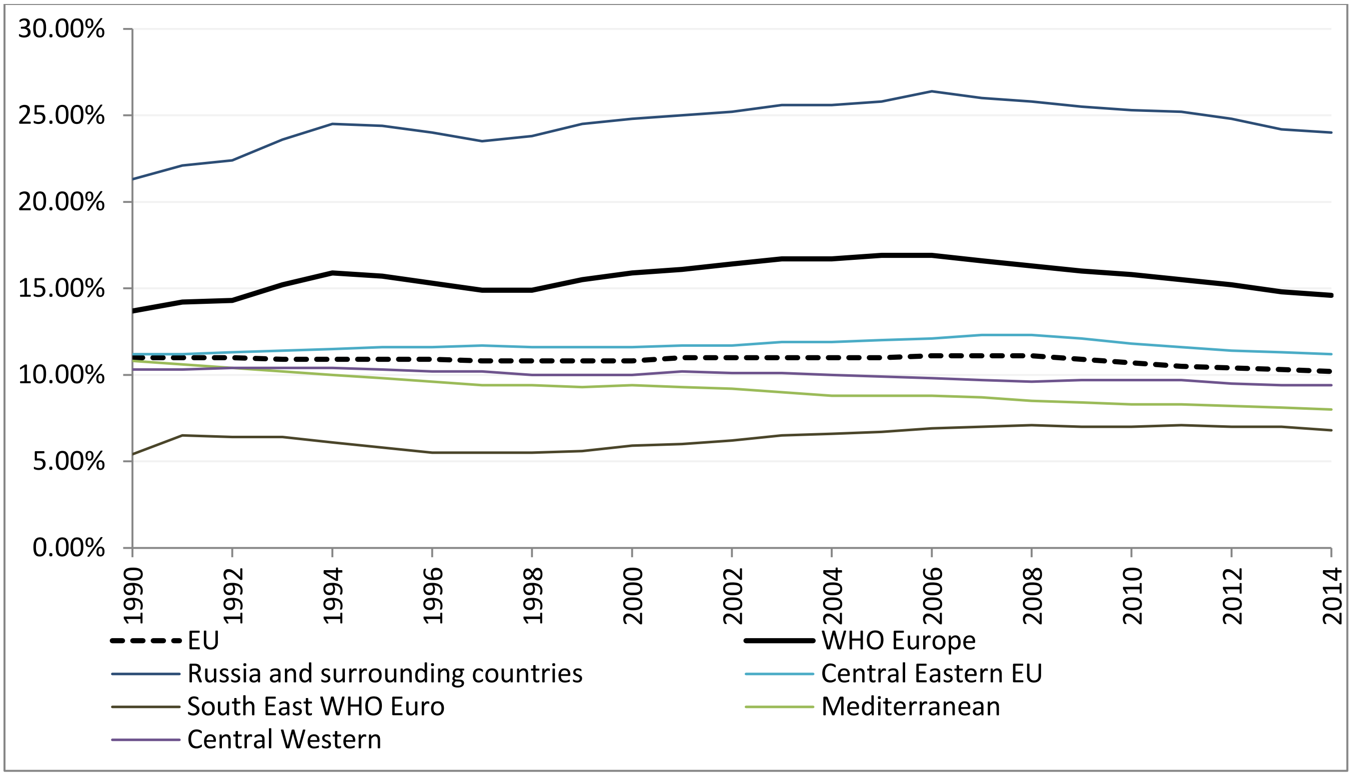


Figure 79: Trends in alcohol-attributable fractions in the WHO European Region and selected sub-regions, 1990-2014 (in % of all causes of death for which there is a causal impact of alcohol))

As expected by the formula on attributable risk, the values follow closely the adult *per capita* alcohol consumption trends (see Figure 10 above), albeit with slightly higher variation between regions. Given this pattern, it is all the more surprising that in 2014, the Mediterranean countries, after a decade long decline in consumption (8.0%), had an almost similar proportion of alcohol-attributable mortality compared to the South Eastern part of the WHO European Region with a high prevalence of people with Muslim faith (6.8%; see Figure 79).

Regional trends in age-standardized rates of major cause of death categories, 1990-2014

In the following, we give trends by regions for each of the major cause of death categories.

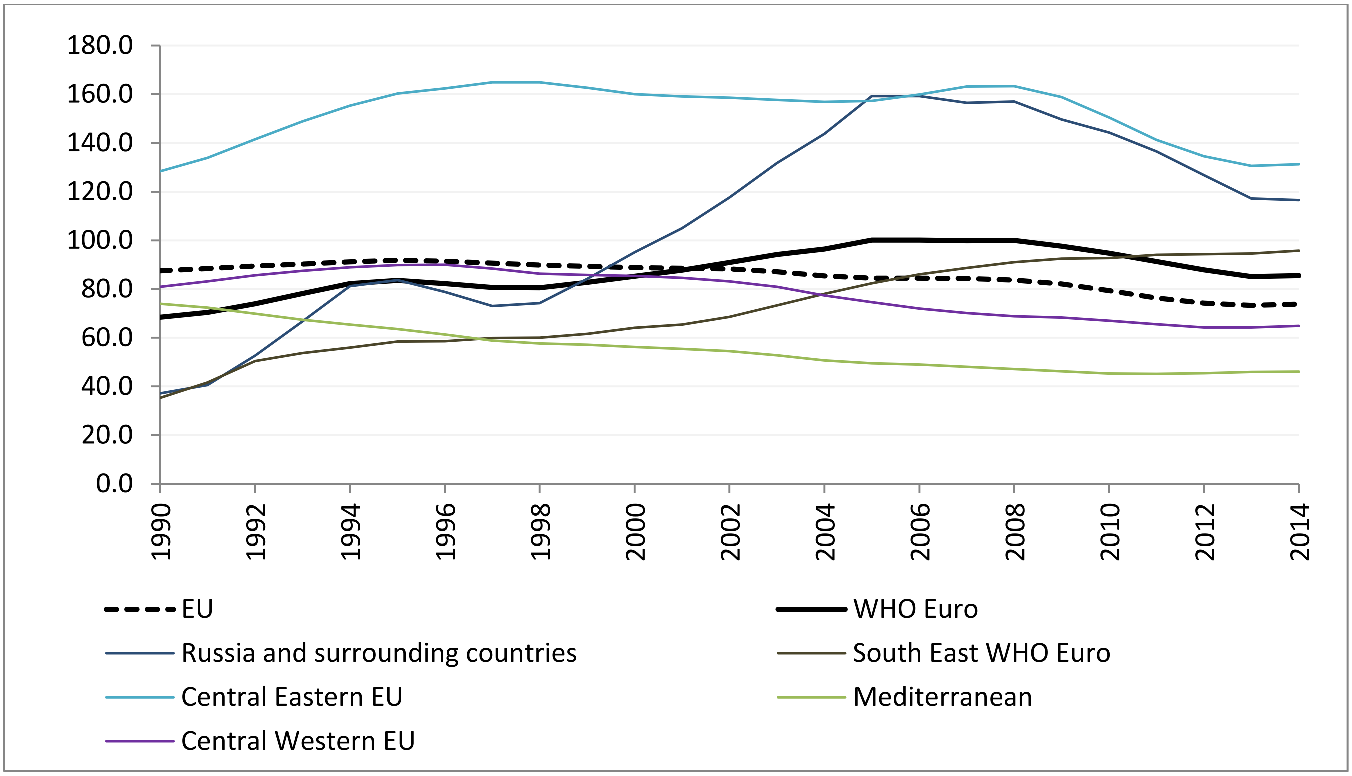


Figure 80: Trends in age-standardized rates of alcohol-attributable adult liver cirrhosis mortality in the WHO European Region and selected sub-regions, 1990-2014 (rates per 1,000,000)

Standardized liver cirrhosis rates have been and are highest in the Central Eastern EU, a region with high overall consumption, consumption alone would not be enough to explain the rates. As indicated above, this is also the region where spirits based on fruits with pits have a tradition (Hungary, Romania, Slovakia and Slovenia[91,142]). Alternatively, short chain aliphatic alcohols contained in unrecorded products have been hypothesized as a possible explanation ([193]; but see[194,195]).

The increase in alcohol-attributable liver cirrhosis mortality in the South Eastern part of the WHO European Region is of concern. While some of this mortality may be overestimated based on generalized risk functions, which may not apply to these countries with high hepatitis-attributable liver cirrhosis mortality rates, it should also be taken into consideration that liver cirrhosis mortality may be impacted by alcohol irrespective of the causal factors leading to the liver cirrhosis in the first place.[90] Relatively small amounts of alcohol may thus lead to high risks of mortality in already damaged livers.[88]

Otherwise, the reduction of standardized liver cirrhosis mortality rates in the last few years even in countries where consumption has not been going down, should be researched further.

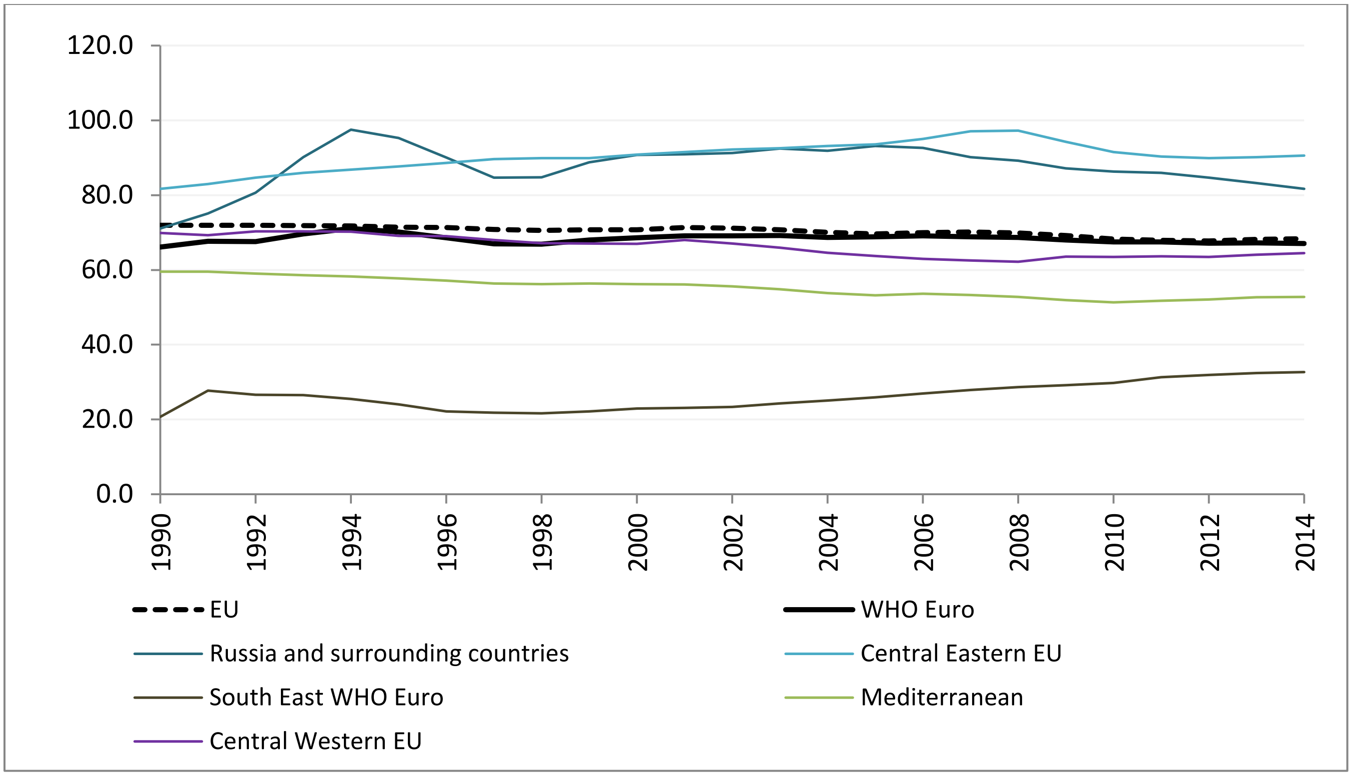


Figure 81: Trends in age-standardized rates of alcohol-attributable adult cancer mortality in the WHO European Region and selected sub-regions, 1990-2014 (rates per 1,000,000)

Alcohol attributable cancer mortality rates have shown relative small variations over the observation period within regions, and predictably, the rates between regions reflect consumption level, with the South Eastern WHO Euro region having markedly lower consumption and lower alcohol-attributable cancer mortality.

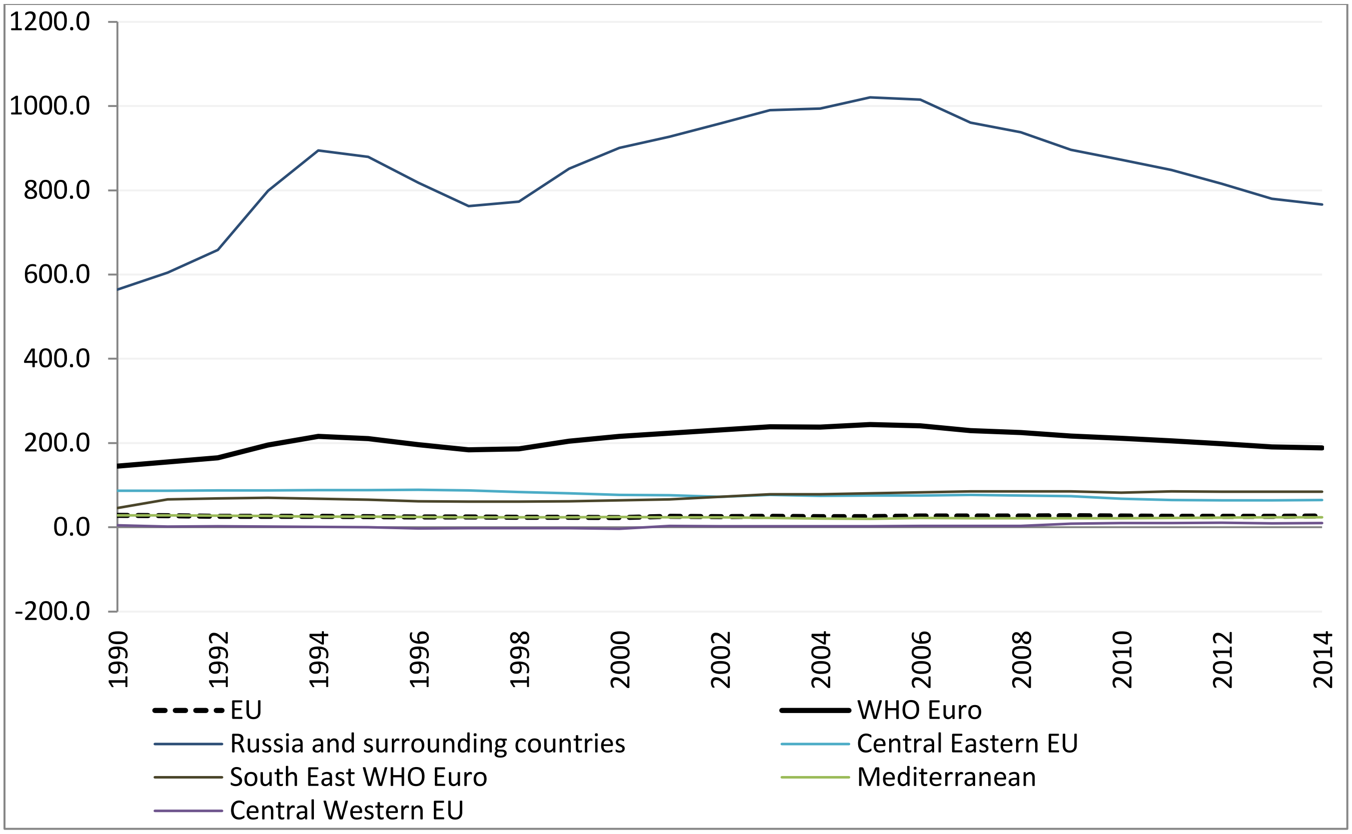


Figure 82: Trends in age-standardized rates of alcohol-attributable adult cardiovascular disease mortality in the WHO European Region and selected sub-regions, 1990-2014 (rates per 1,000,000)

As indicated above, alcohol-attributable cardiovascular mortality has a high variability between regions and within regions over time. Cardiovascular causes of death, especially ischemic categories, are impacted by fluctuations of heavy drinking occasions, and thus even relatively small changes in consumption with impact on heavy drinking will have considerable impact also on cardiovascular mortality. During the already mentioned Gorbachev-era anti-alcohol campaign, alcohol consumption in the Soviet Union went down even after correcting for increases in unrecorded alcohol,[171] and in association 'circulatory disease' deaths decreased, which is the code used for cardiovascular causes of death in the Soviet Union in 1987 (- 9% in men from 1984, - 6% in women in middle age).[170] Cardiovascular mortality changes were reversed when alcohol consumption increased again ([170,171]; for discussions of causality and implications see[157,178,196,197]).

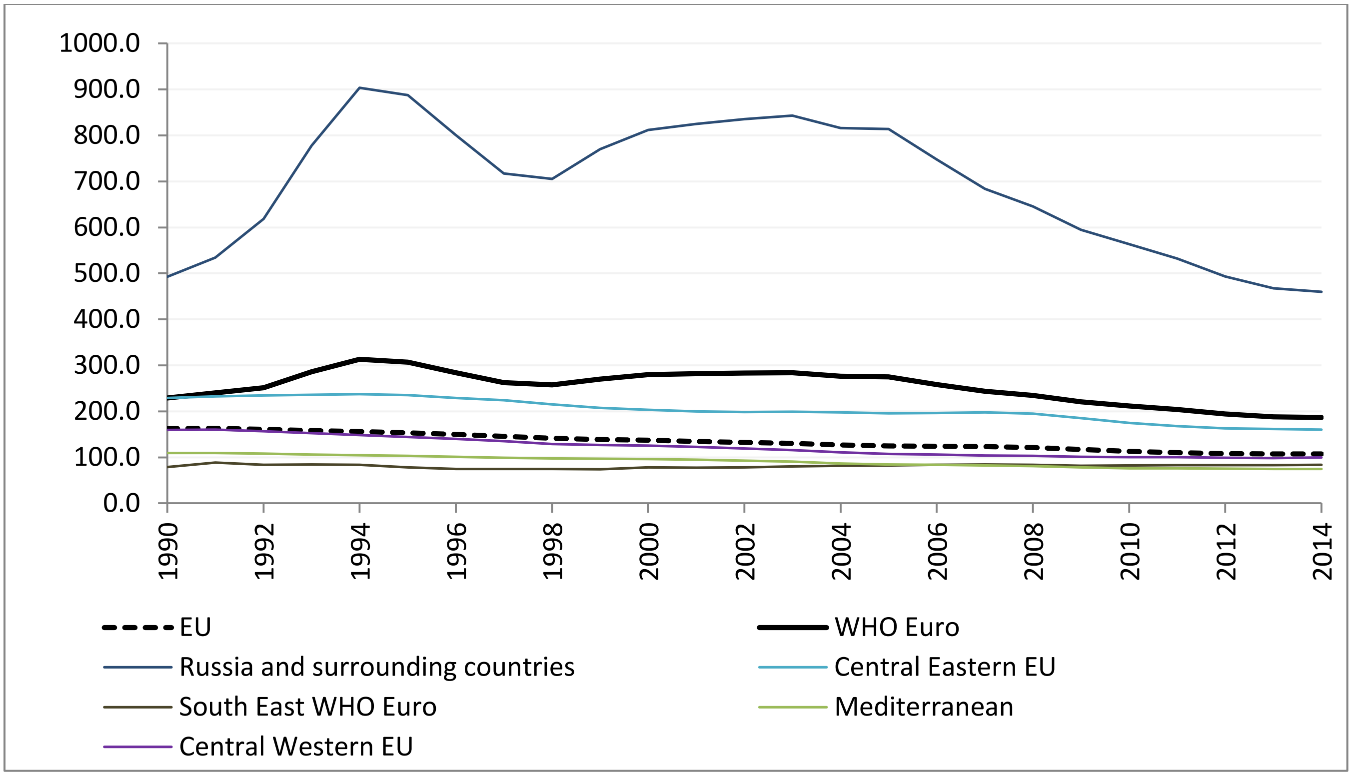


Figure 83: Trends in age-standardized rates of alcohol-attributable injury mortality in the WHO European Region and selected sub-regions, 1990-2014 (rates per 1,000,000)

Alcohol-attributable injury mortality rates can be characterized by a dichotomy between a few countries (Belarus, Estonia, Kazakhstan, Latvia, Lithuania, Moldova, Russia, Ukraine; see Figures 50, 51 and 53 above) concentrated in a particular region (Russia and surrounding countries) with similar drinking levels and patterns (see Figure 77) and the rest of the WHO European Region . Thus, all of the countries with higher than average rates are situated in the Eastern part of the region, from the Baltic countries in North-East of the EU, over Russia to Kazakhstan in the South Eastern part of the WHO European Region.

Overall, the same patterns prevail for unintentional and intentional injury mortality (see Figures 78 and 79), with the difference that the Central Eastern part of the EU is much closer to the WHO European Region average for unintentional injuries than for intentional injury.

For all injury mortality in EU countries, most countries seem to converge with the exception of the Central Eastern part, and in particular the Baltic countries. However part of this appearance of convergence is due to the comparison level from Russia and the surrounding countries with similar drinking level and patterns. As has been shown in the figures above (Figures 45-53), there are still marked between country differences even within the EU, and to reduce injury mortality, other EU countries could benchmark with countries like Italy or Cyprus (see Table 3).

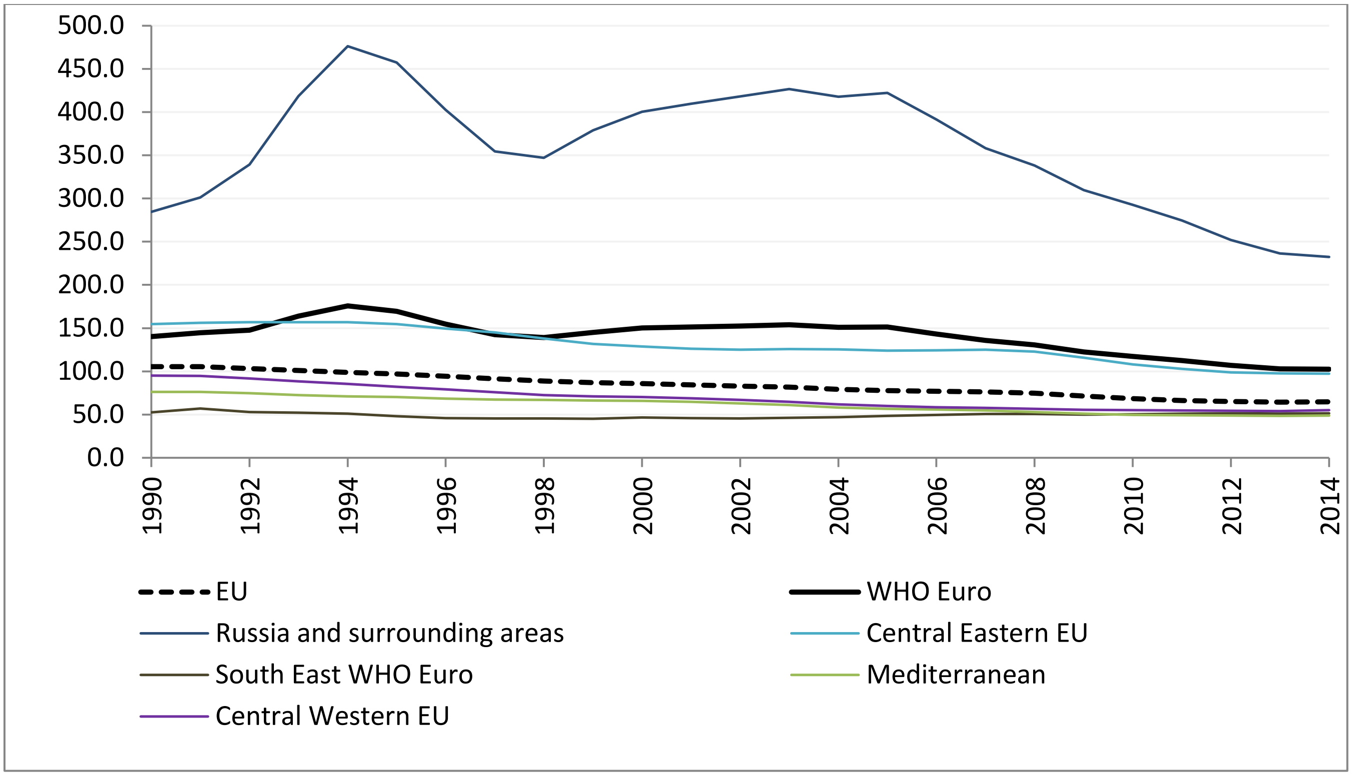


Figure 84: Trends in age-standardized rates of alcohol-attributable unintentional injury mortality in the WHO European Region and selected sub-regions, 1990-2014 (rates per 1,000,000)

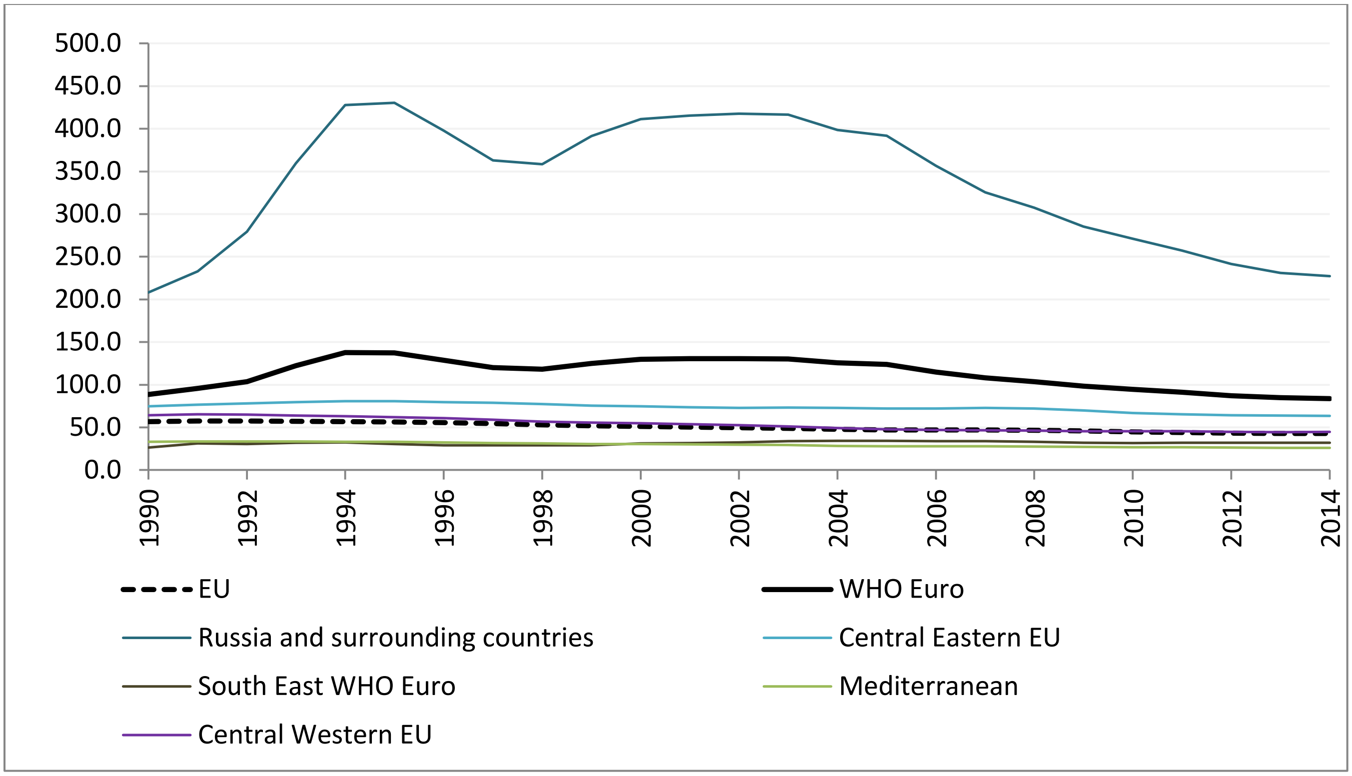


Figure 85: Trends in age-standardized rates of alcohol-attributable intentional injury mortality in the WHO European Region and selected sub-regions, 1990-2014 (rates per 1,000,000)

Conclusion: the need for alcohol policy

Even though alcohol consumption dates back in Europe a long time, the last decades have shown that, despite historical traditions, modern drinking patterns can change quickly and sustainably. The decrease of alcohol consumption in the traditional wine-producing and wine-drinking countries of the Mediterranean region over the past 40 or so years may serve as an illustration of this point.[2,62-64,198] In the above it has been shown that this decrease in consumption the Mediterranean countries resulted in a marked reduction of alcohol-attributable mortality, which had marked effects on life-expectancy.[142] A second example of changing drinking patterns and resulting mortality are the Russian experiences following the Gorbachev era reform, as well as more recent examples.[54,58,170,171]

Some of the changes in drinking and subsequent harm have reflected fundamental changes in the nature of society. For example, with shifts away from agriculture in most European economies, the widespread tradition of drinking at lunchtime are inconsistent with the demands of the 21st Century modern economy (for some empirical evidence see[199]). Other changes had been caused or enforced by alcohol policy.

Certainly, effective[10,200,201] and cost-effective policies[202-204] are available to further minimize the burden of alcohol consumption in European societies. However, even though such policies have been proposed for many years (e.g., [205,206] or the various European action plans; see[9] for the last iteration), relatively little has changed in region, and in the end, the age-standardized alcohol-attributable mortality rate for major chronic and acute causes of death for the WHO European Region in 2014 was even higher than 25 years ago. There had been public health successes in countries, as shown above, and these countries could be used as benchmarks, but there also have been drastic public health failures, and the overall picture certainly cannot be called a public health success. Moreover, as recent examples have shown, getting alcohol policies wrong may also impact dramatically on the disease burden (see above, and[157]).

In order to initiate policies, there needs to be up to date epidemiological data, integrated into a monitoring and surveillance system.[172,173] Time of the essence here, and if relevant data are available to decision makers within a short delay of one or maximally two years, they will serve the purpose much better.[207] This report hopes to stimulate establishing monitoring and surveillance systems on the national level, which routinely yield relevant data on the harmful use of alcohol and attributable harm in a relevant way for decision makers (and this can be done with the NCD monitoring framework;[13,208] but should additionally include liver cirrhosis and injury burden – see above).

So what would be the policy conclusions from this report, and alcohol epidemiological findings for Europe in general? First, and foremost, it must be stated that overall alcohol consumption is clearly too high in Europe, resulting in considerable harm. Ideally, assuming that alcohol consumption will persist in this part of the world, those who choose to drink in Europe should limit their consumption to under 20g/day,[69,209] corresponding to a yearly consumption of 11.6 l pure alcohol among drinkers. However, this **upper** threshold for drinking is lower than the current mean drinking level among drinkers in Europe both for men (19.4 l pure alcohol adult *per capita* per year) and for women (12.9 pure alcohol). The question is how to shift the current drinking level to the one which would incur the least harm.

Drinking guidelines have become more popular in recent years (see recent efforts in Australia, Canada, the UK and the EU;[210-213]) as they conform to the modern ideal of a consumer society, with well-informed consumers putatively adjusting their behaviour based on advice from governmental, research, and professional sources.[214] However, their effectiveness in changing actual drinking is questionable.[215,216] Nevertheless the development of guidelines reflecting best evidence provide an important reference point for engaging with policy makers in developing more directly effective approaches to reducing consumption.

On the other hand, the known cost-effective policy options as outlined by the "best buys" in the WHO NCD framework ([13,217], see also Footnote 1 above), i.e., reductions of availability, increases in taxation and ban of marketing and advertising, have not been overly popular with governments, and there are no signs that this trend will stop. [FN19] How could epidemiology be helpful in improving the situation? There is still a knowledge gap in the general population about alcohol's impact on mortality, especially for cancer.[220] This knowledge gap should be closed, but knowledge may not necessarily change behavior, especially if knowledge concerns rather broad areas without more general implications such as the reduction of consumption.

A more promising approach seems to be to look into the concrete mortality risks, and work on these. There is a need to go beyond passive approaches such as drinking guidelines, so that ministries of health and other public health agencies consider where and how in a particular society there are concerns about alcohol-related problems, and how those concerns might be energized to bring tools in the policy impact literature into play, or create new tools. The model from successful public health action on drink-driving and on cigarette smoking has been to focus attention on the problems (with epidemiology playing a major part), and to push for preventive policies and actions in the context of that focus.

One of these foci could be alcohol-attributable injury mortality, as this indicator has been decreasing more slowly than injury mortality in general. This opens specific prevention opportunities, such as programs on impaired driving (lowering the legal limit for blood alcohol level via *per se* laws for traffic participation and operating machinery and enforcing such laws via random breath testing or sobriety checks depending on the legal situation;[200,221] specifically for lowering blood alcohol concentration from 0.08 to 0.05 g pure alcohol for every decilitre:[222]). Drinking-driving measures have been standard in many countries,[2] but still can be improved to be more effective, and 0.02 g pure alcohol per decilitre should be the goal.[9] Another possibility for more specific interventions would be the recent Dutch law for determining a threshold for a causal effect of substance use in general and alcohol consumption in particular on aggression and violence (for the law published on January 19, 2016:[223]; for a first report on the scientific evidence:[224]).

Addressing both unintentional and intentional injury seemed to work in an initiative in South Dakota, encouraging 24/7 sobriety. A group of people who had been arrested for or convicted of alcohol-involved offenses, were monitored continuously for abstinence with sanctions. Results showed that on the county level, a 12% reduction in repeat driving under the influence of alcohol arrests and a 9% reduction in domestic violence arrests was achieved

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[FN19] There is surprisingly little research how the "best buys" of availability and taxation need to be shaped in light of different environments as characterized by level and availability unrecorded alcohol in different countries (see [218] for a discussion about African countries; and [219] for an example of a failed taxation increase because unrecorded consumption was too important), but such research would be especially necessary for countries in the WHO European region, where unrecorded consumption is very common and there are huge price differentials.

following adoption of the program.[225] Equally important would be to develop programs for prevention of other injury types. The current efforts of the Dutch government to develop *per se* laws with respect to intentional injury should be carefully evaluated and, if successful, transferred to other countries.

With respect to the reduction of alcohol-attributable mortality in the WHO European Region, the most urgent policies needs relate to those countries which have by far the largest burden, characterized by relatively frequent very heavy binge drinking episodes, such as Russia and surrounding countries. While some indications for Russia point to some success of the some of the recent policy changes ([226 58] but see[57]), more is needed. One of the most promising measures against binge drinking are minimum pricing schemes,[227,228] but most of the arguments for this measure are based on modelling studies with limited empirical evidence from Canadian provinces.[229,230] The transferability of such policies to Eastern European countries with a high proportion of unrecorded consumption, which is especially important for binge drinking in the most vulnerable populations,[22,231-233] is questionable (and[234] is not a counter-example, as it only deals with home-produced alcohol and not with surrogate alcohol like medicinal alcohol or industrial alcohol). Obviously, once you are able to reduce recorded consumption as much as was done in the Soviet Union in the Gorbachev era in the 1980s,[171] increases in unrecorded consumption do not matter that much, but for slight reductions in recorded consumption, potential compensations by unrecorded consumption do matter given the fact that unrecorded alcohol, especially surrogate alcohol, tends to be considerably cheaper.[24,235,22]

Thus, it would be important to find local solutions to reduce heavy drinking occasions in countries with high proportion of unrecorded consumption. It is interesting that in the 24/7 sobriety program, one effects on mortality were found, and most pronounced for cardiovascular mortality.[236] Maybe such a program could be adopted for Russia and surrounding countries. Reduction of average alcoholic strength in beverages may also be considered,[11] and the Russian government is trying this strategy by favoring beverages with lower ethanol content via taxation (e.g., beer vs. vodka; see also[58,234]). Taxation is one important tool of alcohol policy, and different taxation schemes can be used for different purposes like switching beverage preferences,[237-239] reducing alcoholic content in certain beverages,[11,240,241] or increasing age of onset in drinking or keeping abstention rates high ([242,243] for a more general overview of the effects of alcohol taxation see:[244]).

The main conclusion of the current study for alcohol policy is clear: if governments do not initiate policies to reduce alcohol consumption in societies with high heavy drinking occasions, a disproportionate burden will result. Reduction of alcohol consumption among heavy drinkers plays a key role. If proven effective policies such as reduction of availability, increase of price via taxation and ban of marketing and advertisements do not prove feasible, reduction of consumption of the most heaviest drinkers via brief intervention or treatment could have population health impact ([203,245] see also [160,246])[FN20]. In most of the other countries in the WHO European region, governments should be aware of the fact that the current level of alcohol consumption is in no way acceptable from a public health perspective and associated with considerable harm, and thus they should continue or initiate successful measures to reduce alcohol consumption. Moreover, governments should be aware of the fact that wrong policies could lead to substantial harm in relatively short time.[10,157]

[FN20] There are other evidence-based ways to impact on heavy drinkers specifically, like a rationing schemes[247] or the above cited sobriety enforcement,[225,236] but realistically brief interventions and treatment will be the most discussed policy options in the current environment of WHO European Region.[9]

No matter what policies the respective governments choose, reducing the alcohol-attributable burden in Europe is an urgent matter and needed to reduce not only individual suffering and harm to others around the drinker, but also economic burden attributable to alcohol.[78,248,249]

To summarize: although alcohol consumption has been going down in the WHO European Region as a whole in the last two and a half decades, it continues to be a major risk factor for mortality, and the overall alcohol-attributable mortality burden increased slightly over that time period. The major contribution for the increased mortality burden came from Eastern European countries, which substantially increased their alcohol-attributable mortality rates. Alcohol policy measures to reduce mortality burden are urgently needed, and while they are the most urgent in the Eastern part of the region, most other countries could quickly be faced with a greater alcohol-attributable mortality burden if they do not continue to decrease their overall level of alcohol consumption and episodic heavy drinking occasions (as an illustration see how the alcohol-attributable mortality rates increased in the UK, when this nation increased their consumption in the 1990s). Given the overall failure in reducing alcohol-attributable mortality burden in the WHO European Region in the last 25 years despite the existence and promotion of traditional evidence-based and cost-effective interventions, some rethinking on introducing additional alcohol policies seem necessary.

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