World Health Organization
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Public health successes and missed opportunities

Trends in alcohol consumption and attributable mortality in the WHO European Region, 1990–2014

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By

Kevin D. Shield, Margaret Rylett and Jürgen Rehm

ABSTRACT
The level of alcohol consumption is high in the WHO European Region. This results in a substantial burden of alcohol-attributable mortality. The overall standardized rate for alcohol-attributable mortality increased in the WHO European Region over the time period between 1990 and 2014. Data are provided by country and show huge differences between countries. This underlines opportunities for countries to benchmark against others and introduce alcohol policies to reduce the burden of alcohol-attributable mortality. It also underlines the overall need to further reduce alcohol consumption in the WHO European Region.

Keywords
Alcohol drinking - prevention and control
Alcohol drinking - adverse effects
Alcohol drinking - mortality
Harm reduction
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ABBREVIATIONS

CI	confidence interval
CVD	cardiovascular diseases
EU	European Union
FAS	fetal alcohol syndrome
GDP	gross domestic product
GISAH	Global Information System on Alcohol and Health
ICD	International Statistical Classification of Diseases and Related Health Problems
NCD	noncommunicable disease
PAHO	Pan American Health Organization
STEPS	STEPwise approach to surveillance
TB	tuberculosis

FOREWORD

I am pleased to present this report, which gives an overview of alcohol consumption and alcohol-attributable mortality in the WHO European Region during the period 1990–2014.

The European Region was the first to adopt an alcohol action plan in 1992, which was later followed by a number of policy instruments and, most recently, by the global strategy to reduce the harmful use of alcohol from 2010, and the European action plan to reduce the harmful use of alcohol 2012–2020. Thus, this report provides information on the entire period when policy guidance has been available from WHO.

There is high variability in alcohol consumption and the harms caused by it between countries of the WHO European Region, as well as within countries over time. Despite divergent trends at the country level, the WHO European Region continues to be the WHO region with the highest adult per capita alcohol consumption. There was a slight decrease in the consumption level between 1990 and 2014, and this was fuelled by decreases in the richest countries in the central-western European Union (EU) and Mediterranean parts of the Region, whereas drinking levels in central-eastern EU remained stable over the past 25 years, and increased in the eastern and the south-eastern parts of the WHO European Region.

The high level of alcohol consumption led to a substantial burden of attributable mortality from cardiovascular diseases, cancer, liver cirrhosis, and unintentional and intentional injury. The overall standardized rate of alcohol-attributable mortality increased in the WHO European Region over the time period between 1990 and 2014.

There is a need to reduce the overall alcohol consumption and the number of irregular heavy drinking occasions, as alcohol is causally related to considerable mortality.

Different policy options have proven effective and cost-effective in reducing the level of alcohol consumption, and heavy drinking in particular. These include, but are not limited to, the so-called "best buys" of increasing price, restricting availability and imposing bans on marketing. They should include a wide range of policies as described in the WHO action plan.

We at the WHO Regional Office for Europe hope that Member States can use the information in this publication for further improvement of relevant areas of their alcohol policies in order to reduce alcohol consumption and resulting harm.

Zsuzsanna Jakab
WHO Regional Director for Europe

EXECUTIVE SUMMARY

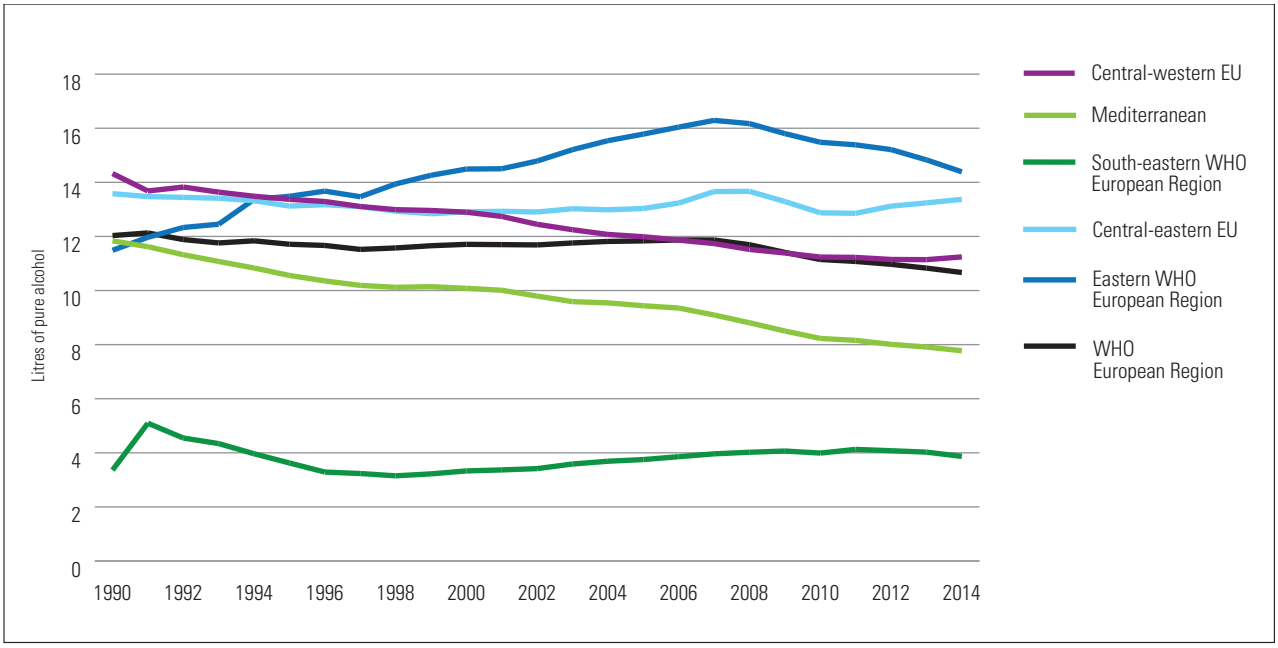
This report aims to contribute to a monitoring system for harmful alcohol consumption in the WHO European Region by describing the trends in alcohol consumption and attributable mortality for the time period 1990–2014 for all countries of the Region and for the Region as a whole. It is based on data from the Global Information System on Alcohol and Health, and uses standard methodology developed for comparative risk assessments over the past decade. While the main emphasis of the report is on the country level, trends are also reported for selected subregions identified partly on the basis of geography and partly on drinking patterns.

There is high variability in alcohol consumption between countries of the WHO European Region, as well as within countries over time. Despite divergent trends at the country level, the WHO European Region continues to be the WHO region with the highest adult per capita alcohol consumption. Slight decreases in the level of alcohol consumption were seen between 1990 and 2014, which, combined with increases in alcohol consumption in Asia and Africa over 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 fuelled by decreases in the richest countries in the central-western European Union (EU) and Mediterranean parts of the Region (*see* Fig. A), whereas drinking levels in central-eastern EU remained stable over the past 25 years, and drinking levels in the eastern WHO European Region, and in the south-eastern part of the WHO European Region increased. There are indications that the Russian Federation and surrounding countries with similar drinking patterns (Belarus, the Republic of Moldova and Ukraine) have decreased their consumption levels in recent years (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 over the 25 years analysed (1990: 20.5%). It is higher in the eastern part of the WHO European Region, especially in the Russian Federation and surrounding countries.

Fig. A. Trends in adult per capita alcohol consumption in the WHO European Region and selected subregions, 1990–2014[a]



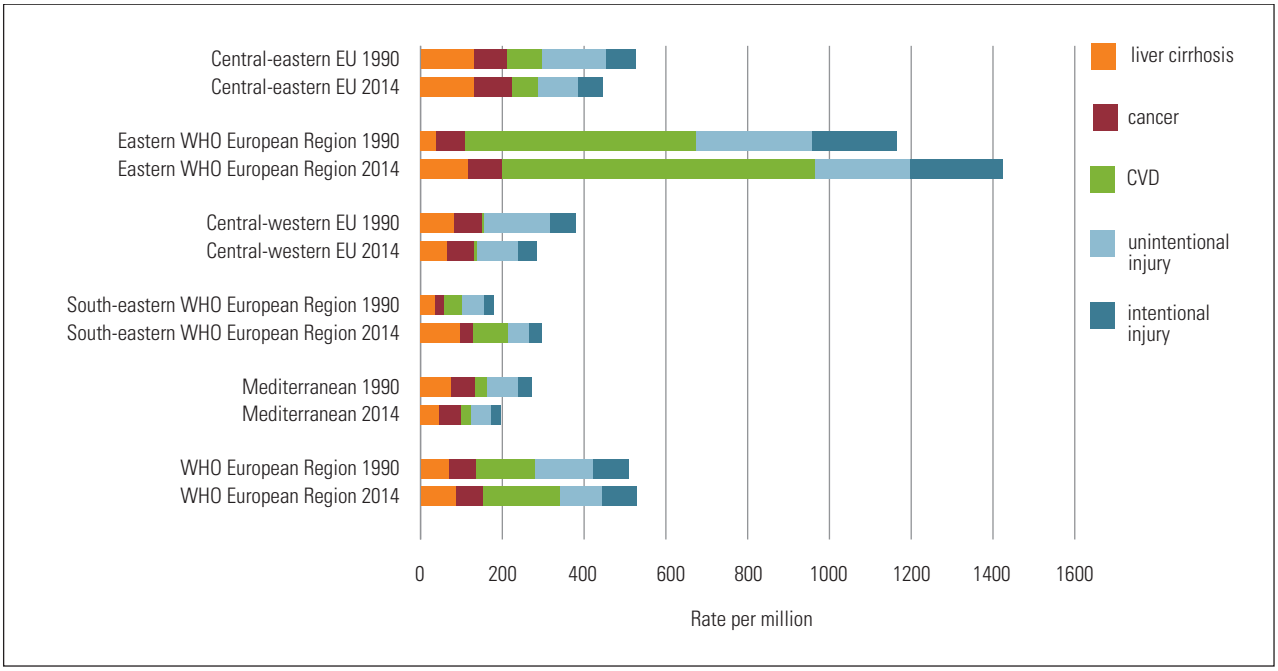
[a] For definitions of regions, *see* Box 2, page 5.

The high level of alcohol consumption in the WHO European Region led to a substantial burden of attributable mortality from chronic and acute causes of death, as evidenced by the burden of mortality from cardiovascular diseases (CVD), 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 the 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* Fig. B).

Fig. B. Comparisons of age-standardized alcohol-attributable mortality for major causes of death, 1990 vs 2014, in the WHO European Region and selected subregions



The increase in the burden of attributable mortality in the WHO European Region was mainly fuelled by the mortality trends in the eastern WHO European Region (+22% in 2014 compared to 1990) and in the south-eastern part (+65%, albeit from a relatively small base). On the other hand, regions within the EU and surrounding countries decreased their burden of alcohol-attributable mortality, more in the Mediterranean (–27%) and the central-western EU regions (–25%) than in the central-eastern EU region (–15%).

The increase in the burden of alcohol-attributable mortality in the WHO European Region, despite a small decrease in overall consumption, is due to a number of reasons:

- the exponential increase in 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 the eastern WHO European Region);
- the effect of episodic and chronic heavy drinking on cardiovascular mortality and injury; and
- the overall increased adult mortality rate and low life expectancy in some parts of the WHO European Region, in particular, the eastern WHO European Region.

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 formulating an 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, CVD and injury in certain parts of the Region. Currently, in this Region, the average level of alcohol consumption per drinker already exceeds the threshold for acceptable risk in modern societies

for voluntary behaviours.[1] Second, heavy drinking, including episodic heavy drinking occasions, should be reduced in particular. Episodic heavy drinking is an important determinant of CVD and injuries, over and above the average level of consumption.

Different policy options have proven effective and cost-effective in reducing the level of alcohol consumption, and heavy drinking in particular. These include, but are not limited to, the so-called "best buys"[2] of increasing price via taxation (unless there is too much unrecorded consumption), restricting availability, and imposing a ban on marketing and advertising. Unfortunately, despite the availability of effective and cost-effective policy options to reduce alcohol-attributable mortality, and despite marked decreases in alcohol consumption in several countries of the WHO European Region, which could serve as benchmarks, the overall trend 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 earlier.

This means that other policies to reduce the alcohol-attributable mortality burden should be considered. The 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 interventions in primary health care, or treatment of alcohol use disorders have been shown to impact on alcohol-attributable mortality.

[1] People have different standards for risks from voluntary behaviours vs involuntary exposures. While they accept only a lifetime risk of one in a million for things the State is responsible for, such as drinking-water, they take much higher risks for behaviours they initiate, such as skiing, drinking, etc.

[2] A "best buy" is a more pragmatic concept introduced into the discussion of interventions for noncommunicable disease 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 it is not only highly cost-effective but is also feasible, low-cost and appropriate to implement within the constraints of the local health system.

INTRODUCTION

Alcohol use is one of the most important risk factors for disease *(1)* (for comparison with other risk factors, *see (2,3)*). The WHO 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 *(1)*. Consequently, the disease burden caused by alcohol is also high in this Region, in particular, the eastern part *(1,4,5)*, despite the overall high life expectancy in large parts of this Region *(6)*.

The high burden of alcohol-attributable disease has led to a plea for interventions globally *(7,8)* 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 of people or for nations *(11)*. Public health policy planning needs to be based on empirical evidence *(12)*, and monitoring of and surveillance for alcohol consumption and the burden of alcohol-attributable disease have been key elements both of the *Global strategy to reduce the harmful use of alcohol (7)* and of the *Global action plan for the prevention and control of noncommunicable 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. It also asked for monitoring the patterns of drinking associated with an increased risk of adverse health outcomes. More operational definitions with concrete indicators used in this report were given within the monitoring framework for noncommunicable diseases (NCDs) *(13)*.

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

- to describe the trends in alcohol consumption and attributable mortality burden for the time period 1990–2014 in the WHO European Region;
- to describe country-level trends,[3] as health-care planning and policy decision-making are mainly at the country level;
- to describe trends in selected regions;
- to help establish a monitoring system for the WHO European Region and for countries as an evidence base for an alcohol policy.

[3] While there have been a few country-level studies *(15–17)*, this is the first time that trends in alcohol exposure or attributable burden have 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 at the country and international level is adult (defined as age 15 years and over) per capita consumption *(18)*, which is a composite measure comprising mainly recorded and unrecorded consumption. Recorded consumption refers to all alcoholic beverages that 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 as such to avoid the higher taxation of officially declared alcoholic beverages. Ethanol-based medicinal tinctures or perfumes with fragrances would be one such example in the Russian Federation *(23,24)*.

Globally, unrecorded alcohol has constituted at least 20% of all alcohol consumed in the past 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 [GDP]), the lower the proportion of unrecorded alcohol to overall consumption *(1,28)*. 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 consumed (*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 the long-term adult per capita alcohol consumption[4] for all countries that are part of the WHO European Region from 1990 onwards. This is the earliest year for which there are systematic estimates of unrecorded consumption. In addition, it has been the goal to provide estimates of recorded versus unrecorded consumption, and estimates of average consumption per drinker. While some regional trends are included, these will be used only to illustrate trends for groups of countries with similar drinking levels or drinking patterns. The main emphasis is on the country level.

METHODS FOR ESTIMATING TRENDS IN ALCOHOL EXPOSURE

DATA

The Global Information System on Alcohol and Health (GISAH) *(29)* has been used for estimates of adult per capita consumption of alcohol, mostly derived from taxation, or production, import and export data *(18,19)*.

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 according to 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 available data were 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 WHO Collaborating Centre for Mental Health and Addiction, Toronto within the WHO monitoring system on alcohol (for methodology, *see (28,30,31)*) (see Box 1). The years in between the estimated years were imputed based on linear interpolation between data points.

[4] In the remaining text, adult per capita consumption or alcohol per capita consumption is used as total consumption. Sub-categories will be specified.

Box 1. 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 STEPwise approach to surveillance (STEPS)) where use of 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 unrecorded consumption is still fraught with difficulties and contains considerably more bias than recorded consumption.

Tourist consumption was estimated with the algorithm developed for the *Global status report on alcohol and health (1)*, based on World Bank data on the annual number of tourists per country. This algorithm specifies that tourist consumption is taken into account only 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 adults – 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 estimates of consumption per drinker, adult per capita alcohol consumption data were divided by the proportion of drinkers, separated by sex. Any information on drinking by sex and age was derived from surveys, collected by the WHO Collaborating Centre *(34)* and 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 included: Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, the former Yugoslav Republic of Macedonia, Malta, the Republic of Moldova, Montenegro, the Netherlands, Norway, Poland, Portugal, Romania, the Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, the United Kingdom of Great Britain and Northern Ireland, and Uzbekistan.

Estimates of exposure for Luxembourg are also presented, but these estimates were derived via the consumption in the neighbouring countries, as it is difficult to determine how much alcohol is sold to people living in this 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 Fig. 1–9 comprise all countries in the WHO European Region with the exception of the following small countries: Andorra, Monaco and San Marino.

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

In addition to country estimates, adult per capita consumption for the WHO European Region is estimated 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)*: first, a drinking style with wine as the predominant alcoholic beverage and frequent (daily or almost daily) alcohol consumption, mostly as a part of meals. (For a wider discussion on the categorization of drinking patterns, *see (38)*.)[5] This so-called Mediterranean drinking style was 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, beer was the predominant alcoholic beverage and, compared to the Mediterranean drinking style, there was less frequent drinking as well as a higher proportion of alcohol consumed outside of meals *(1,25,27,37)*. In the Nordic countries, as well as in many countries in central-eastern and eastern Europe, the traditional drinking style was non-daily drinking, mainly outside of meals, and spirits were the most popular beverage *(36,42)*. Abstinence is low overall in the WHO European Region *(1)*, but substantial in several south-eastern and central Asian countries with higher proportions of Muslim populations.

Modern European drinking has been moving into similar drinking levels and patterns in most countries, with almost no more prototypical drinking styles dominating at the population level of any country, with the exception of the countries around the Russian Federation (*see below*; for more details on current drinking styles, *see (1,37,43,44)*).

Based on the current drinking patterns and economic wealth of countries,[6] the following regional clusters were separated.[7] Please note that these clusters were selected as illustrations, and were 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)** comprise Austria, Belgium, Denmark, Germany, the Netherlands and Switzerland. The countries in the central-western part of the EU were all categorized as high-income by the World Bank *(47)*, and would rank at the higher end within that category within the WHO European Region. All central-western EU countries had been part of this category for the whole observation period (i.e. 1990–2014). The drinking styles in these countries are characterized by a large proportion of beer and wine as the preferred beverages, and by drinking both with and outside of meals in a relatively frequent style (*see also* footnote 6).
- **EU countries in central and eastern Europe** comprise Bulgaria, Croatia, the 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 of these countries was traditionally characterized by consumption of a comparably large proportion of spirits, with frequent episodes of heavy drinking in most countries. However, in 2014, only Bulgaria, Estonia, Lithuania and Slovakia had a preference for spirits, and the difference between drinking beer and spirits even in these countries was small and mostly within measurement error of standard surveys. A considerable proportion of drinking occasions occur outside of meals.
- **Mediterranean countries** comprise Cyprus, France, Greece, Israel, Italy, Malta, Portugal, Spain and Turkey. All of these 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 *(49)* (but *see* footnote 8). However, since 2000, there has been a shift to both beer and spirits in Cyprus, Israel and Turkey; and to beer in Spain *(1,25,27)*.

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[5] In the WHO European Region, alcohol consumption has roots 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)*.

[6] Economic wealth is related to the level of alcohol consumption, but more so in low- and lower–middle-income countries *(45,46)*. Within the group of high-income countries, indicators of economic wealth no longer have predictive value for the overall level of consumption.

[7] For some regional comparisons, trends have been used for the EU as a whole (2015) comprising the following countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg (only for exposure), Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the 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 *(47)*, and most EU countries had been part of this category for the whole observation period (i.e. 1990–2014). While drinking levels are similar, drinking styles differ within the EU with regard to the highest percentage of pure alcohol consumed by alcoholic beverage type. Countries where currently (2014) beer is the preferred beverage type are: Austria, Belgium, the Czech Republic, Finland, Germany, Hungary, Ireland, Latvia, the Netherlands, Poland, Romania, Spain and the United Kingdom. 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, the most preferred and the second most preferred beverage types were of almost equal proportions. EU countries also differ with respect to drinking frequency, proportion of heavy drinking occasions and drinking with meals (for more details, *see (1,36,37,48)*).

[8] Turkey and Israel were exceptions with respect to almost daily drinking.

- **Eastern European countries with similar drinking habits** comprise the Russian Federation, Belarus, the 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 the middle-income category. Their drinking style is characterized by episodic heavy drinking, with both longer duration and larger volume of alcohol consumed per occasion than in other parts of the WHO European Region *(50,51)*.
- **Countries in the south-east of the WHO European Region** comprise 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, a relatively low level of alcohol consumption *(1)*, in part due to the fact that in many countries, the majority of people are Muslims *(52)*. Spirits are the preferred beverage type, except in Georgia (wine) and Turkey (beer) *(1)*.

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

Box 2. Regions used in this report and included countries

Regions	Countries
Central-western EU	Austria, Belgium, Denmark, France, Germany, Luxembourg, Netherlands and Switzerland
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
Central-eastern EU	Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia
Mediterranean	Cyprus, France, Greece, Israel, Italy, Malta, Portugal, Spain and Turkey
Eastern WHO European Region	Russian Federation, Belarus, Republic of Moldova and Ukraine
South-eastern WHO European Region	Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan

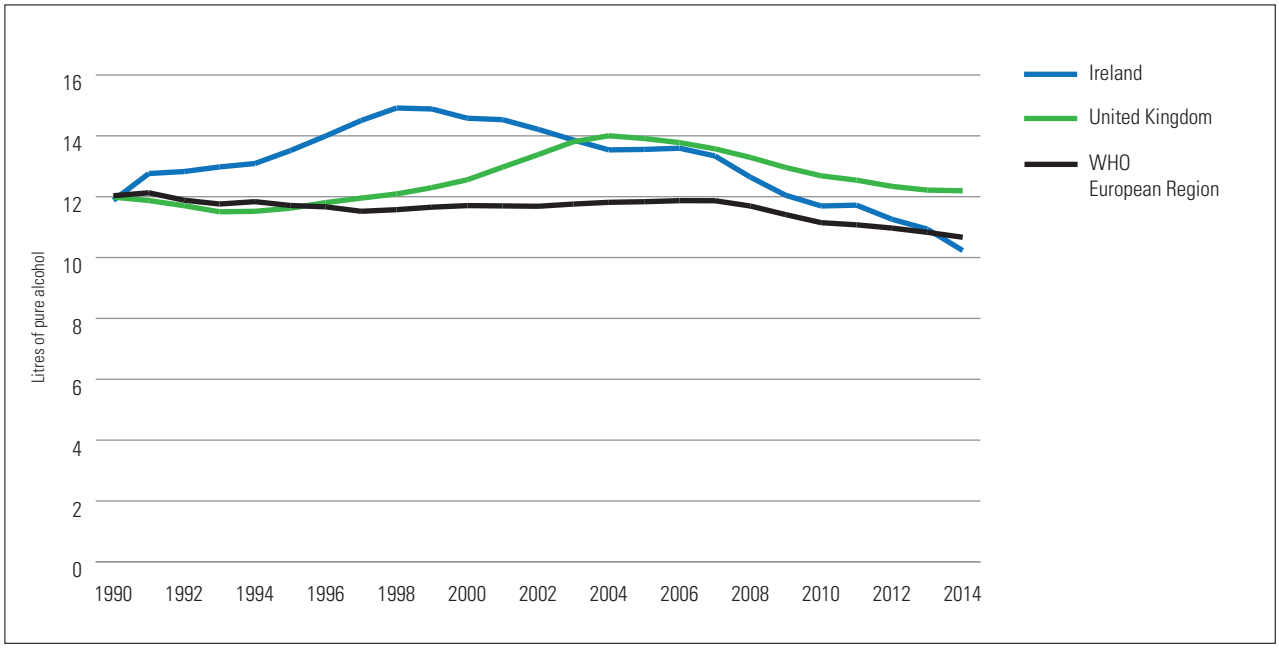
Any regional trends are based on population-weighted three-year moving averages of the respective countries (weighted by the population aged 15 years and older) for the year under consideration (i.e. for the year 2010, the average of 2009–2011 is presented). Finally, the trend in adult per capita consumption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

TRENDS IN TOTAL ADULT PER CAPITA ALCOHOL CONSUMPTION FOR ALL COUNTRIES IN THE WHO EUROPEAN REGION

Trends in total adult per capita alcohol consumption are presented, which includes the sum of recorded, unrecorded and tourist consumption, for all countries in the WHO European Region, with clusters of several neighbouring countries being on the same graph. For comparison purposes, each graph will contain the trend in the WHO European Region as well.

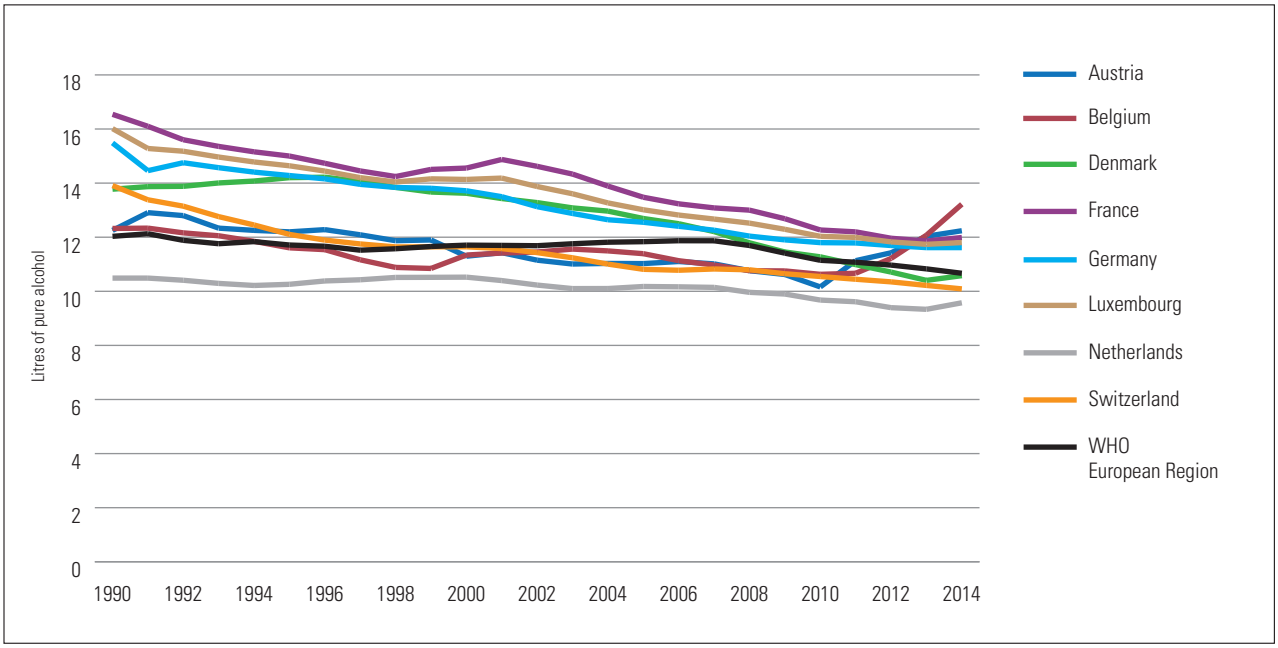
In 1990, the western European countries of Ireland and the United Kingdom (England, Scotland, Wales and Northern Ireland) had similar consumption as the WHO European Region as a whole (Fig. 1[9]), but lower alcohol consumption than most continental EU countries (Fig. 2). While these continental EU countries and the WHO European Region as a whole decreased alcohol consumption over the time period of 25 years, both Ireland and the United Kingdom experienced increases in consumption before decreases were observed. Currently, adult per capita alcohol consumption in the United Kingdom is still higher than the WHO European Region average.

Fig. 1. Trends in adult per capita alcohol consumption for Ireland and the United Kingdom, 1990–2014



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

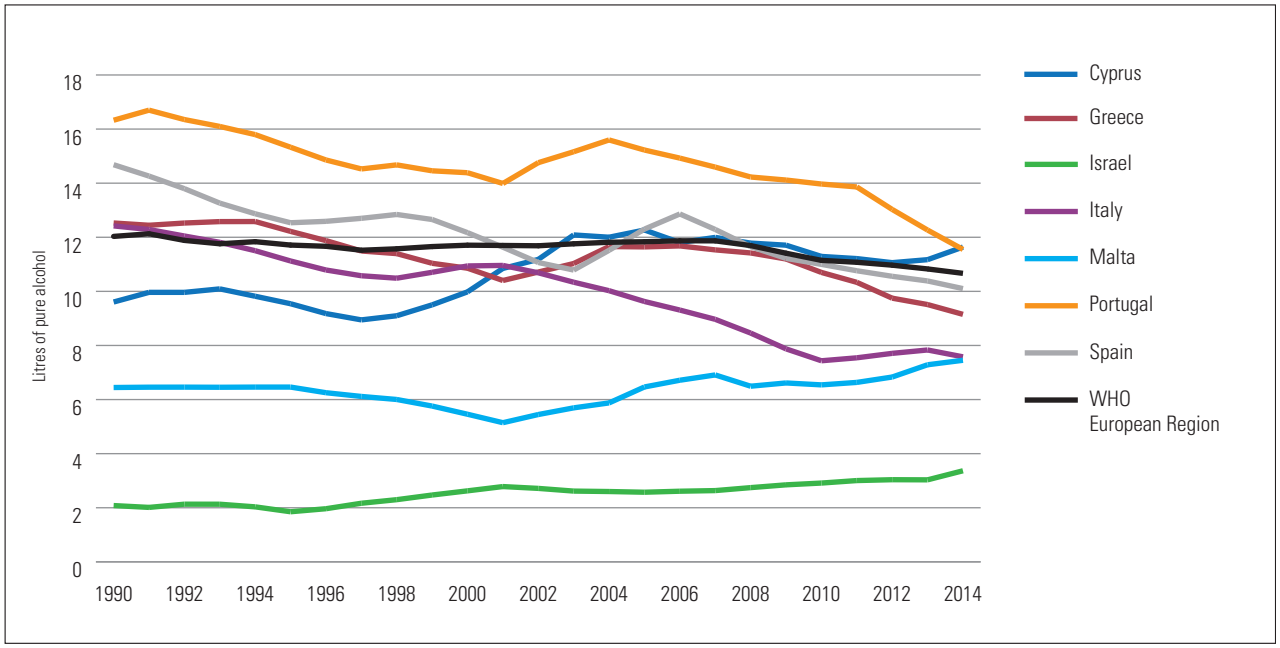
Fig. 2. Trends in adult per capita alcohol consumption for Austria, Belgium, Denmark, France, Germany, Luxembourg, the Netherlands and Switzerland, 1990–2014



[9] As the main purpose of the figures on trends in adult per capita exposure is the comparison between neighbouring countries, different scales have been used in different figures. For overall comparison within the WHO European Region, the trend line for the Region as a whole is added as well.

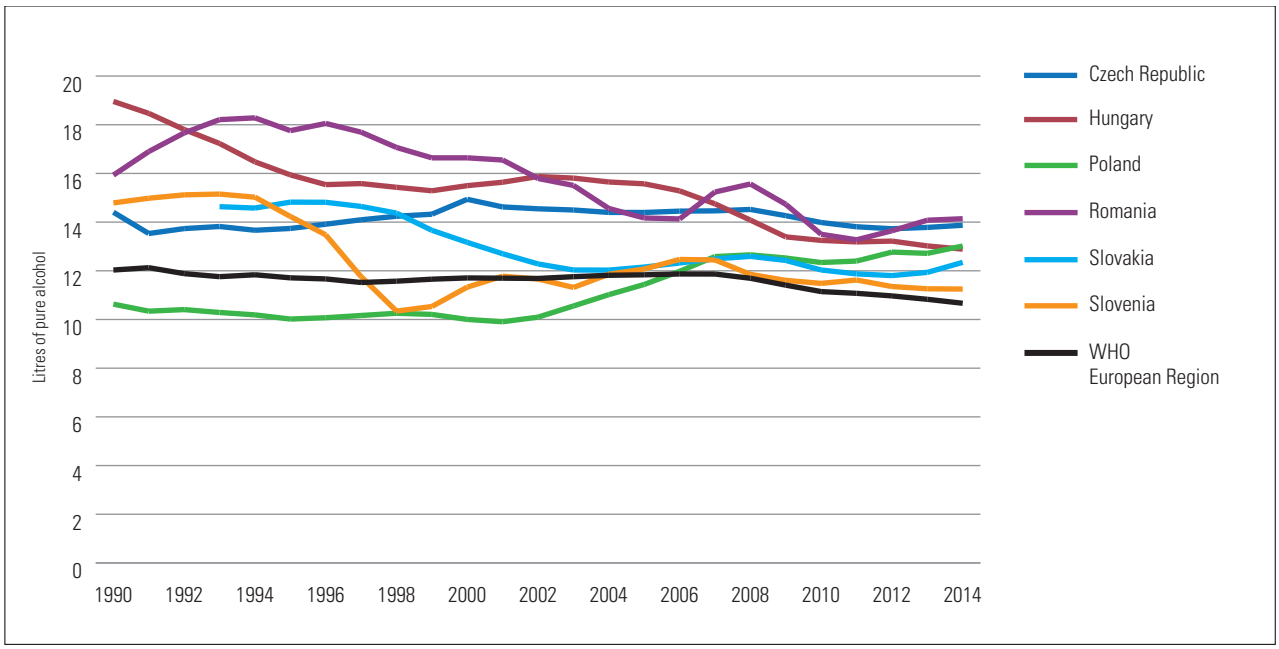
Overall, alcohol consumption in countries in the south of the WHO European Region around the Mediterranean Sea has been decreasing, especially in the largest countries of Spain and Italy (Fig. 3). However, adult per capita alcohol consumption in the south of the WHO European Region is converging, and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

Fig. 3. Trends in adult per capita alcohol consumption for Cyprus, Greece, Israel, Italy, Malta, Portugal and Spain, 1990–2014



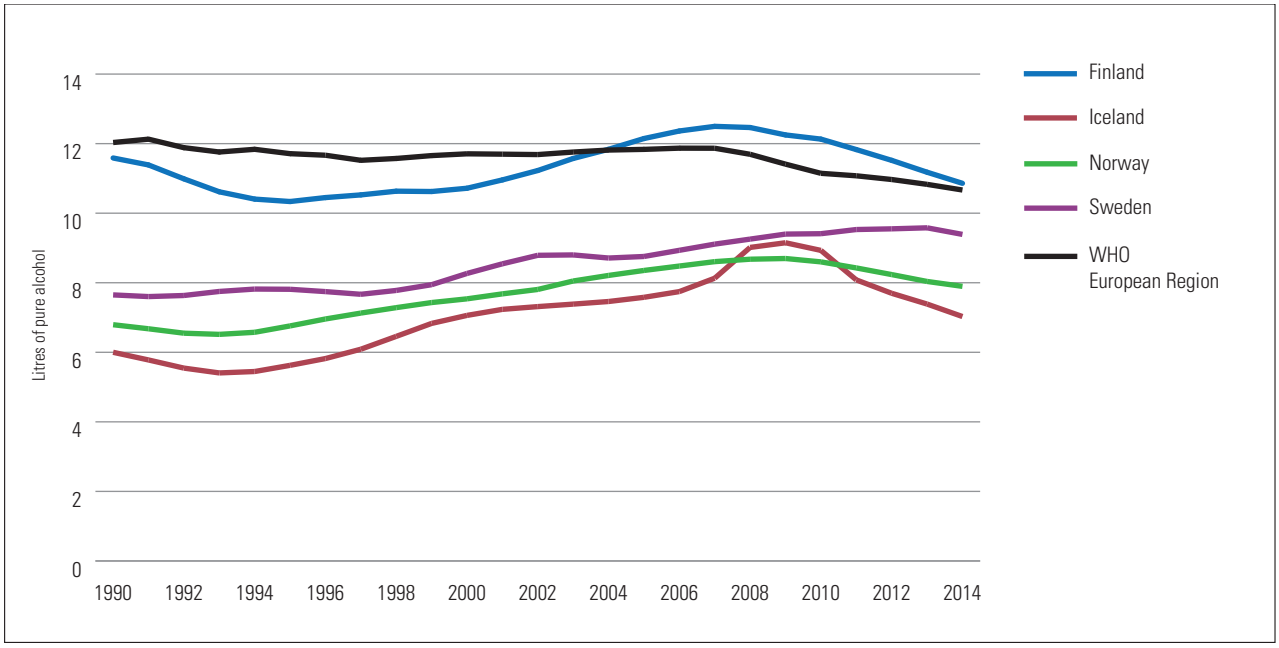
In 2014, all six countries in Fig. 4 consumed alcohol at a level that was higher than the WHO European Region average. Alcohol consumption in this region can also be characterized by the higher variation in consumption levels between countries and across time compared to the central-western EU countries.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

Fig. 4. Trends in adult per capita alcohol consumption for the Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia, 1990–2014



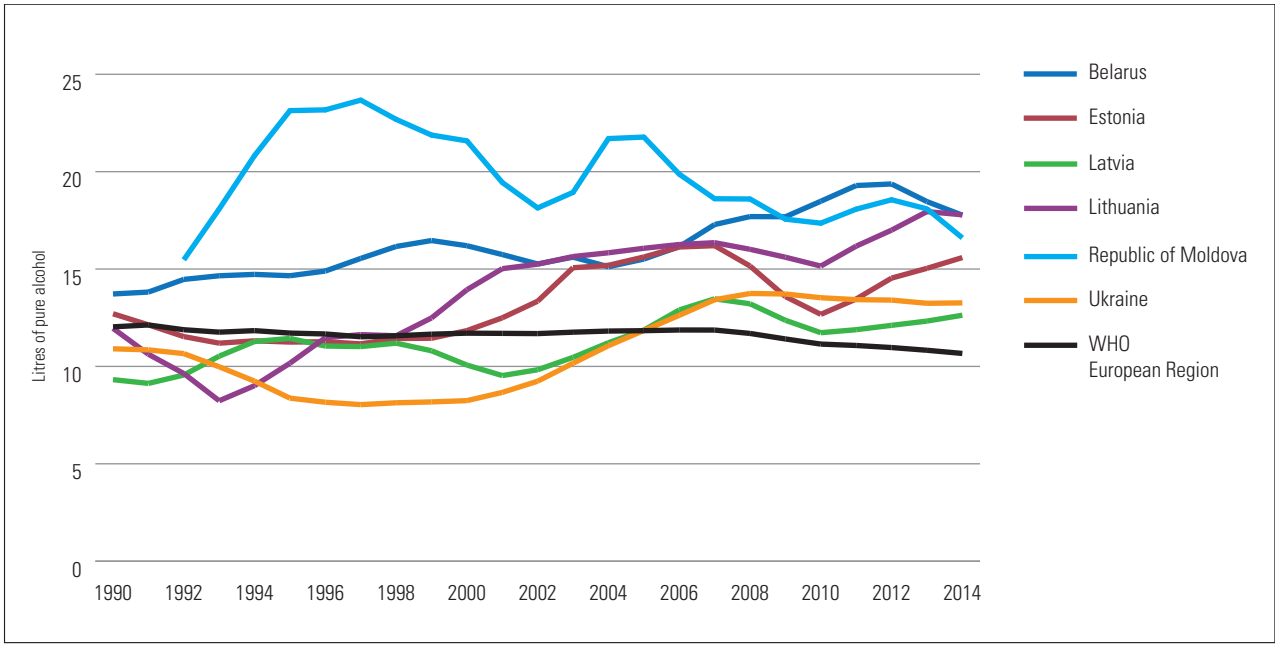
The Nordic countries in Fig. 5 were historically at the lower end of the alcohol consumption continuum of Europe. This changed in the 2000s, and in 2014, consumption in Finland was higher than the WHO European Region average; and the other Nordic countries had increased their consumption since 1990 as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

Fig. 5. Trends in adult per capita alcohol consumption for Finland, Iceland, Norway and Sweden, 1990–2014



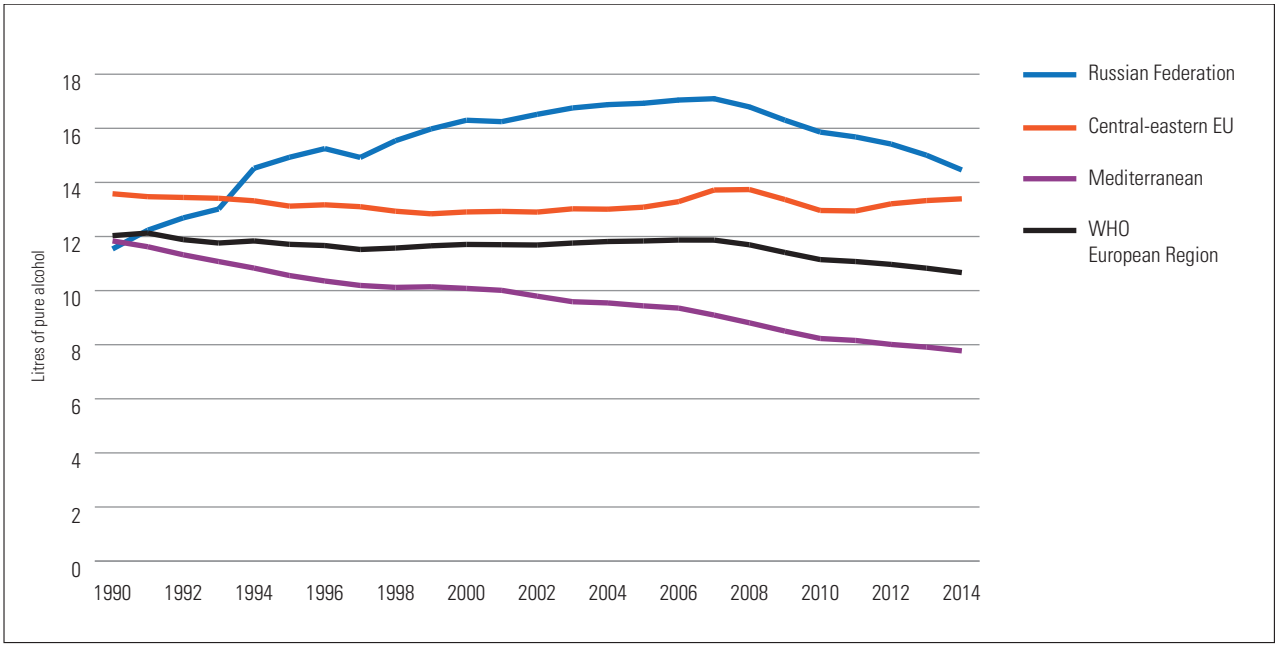
The eastern European countries in Fig. 6 had markedly higher consumption levels when compared to the WHO European Region average in 2014; however, this was not always the case. For several of these countries, in the beginning of the 1990s, consumption levels were below or at the WHO European Region average.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

Fig. 6. Trends in adult per capita alcohol consumption for Belarus, Estonia, Latvia, Lithuania, the Republic of Moldova and Ukraine, 1990–2014



The Russian Federation is the most populous country in eastern Europe, and has a long history of heavy drinking associated with considerable alcohol-attributable harm, which persists into the present *(5,53–55)*. Fig. 7 shows that in the past two-and-a-half decades, consumption levels have continued to be high (and in 2014, higher than the central-eastern EU countries). There is a good indication, however, that over the past seven years, consumption has decreased in the Russian Federation. This decrease may have been due to recent changes in alcohol policies *(56,57)*.

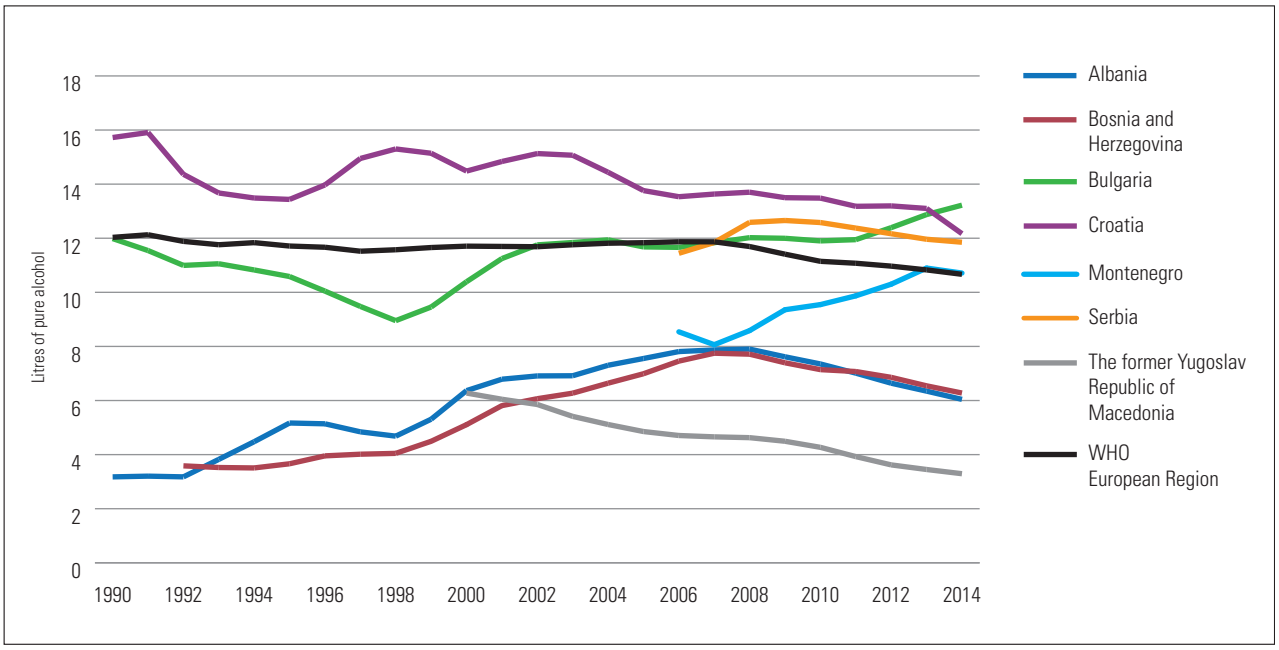
Fig. 7. Trends in adult per capita alcohol consumption for the Russian Federation with several comparator regions, 1990–2014



The trends in alcohol consumption have been contrasted with two more regions (for definitions, *see* Box 2, page 5) to illustrate how different the trends in the Russian Federation have been. In 1990, shortly after an anti-alcohol campaign was initiated in 1985, the alcohol consumption level in the Russian Federation was relatively low, below the WHO European Region average, slightly below the average of the Mediterranean countries and markedly below the average of the central-eastern EU countries. In the following years, consumption levels increased markedly until 2007, when the Russian Federation population consumed 3 litres more per capita of pure alcohol than central-eastern EU countries, 5 litres more than the average of the WHO European Region, and 8 litres more than the Mediterranean countries. In 2014, the three averages came closer together, with the Russian Federation decreasing consumption levels again, but there are still marked differences, as both the WHO European Region average and the average of the Mediterranean countries decreased as well.

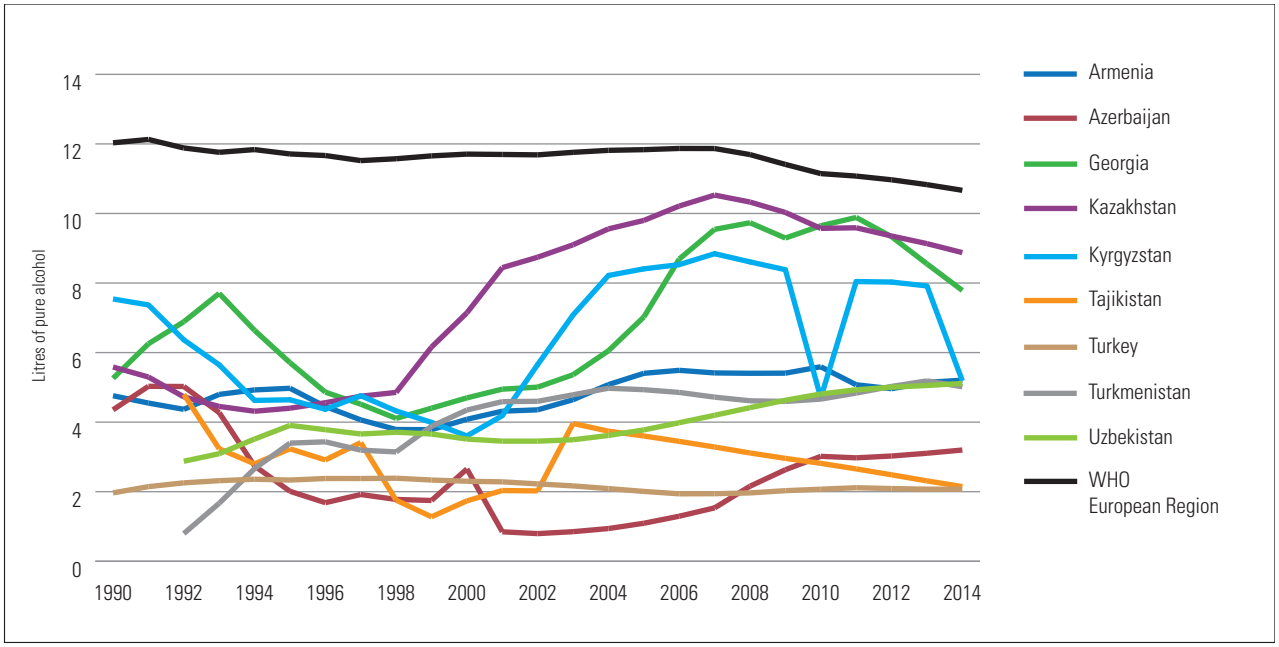
There is considerable variation in the alcohol consumption levels among countries in central south-eastern Europe (Fig. 8) over the past decades, both between and within countries, with no clear overall trend and no convergence. Many of these countries were part of the former Yugoslavia, and some of the observed variation may also reflect the establishment of national recording systems. Bulgaria, Croatia and Serbia have had levels above the WHO European Region average for almost a decade, whereas Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia and Albania are clearly below the WHO European Region average levels of alcohol consumption. In the latter countries, there is a marked proportion of people who follow the Muslim faith *(52)*.

Fig. 8. Trends in adult per capita alcohol consumption for Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Serbia and the former Yugoslav Republic of Macedonia, 1990–2014



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 (Fig. 9). 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 countries in this region have a large proportion of Muslims, but operated under alcohol regulations influenced by prior Soviet Union laws in the first years of the observation period.

Fig. 9. Trends in adult per capita consumption for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan, 1990–2014

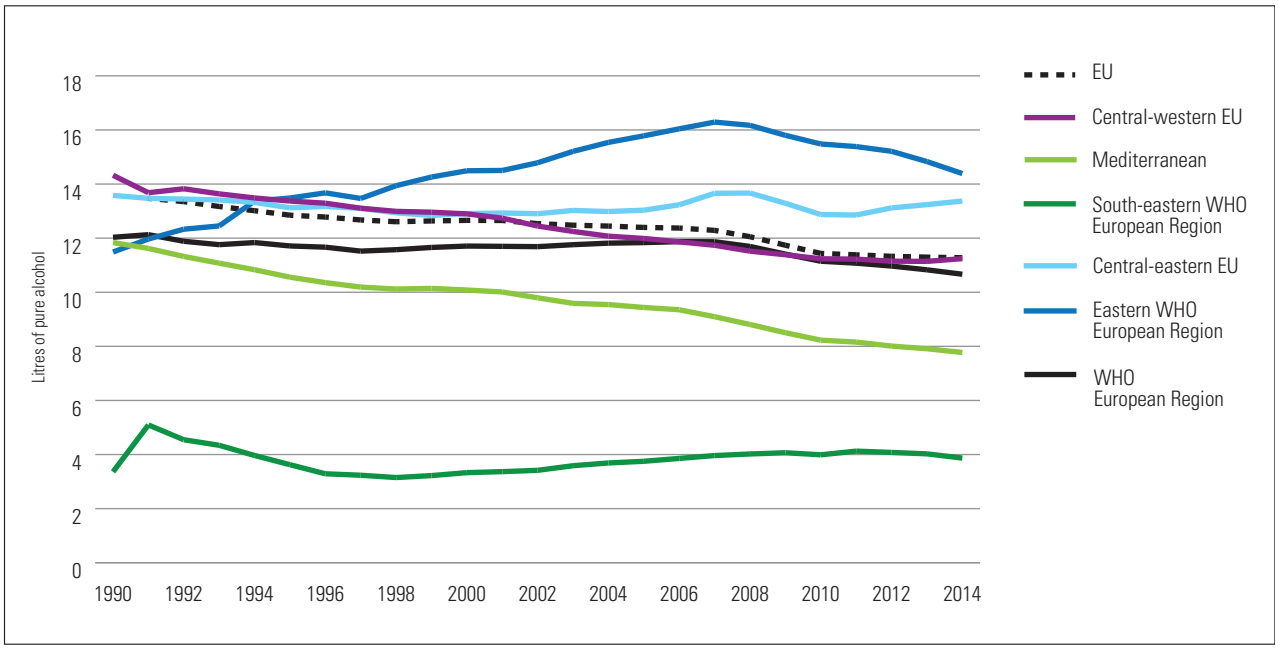


REGIONAL TRENDS IN TOTAL ADULT PER CAPITA ALCOHOL CONSUMPTION

Fig. 10 summarizes the trends in different subregions within the WHO European Region and for the Region as a whole between 1990 and 2014.[10] There are clear differences in trend: consumption in the WHO European Region in the past 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 the number of unemployed people *(58,59)*. (For the relationship between unemployment and alcohol consumption, *see (60)*.) Such an effect would be most relevant for countries with a lower income, 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 fuelled primarily by an almost linear decrease in the countries of the EU over the period (approximately –18% based on the 1990 level). 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 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 *(61–63)*.

Fig. 10. Trends in adult per capita alcohol consumption in the WHO European Region and selected subregions, 1990–2014



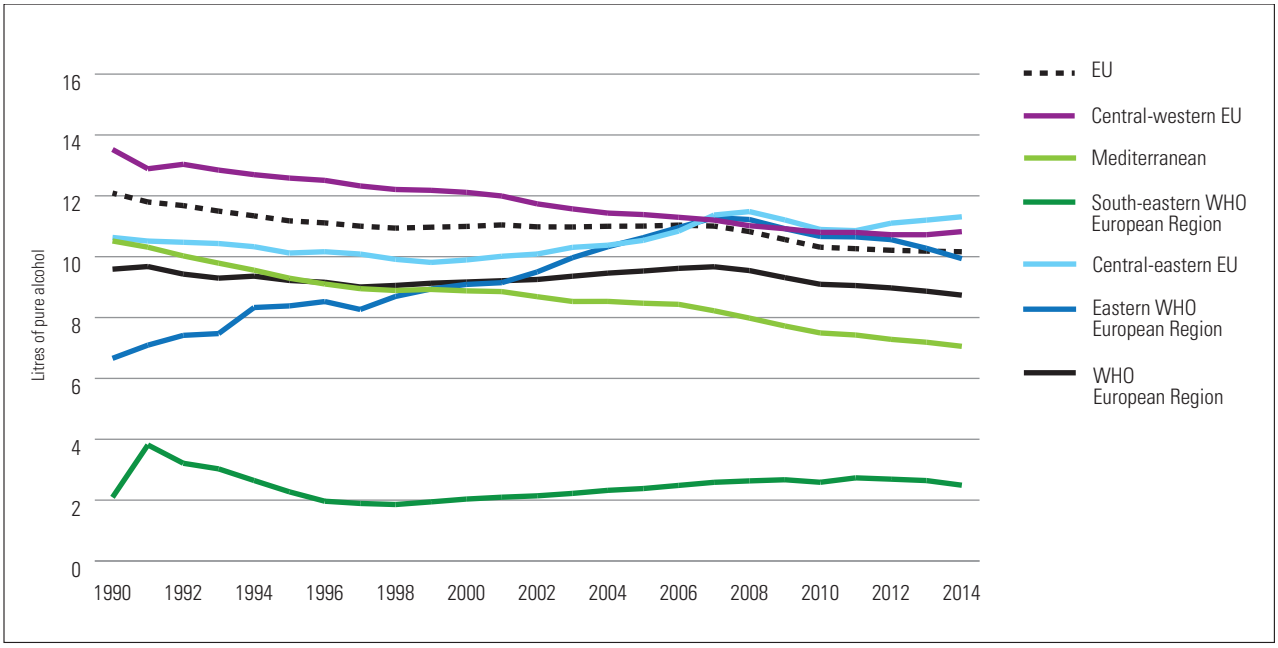
However, not all regions of the EU showed a decrease in alcohol consumption. The central-eastern part of the EU had almost stable consumption over the observation period. The eastern WHO European Region in 1990 had consumption levels that were below that of the EU and Mediterranean countries, and now their consumption exceeds the consumption in these regions by far: in 2014, the eastern WHO European Region had 3.1 (28%) and 6.6 (85%) litres per capita higher consumption than the average of the EU and 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 from the Muslim faith *(52)*. 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.[11]

[10] While the emphasis of this report is on the country level, and thus the majority of figures concern all countries in comparison with neighbouring countries, the next section gives some regional trends. There is some overlap between regions, as the regions were selected based on geography, economic wealth and drinking tradition (*see above* for details).

[11] 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 (1)*), 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).

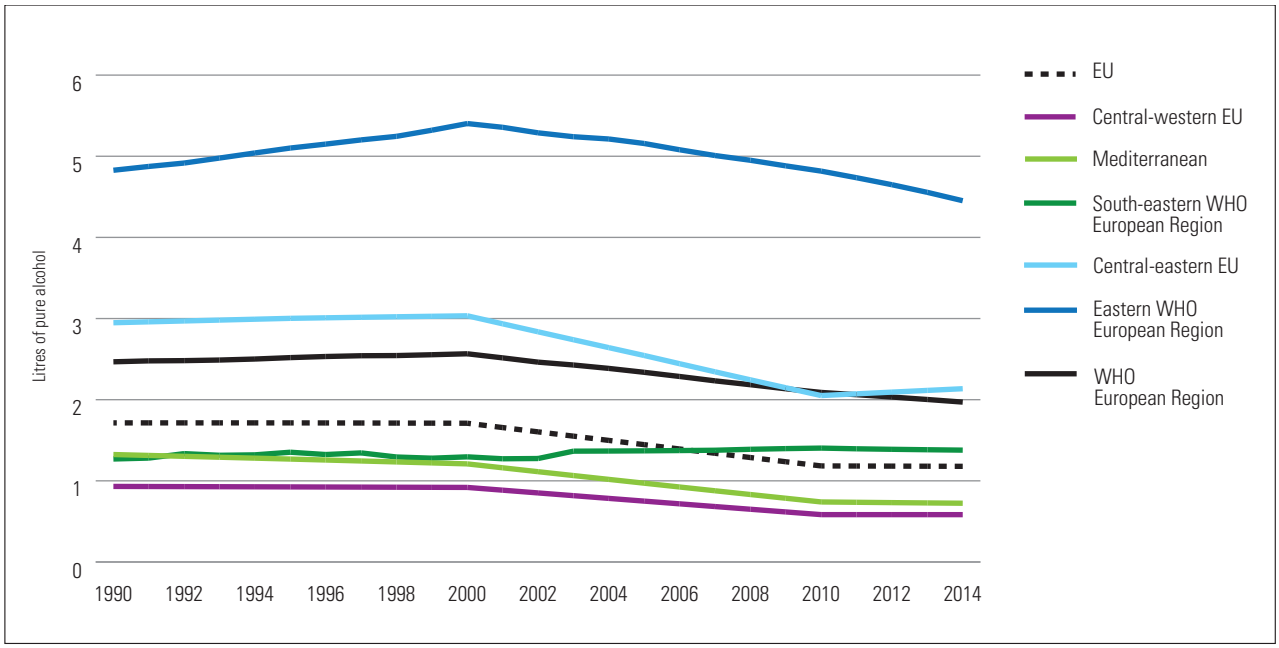
Most of the changes in alcohol consumption levels were driven by changes in recorded consumption (Fig. 11). The traditionally high-consuming countries in the central-western part of the EU decreased their consumption by 2.7 litres per capita (about 20%), with EU decreasing by 16% and the Mediterranean 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.

Fig. 11. Trends in recorded adult per capita alcohol consumption in the WHO European Region and selected subregions, 1990–2014



Unrecorded consumption in the WHO European Region and in most of its composite parts, as estimated periodically, was stable or decreased (Fig. 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. Central-western EU countries decreased their unrecorded consumption even further. The largest absolute level and relative impact of unrecorded consumption was found in the eastern WHO European Region *(22).*

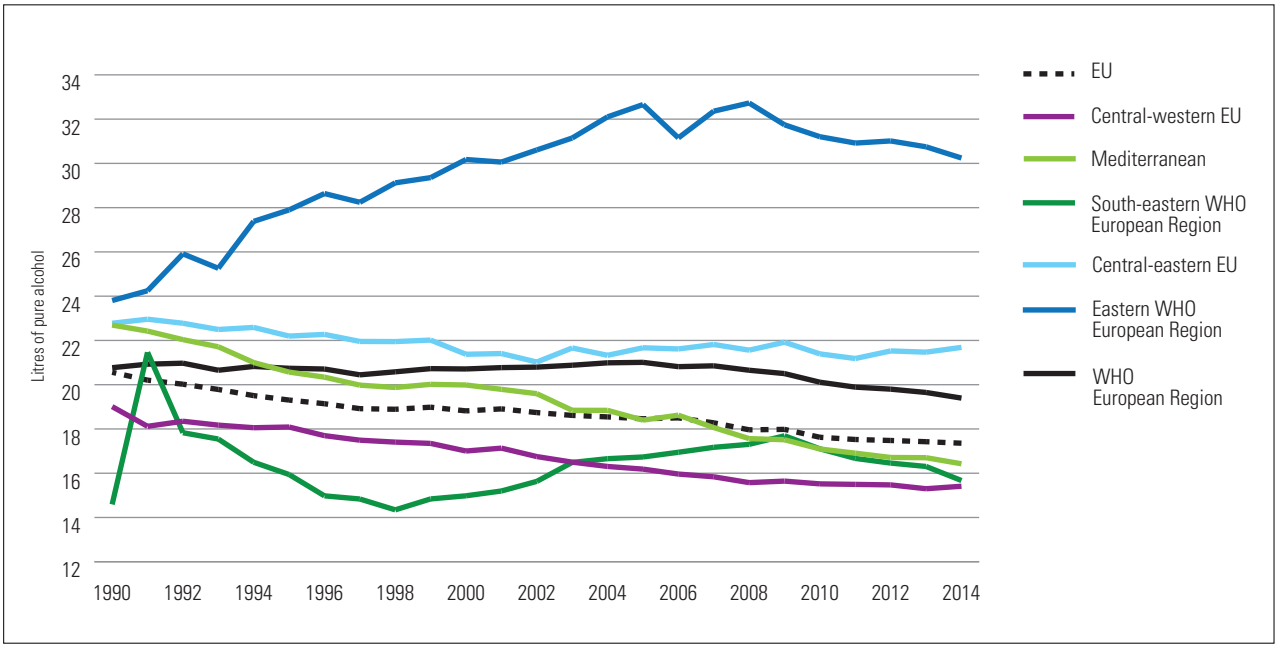
Fig. 12. Trends in unrecorded adult per capita alcohol consumption in the WHO European Region and selected subregions, 1990–2014



TRENDS IN ALCOHOL CONSUMPTION PER DRINKER

Fig. 13 and 14 give an overview of the average alcohol consumption per adult drinker by sex. For men, most of the regions cluster around the WHO European Region average (Fig. 13), including even the countries from the south-eastern part of the Region, indicating again that once subpopulations start using alcohol, they often tend to drink at similar levels, almost independent of culture *(64,65)*.[12] However, the levels in the eastern WHO European Region are markedly higher in this regard, which helps to explain why this region has experienced a proportionally larger alcohol-attributable burden *(1,5,66)*. The lowest per-drinker consumption was in the central-western part of the EU, where the abstinence rates have traditionally been very low.

Fig. 13. Trends in per drinker per capita alcohol consumption for adult men in the WHO European Region and selected subregions, 1990–2014



For women, a largely similar picture as for men has been identified at a lower level, but women from the south-eastern WHO European Region consume markedly less alcohol compared to the other regions and to the WHO European Region as a whole (Fig. 14).

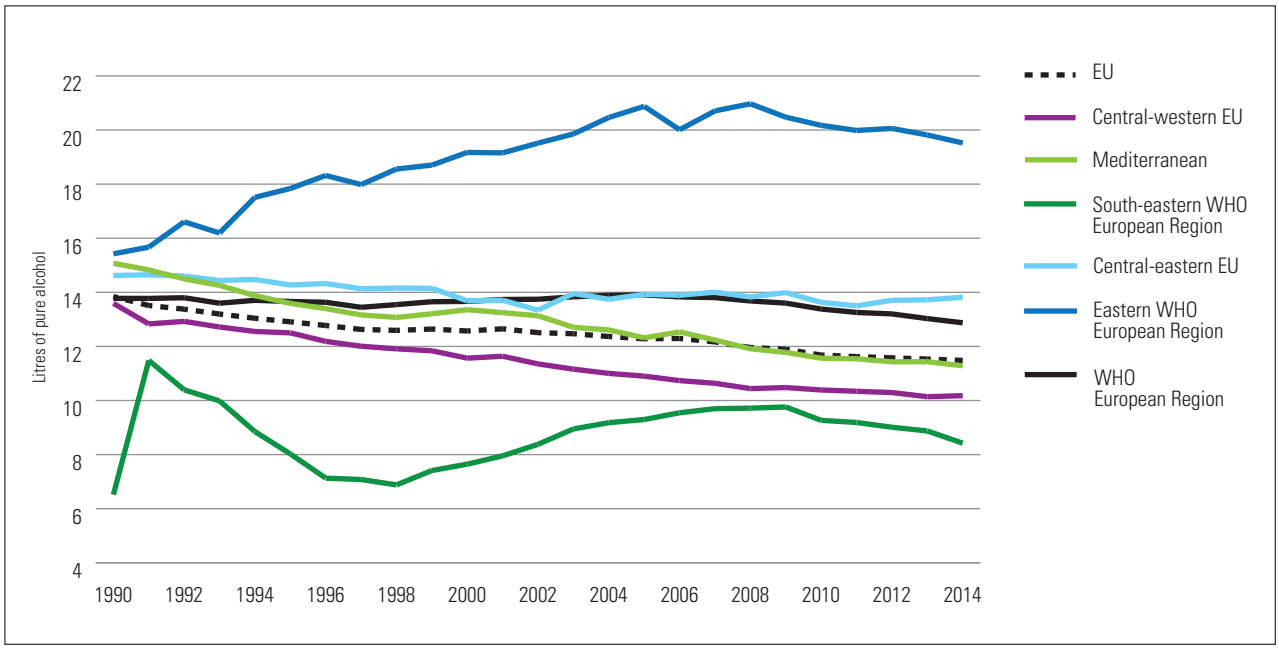
CONCLUSION: TRENDS IN ALCOHOL CONSUMPTION OVER THE PAST 25 YEARS IN THE WHO EUROPEAN REGION

Adults in the WHO European Region have decreased their alcohol consumption over the past 25 years. This decrease was fuelled by trends in countries with the highest economic wealth in the EU and, in particular, by the wine-drinking countries in the Mediterranean region. However, if countries in the eastern parts of the WHO European Region further increase their consumption, the NCD goals for reduction in the harmful use of alcohol (–10%) could be threatened in the Region (for more general considerations on reaching the NCD goal to reduce the harmful use of alcohol in the Region, *see (67)*). 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 reduction in the level of alcohol consumption in the WHO European Region, the enormous variation between countries, even between neighbouring countries, should be pointed out. The current increase in adult per capita alcohol consumption in several countries is worrisome, especially in the eastern part of the Region.

[12] A corollary of this statement is that the drinking level in different countries is markedly determined by the proportion of abstainers in the respective country. For 2010, based on data from the *Global status report on alcohol and health (1)*, 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 (CI): –0.86, –0.77; t = 19.6; P < 0.001); and for the WHO European Region it was –0.61 (n = 51 countries; 95% CI: –0.76, –0.40; t = 5.4; P < 0.001).

Fig. 14. Trends in per drinker per capita alcohol consumption for adult women in the WHO European Region and selected subregions, 1990–2014



More efforts should be undertaken to counter such developments by the respective countries and by the WHO European Region as a whole. Second, despite the overall decrease in alcohol consumption, the Region still has the highest levels of consumption in the world. From a broader public health perspective, the average consumption per adult in the WHO European Region is high, with comparatively more risks associated with drinking as compared with other voluntary activities or other forms of substance use *(68–70)*. This argues for a special effort to reduce alcohol consumption by well beyond 10% in the European Region.

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

COMPARISONS BETWEEN THE WHO EUROPEAN REGION AND OTHER WHO REGIONS

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

The following general statements can be made:

- Adult per capita alcohol consumption in WHO regions increased by about 10% over the past 25 years, and the rank order of regions remained stable, with the WHO European Region consuming the most alcohol, followed by the Region of the Americas, Western Pacific Region, African Region, South-East Asia Region and 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, fuelled by marked increases in consumption in China (Western Pacific Region; *see (71)*) and India (South-East Asia Region; for more details, *see (72)*). The African Region also increased its alcohol consumption markedly (for more details on the WHO African Region, *see (73)*).

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

Fig. 15. Adult per capita alcohol consumption in WHO regions in 1990 and 2014

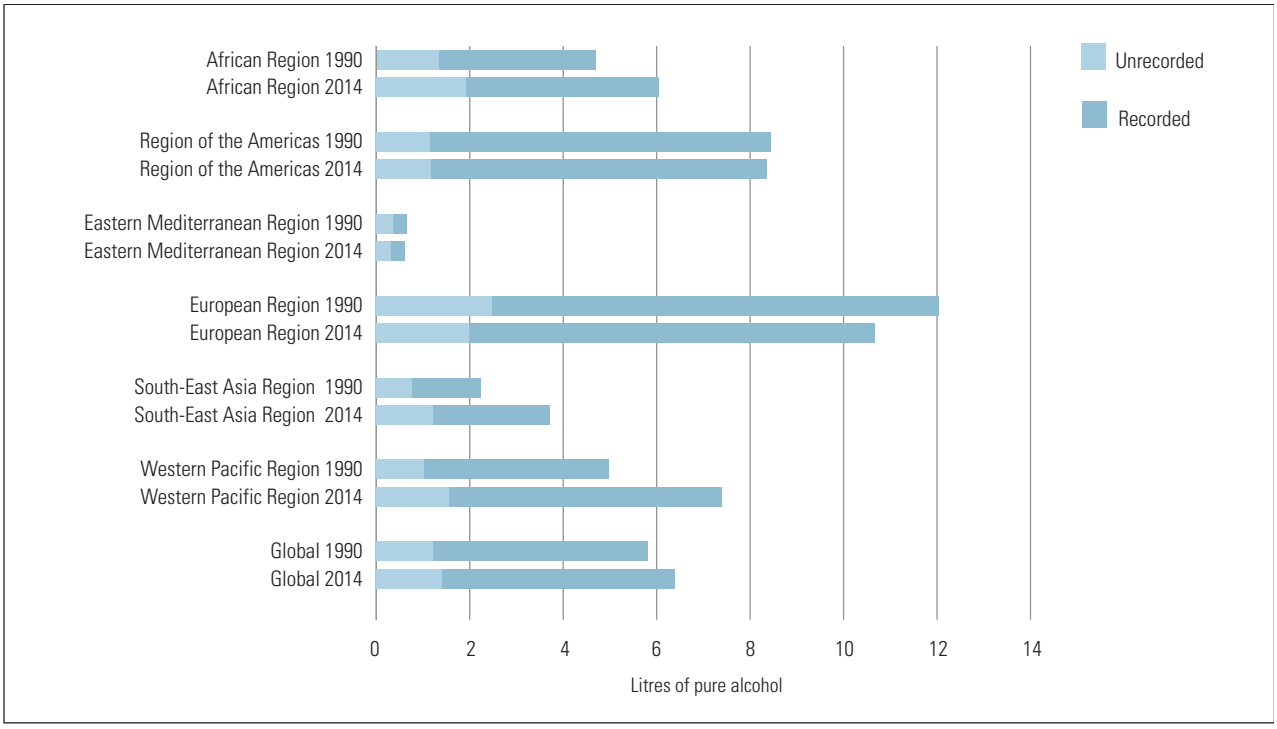


Fig. 16. Proportional changes in adult per capita alcohol consumption in WHO regions between 1990 and 2014

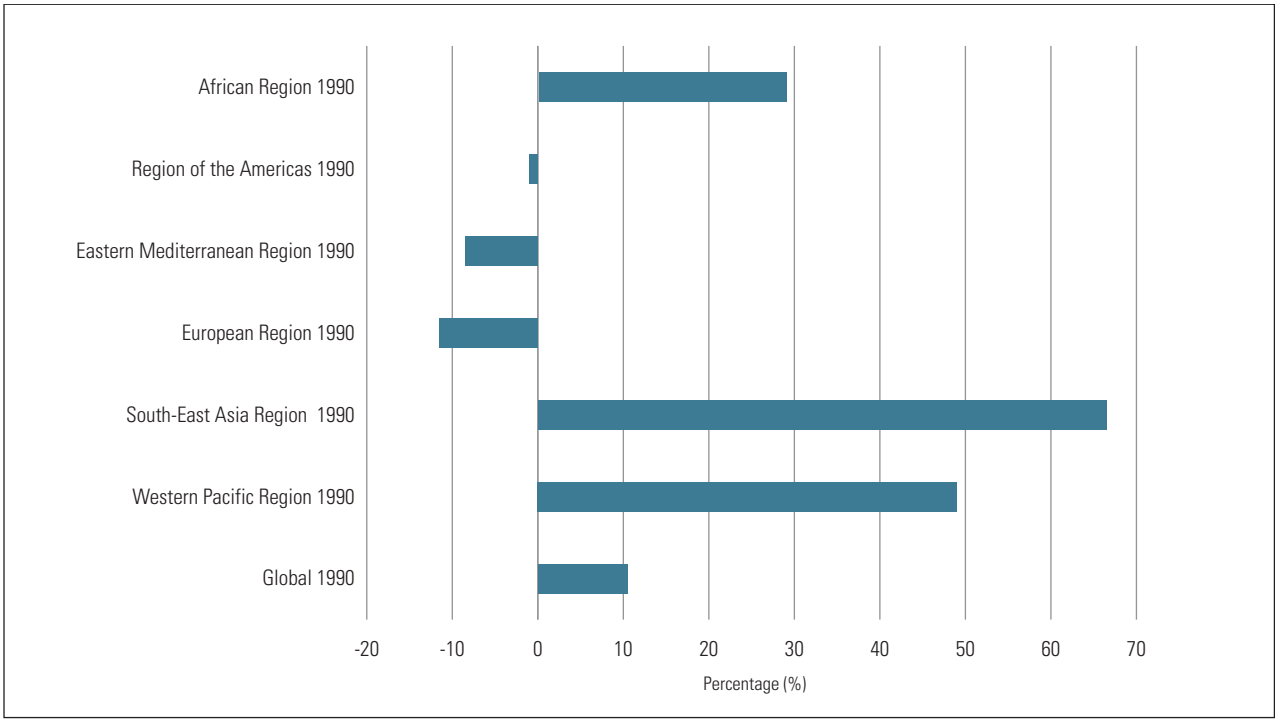
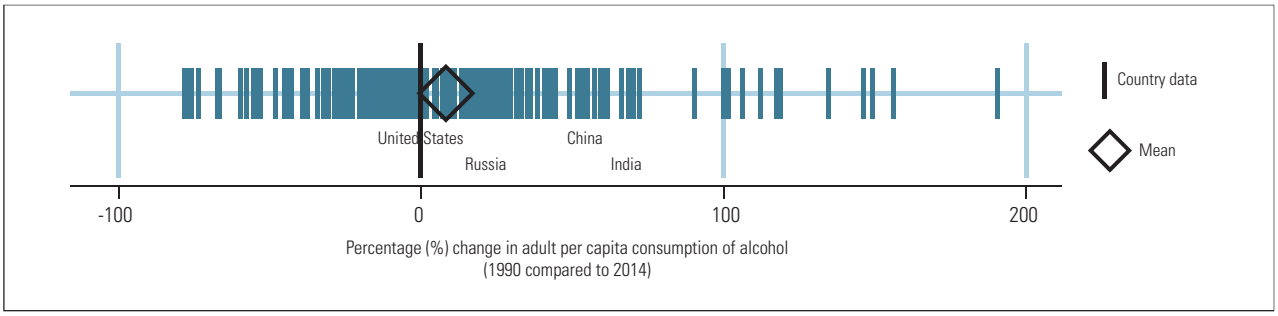


Fig. 17. Country-level data on change in adult per capita alcohol consumption between 1990 and 2014



BURDEN OF ALCOHOL-ATTRIBUTABLE MORTALITY IN THE WHO EUROPEAN REGION, 1990–2014

ON THE SELECTION OF MORTALITY AS THE MAIN OUTCOME

Mortality is clearly the most severe health consequence of alcohol consumption. This outcome has other advantages as well; it is more comparable and has less measurement bias than non-fatal health measures *(74)*. However, there are also limitations: progress in medicine and other factors may lead to a prolongation of life *(6)*, and thus, some effects of alcohol on health may be disguised if mortality alone is used as an outcome. Supporting this hypothesis, there is some indication that the trends diverged for alcohol-attributable mortality and morbidity, including but not limited to using hospitalizations as an indicator of the latter *(15,75,76)*.

MAIN CATEGORIES OF ALCOHOL-ATTRIBUTABLE CAUSES OF DEATH

Alcohol consumption has a causal impact in over 200 three-digit categories of the International Statistical Classification of Diseases and Related Health Problems (ICD)-10 *(77–79)*. However, an overwhelming majority of the burden of alcohol-attributable mortality, especially in Europe *(80,81)*, 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 (1)*, globally 88% of the burden of alcohol-attributable mortality 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* Table 7 in *(1)*). The remaining proportion of alcohol-attributable mortality was due to infectious diseases (tuberculosis [TB], HIV and pneumonia), neuropsychiatric conditions (epilepsy, alcohol use disorders) and neonatal conditions (fetal alcohol syndrome [FAS]).

The five categories are not only most relevant for alcohol-attributable deaths, but they also make up 76% of all-cause mortality in the WHO European Region (same proportion in both sexes), most in CVD, followed by cancer, injury and liver cirrhosis (calculations based on the Global Burden of Diseases, 2013 iteration *(82)*).

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

- **Liver cirrhosis**, although not identified as part of the NCDs within the WHO *Global action plan for the prevention and control of noncommunicable diseases 2013–2020 (13)*, is one of the more important single causes of death globally and in Europe *(83–85)*. Alcohol consumption has been identified as a causal factor for liver disease in general, and liver cirrhosis in particular, for centuries *(86)*. There is a clear dose–response relationship, which starts slowly and then accelerates (*87)*. Overall, the relative risks of heavy drinking are substantial *(87,88)* and consequently, mortality due to alcohol-attributable liver cirrhosis constitutes a major part of mortality as a whole *(83,89)*, especially in Europe *(90)*.
- Alcohol consumption has been identified as carcinogenic by the International Agency for Research on Cancer *(91–93)*. The following **cancers** have been identified to be partially attributable to alcohol: cancers of the nasopharynx, oesophagus, larynx, pancreas, liver, colon/rectum and female breast *(94)*. Dose–response relationships are close to linear on the relative risk scale *(95,96)*, with no apparent lower threshold; even light drinking has been shown to increase the risk of cancer *(96,97)*. 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 particularly true for the WHO European Region *(98,99)*.
- **CVD** have a complex relationship with alcohol consumption *(100,101)* (*see* Box 3). On the one hand, light-to-moderate regular drinking has been shown to be linked to decreases in morbidity and mortality from ischaemic disorders *(102,103)*. On the other hand, heavy drinking, both episodic and chronic, has detrimental effects *(104–106)*. For most other cardiovascular causes of death, the impact is detrimental with a clear dose–response relationship (hypertension *(107)*, haemorrhagic stroke *(103)*, atrial fibrillation *(108)*). As a result, the overall impact of alcohol on cardiovascular causes of death has been negative in most countries *(1,101)*, while the net impact on death from ischaemic diseases has been beneficial for many countries, with the exception of countries with pronounced episodic or chronic heavy drinking patterns *(109,110)*.

- Alcohol has a causal impact on almost all categories of **injury**, both intentional and unintentional *(78,118,119)*. For some kinds of injuries such as traffic injury and violence, there is both the impact on the drinker *(120)* and the impact on others *(14,121)*. All levels of alcohol consumption have some impact on injury, as alcohol impacts the central nervous system even at low-to-moderate doses *(122,123)*; however, the dose–response relationship increases with higher levels of consumption *(124,125)*.

Box 3. 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 that underlie the estimates of the 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 for a while, with exposure such as alcohol consumption usually measured at the beginning of the study and outcomes years later. The association between exposure and different outcomes is estimated after that.

However, there are some indications that the beneficial effects of alcohol consumption on ischaemic heart disease and ischaemic stroke as derived from usual epidemiological studies have been overestimated. A number of selection biases were found in the underlying studies *(29,111)*; results from Mendelian randomization studies, another type of study with stricter control, seem to contradict the results *(112)* (but *also see (113)*); and finally, aggregate-level studies also found conflicting results *(114)*.

While the current evidence suggests that the beneficial effects of alcohol on CVD outcomes may have been overestimated, there are still good biological reasons for the beneficial effect based on experimental evidence from surrogate markers of ischaemic heart disease *(115–117)*. Moreover, it is hard to quantify the overestimation, and the best available estimates have been used from meta-analyses of individual-level studies, even if they overestimate the beneficial effect.

The burden for these cause-of-death categories are presented separately for each country from 1990 to 2014; for injuries, also separately by major subcategory, i.e. unintentional and intentional injury. The main calculations will be restricted to drinkers harming themselves, but some indication of harm to others from alcohol consumption will be presented.

METHODOLOGY TO ESTIMATE THE ALCOHOL-ATTRIBUTABLE BURDEN

The same standard methodology that was used for the WHO *Global status report on alcohol and health* (last iteration 2014 *(1)*) and the Global Burden of Disease, Injury and Risk Factor studies (last iteration 2013 *(2)*) was used to estimate the alcohol-attributable burden. While the methodology has been described in detail elsewhere *(1,2,126)*, the main steps are 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, *see (126,127)*). Survey data are necessary to distribute information on per capita consumption, 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 causes of death from ischaemic heart disease and injury, were taken from surveys (*see* Appendix 61 for a listing of all sources for heavy drinking occasions).
- For all countries except the Russian Federation and surrounding countries with similar patterns of drinking (Belarus, the Republic of Moldova, Ukraine), dose–response relationships were taken from meta-analyses (for liver cirrhosis: *(87)*; for all alcohol-attributable cancer sites: *(128)*; for the various categories of CVD and hypertensive disease: *(107)*; ischaemic heart disease and ischaemic stroke: *(101,104)*; other stroke types: *(103)*; atrial fibrillation: *(108)*; for injury: *(128)*). For the Russian Federation and surrounding countries with similar patterns of drinking, country-specific estimates were used for dose–response relationships from the Russian Federation from a large prospective study (*(54,109)*; *see (66)* for further reasoning).

- For injury, the relative risks from the meta-analysis of Corrao and colleagues *(128)* were used, modified to incorporate the effects of binge drinking. While it did not explicitly include risk to others[13] in general, some of the effects of alcohol use on traffic injury were included. Thus, the WHO *Global status report on road safety 2015* was used *(133)* as a source for the distribution of the sex of the driver, and the number of passengers per car to add to the alcohol-attributable injury. (For general considerations on harm to others, *see (14,121)*.)
- Exposure and dose–response relationships were combined using standard formulas for attributable risk *(126)* (for foundation, *see (134–136)*) to derive alcohol-attributable fractions by sex and age (the usual age groups for comparative risk assessments characterizing alcohol exposure (15–34 years; 35–64 years; and 65+ years).
- The alcohol-attributable fractions were then applied to the cause-of-death statistics *(137)* divided by the respective population to derive rates per million population. To achieve comparability, the rates were age-standardized using the standard population of the International Agency for Research on Cancer *(138)*.

BURDEN OF ALCOHOL-ATTRIBUTABLE MORTALITY IN 2014 IN THE WHO EUROPEAN REGION

Table 1 gives an overview of standardized mortality rates of major alcohol-attributable disease categories for the year 2014. While the countries with the highest overall rates of alcohol-attributable mortality from the eastern part of the WHO European Region tend to be the highest in many of the six subcategories of causes of death reported here (i.e. liver cirrhosis, cancer, CVD, injury, unintentional injury, intentional injury), the results are differentiated by country and region-specific characteristics.

- Like any other type of alcohol-attributable mortality, mortality rates due to alcohol-attributable liver cirrhosis are mainly impacted by two factors: the overall mortality rate from liver cirrhosis in the country/region under consideration and the level of alcohol consumption. For European countries with high rates of alcohol-attributable liver cirrhosis, these two causal factors determine three clusters of countries:[14] first, the central Asian countries of Kazakhstan, Kyrgyzstan, Turkmenistan and Uzbekistan have a high overall prevalence of and mortality from liver cirrhosis, in large part driven by hepatitis B and C infections *(84)*. 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, independent of the original cause for incidence of this disease category, as even relatively small amounts of alcohol may lead to mortality in people who have the disease, irrespective of its etiological pathway *(87)*. (For the difference in risk curves between morbidity and mortality, *see (90,139)*.[15]) Second, countries such as Hungary, the Republic of 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 *(141)*. Finally, countries such as Lithuania or Ukraine would be typical of 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 *(142,143)*, and that more variable drinking of the same amount of alcohol does not imply additional risks for liver cirrhosis mortality, as abstinence days are favourable for liver regeneration (so-called liver holidays *(144,145)*).
- 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 *(146)*. Another reason is that alcohol is not causally or is only weakly related to the most numerous cancers. As a result, the level of alcohol consumption is the main determinant of 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% (the Republic of Moldova) – in 2014 for alcohol-attributable fractions of cancer mortality in the WHO European Region is still very important,[16] given the overall impact of cancer on mortality in the Region.

[13] Thus, neither the effects of pregnant women's drinking on the newborn (such as on FAS or fetal alcohol spectrum disorders, *(129,130)* or the sequelae of low birth weight *(131)*) or the effect of alcohol on aggression towards others was included *(132)*.

[14] Only countries with the 10 highest age-standardized rates for alcohol-attributable liver cirrhosis and the other disease and injury causes of death are mentioned.

[15] It should also be noted that alcohol use is associated with an increased risk of so-called non-alcoholic liver diseases *(140)*.

[16] The comparisons of alcohol-attributable fractions were based on the rate itself, as the focus was on the role of alcohol in explaining mortality rather than on the level of standardized rates.

- As described above, mortality from alcohol-attributable CVD 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 *(100)*. Some countries have slight protective effects on balance, and for many countries, the protective effect of light-to-moderate drinking on deaths due to ischaemic disease, and the detrimental effect of chronic and episodic heavy drinking occasions on all cardiovascular causes of death more or less balance out (Table 1). Several elements are important here:
    - the distribution between ischaemic and other causes of death (mainly ischaemic heart disease versus cerebrovascular disease [stroke] *(147)* and, within stroke, between ischaemic stroke versus haemorrhagic stroke *(148)*);
    - the distribution of drinking levels in the respective populations as well as patterns of drinking *(117)*, in particular, the prevalence of episodic and chronic heavy drinking occasions;
    - misclassification of the cause of death *(149)* (for the specific misclassification of alcohol poisoning as a cardiovascular cause of death, *see below*); and
    - 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 *(150)*, and thus the current estimates include considerable measurement error. Moreover, while current epidemiology has started to use country-specific relative risk estimates *(1,151)*, at present and for this report, only two sets of relative risk estimates are available: the global one *(78)*, and the Russian Federation-specific one *(109)*. The global estimates from meta-analyses are based mainly on cohorts from a limited number of high-income countries with rather favourable and stable drinking patterns, resulting in lower estimates of relative risks compared to Russian estimates. One may speculate that countries like the Baltic countries may have risks that lie in between the global and Russian estimates, given the large amount of episodic heavy drinking *(36)*, which plays such an important role in cardiovascular causes of death (*see above* and *(100)*). However, as good epidemiological studies on alcohol and death due to CVD do not exist from most countries, the global estimates were used, which will result in underestimating the real burden for many countries with more detrimental drinking patterns; i.e. patterns that include a large proportion of heavy drinking occasions.
- Mortality due to injury is one of the major categories of alcohol-attributable mortality *(1)*, and alcohol is one of the major risk factors for morbidity and mortality due to injury *(2)*. Alcohol has a relatively high impact on the mortality burden from injury; from around 5–8% (Tajikistan, Turkey) to over 60% (Belarus, the Republic of Moldova, the Russian Federation and Ukraine) for intentional injury; and to over 45% for unintentional injury (Belarus, Lithuania, the Russian Federation and Ukraine; *see* Table 1). Most European countries have alcohol-attributable fractions of around 30–40% 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 20-fold. Given that all mortality due to alcohol-attributable injury is in principle entirely avoidable from one day to another *(152,153)*, and can be substantially reduced in a short time, these differences between countries in one Region are hard to accept (*see also* Conclusions below).

BURDEN OF MORTALITY DUE TO ALCOHOL-ATTRIBUTABLE LIVER CIRRHOSIS

Fig. 18 shows that western European countries in 2014, along with most continental EU countries (except for countries in the central-eastern part [*see* Fig. 21] and the Baltic countries), had a lower liver cirrhosis rate than the WHO European Region. Consistent with the trends in consumption (*see* Fig. 1), standardized rates of alcohol-attributable liver cirrhosis increased in the first decade of the observation period, and decreased in the later years. The rise in liver cirrhosis mortality in the United Kingdom from historically comparatively low levels to being the third most important cause of death for people under 65 years of age at present has led to discussion and policy action, especially as rates of other chronic diseases have been on the decrease in this country *(154)*.[17]

[17] As will be discussed in more detail, trends in liver cirrhosis mortality rates, especially if they are 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 United States *(155,156)*.

Table 1. Standardized mortality from alcohol-attributable disease and injury categories in 2014 (overall age-standardized rate and rate of alcohol-attributable causes of death per million)

Country (ranking by overall AA mortality rate)	Liver cirrhosis	Liver cirrhosis AA	Cancer	Cancer AA	CVD	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
Republic of 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

Table 1 contd

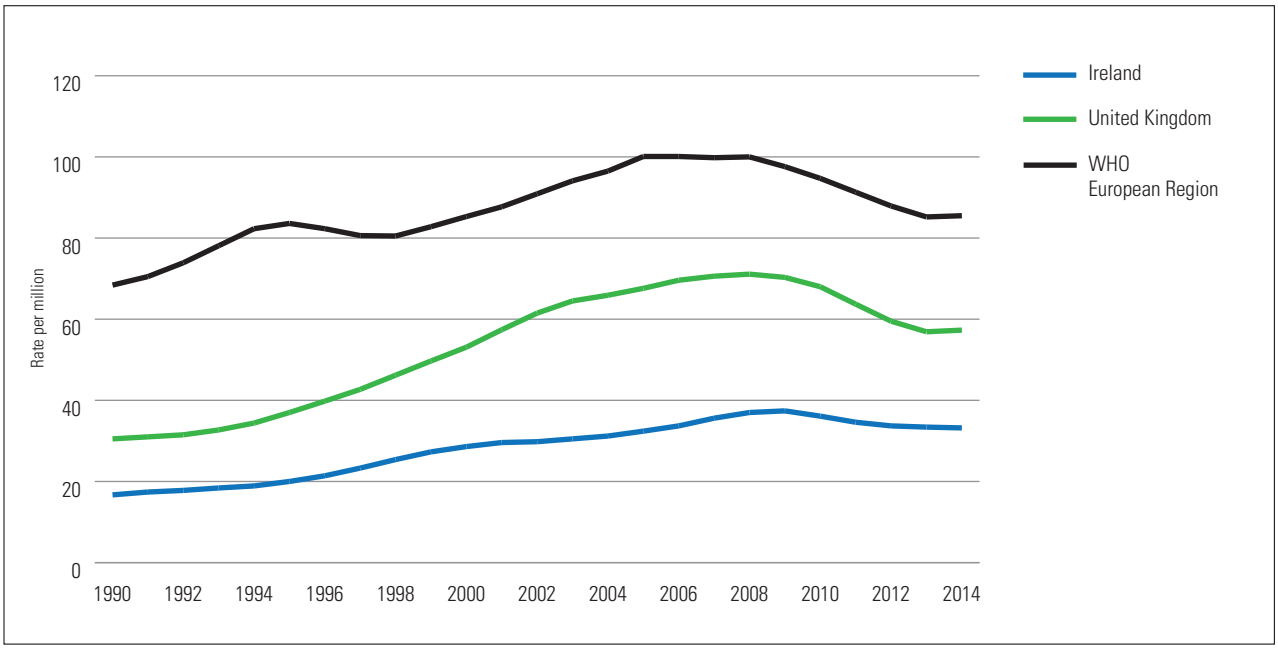
Country (ranking by overall AA mortality rate)	Liver cirrhosis	Liver cirrhosis AA	Cancer	Cancer AA	CVD	CVD AA	Injury	Injury AA	Unintent. injury	Unintent. injury AA	Intent. injury	Intent. injury AA
Slovenia	155.7	113.5	1165.6	77.6	1200.1	23.8	410.7	145.1	243.1	79.8	167.7	65.3
Croatia	152.4	112.9	1331.1	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 and 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

Table 1 contd

Country (ranking by overall AA mortality rate)	Liver cirrhosis	Liver cirrhosis AA	Cancer	Cancer AA	CVD	CVD AA	Injury	Injury AA	Unintent. injury	Unintent. injury AA	Intent. injury	Intent. injury AA
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
The former Yugoslav Republic of 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

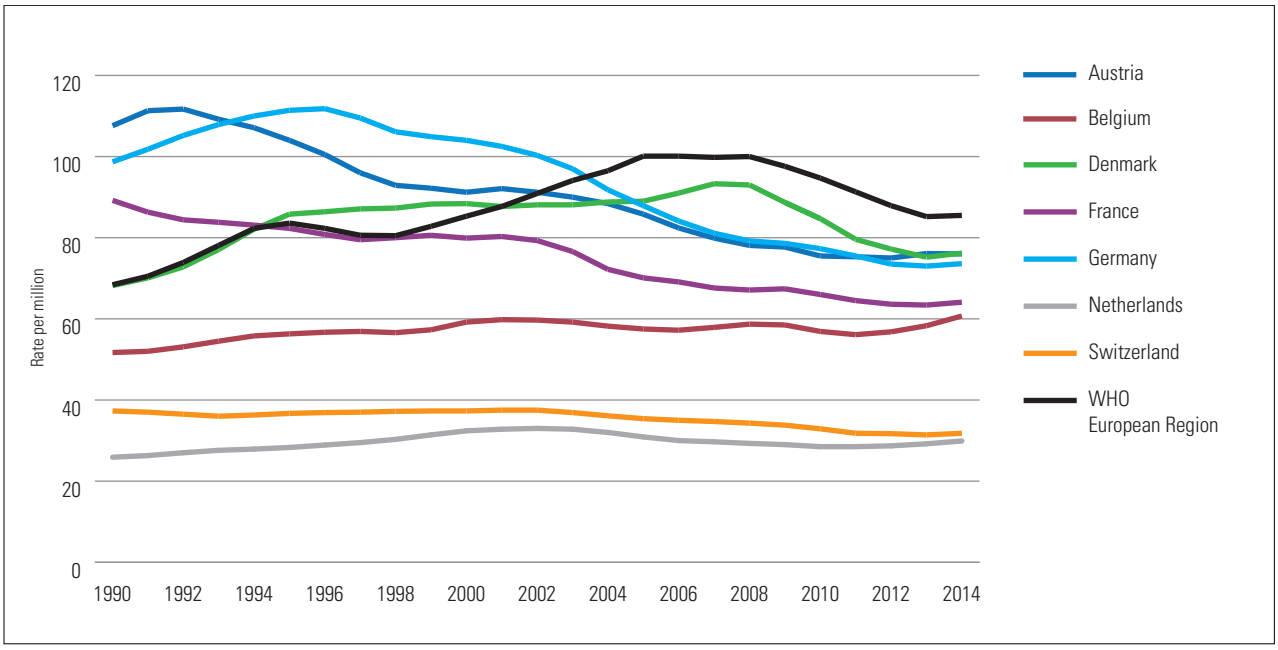
AA: alcohol-attributable; intent.: intentional; unintent.: unintentional; green highlighted countries have the lowest age-standardized alcohol-attributable mortality rates (5 lowest rates); red highlighted countries have the highest standardized alcohol-attributable mortality rates for the respective categories (10 highest rates).

Fig. 18. Trends in age-standardized adult mortality due to alcohol-attributable liver cirrhosis for Ireland and the United Kingdom, 1990–2014



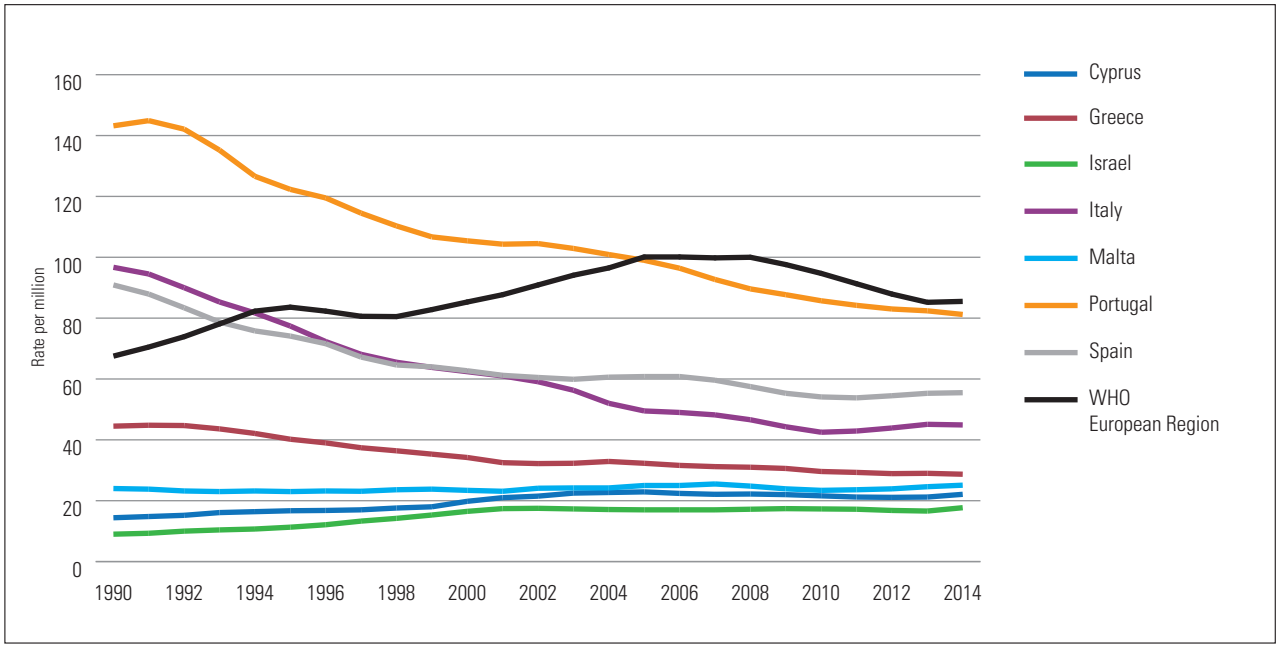
Since early in the twenty-first century, all countries in central-western Europe have lower liver cirrhosis rates than the WHO Region as whole (Fig. 19). Austria, Denmark, France and Germany, all of which had higher rates in the earlier years of the observation period, have all reduced mortality due to alcohol-attributable liver cirrhosis, consistent with their consumption levels (*see* Fig. 2).

Fig. 19. Trends in age-standardized adult mortality due to alcohol-attributable liver cirrhosis for Austria, Belgium, Denmark, France, Germany, the Netherlands and Switzerland, 1990–2014



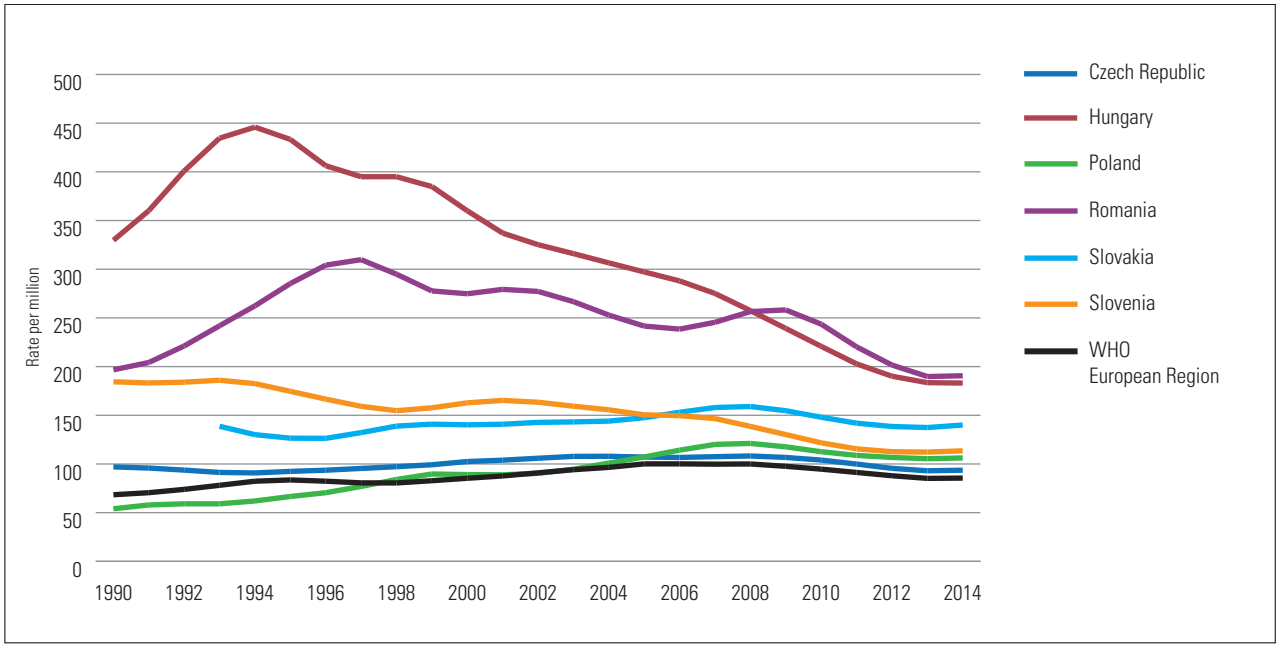
After 2005, all Mediterranean countries had lower liver cirrhosis mortality rates than the WHO European Region average (Fig. 20). In 1990, Italy, Portugal and Spain had higher rates, but with the continuous decline in adult per capita consumption in these traditionally wine-drinking countries, the liver cirrhosis rates also declined, starting more than a decade before 1990 *(157)*.

Fig. 20. Trends in age-standardized adult mortality due to alcohol-attributable liver cirrhosis for Cyprus, Greece, Israel, Italy, Malta, Portugal and Spain, 1990–2014



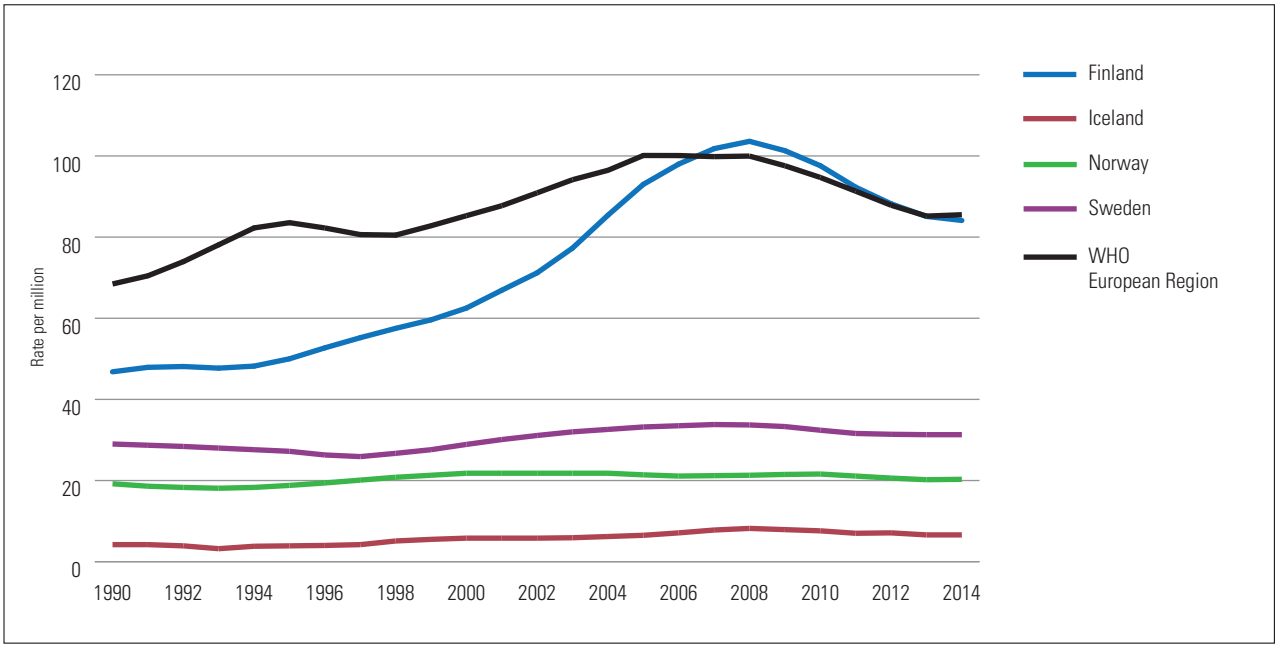
All countries from the central-eastern EU region have higher liver cirrhosis mortality rates than the WHO European Region average, albeit to different degrees. The rates are highest in countries where spirits made of fruits with pits have some market share (Hungary, Romania, Slovakia and Slovenia; *see* earlier the discussion on page 19 on the pit fruit hypothesis *(90,141)*). However, there is some indication that the highest rates have been decreasing in the past 5 years (*see* Fig. 21).

Fig. 21. Trends in age-standardized adult mortality due to alcohol-attributable liver cirrhosis for the Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia, 1990–2014



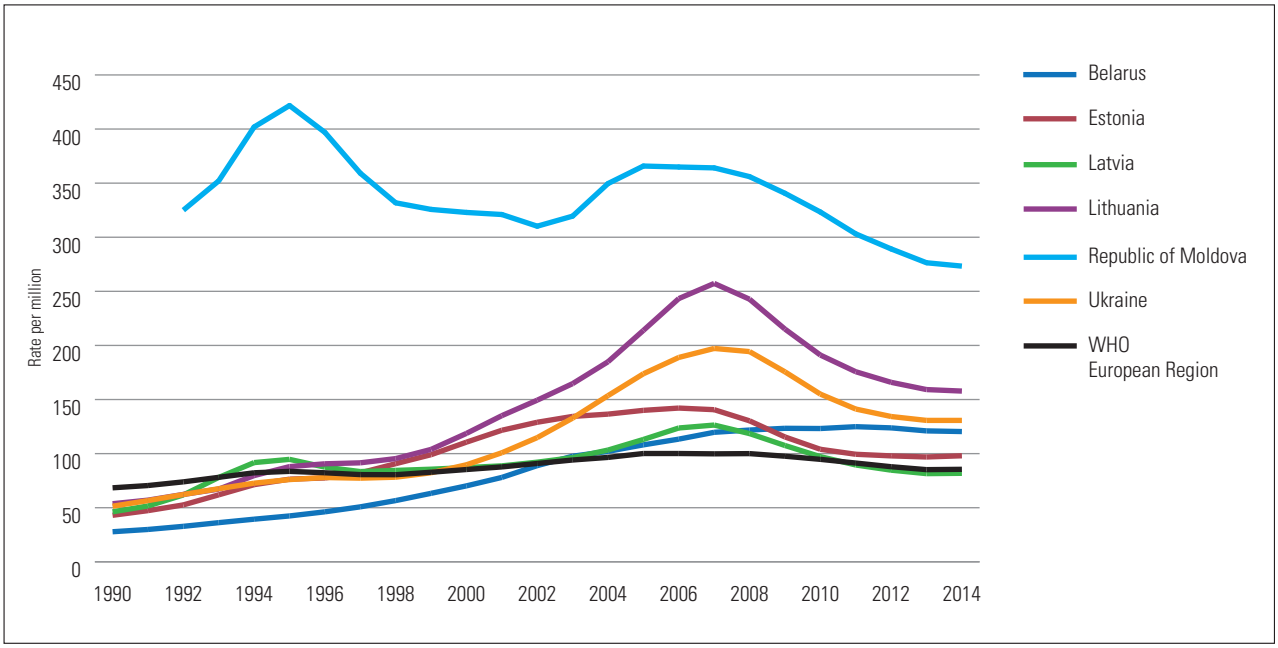
As with level of consumption (*see* Fig. 5), mortality due to alcohol-attributable liver cirrhosis in Finland is close to the average rate of the WHO European Region. The other Nordic countries are still markedly below this rate, despite slight increases (*see* Fig. 22). Iceland is among the countries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

Fig. 22. Trends in age-standardized adult mortality due to alcohol-attributable liver cirrhosis for Finland, Iceland, Norway and Sweden, 1990–2014



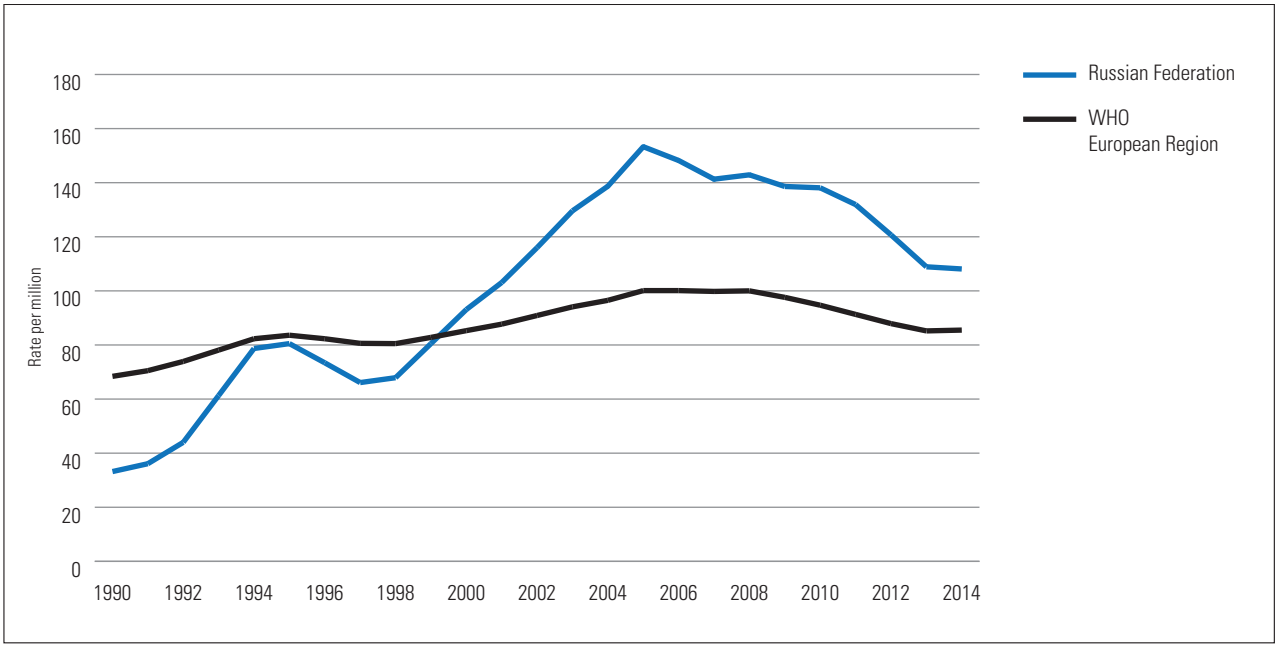
Although all eastern European countries displayed in Fig. 23 except the Republic of Moldova started with alcohol-attributable liver cirrhosis rates below the average of the WHO European Region, since the turn of the century, their rates are considerably higher. For the past few years, liver cirrhosis rates have been going down in most of these countries, and as a consequence, alcohol-attributable rates have been going down as well. There is no clear reason for this phenomenon in the countries in Fig. 23, but the rates seemed to go down when economic recession started, and the countries in Fig. 23 were hit very hard by recession. Economic recession is linked to consumption in a complex way *(58)*, 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, although consumption levels in these countries in the central and eastern part of the WHO European Region went up again after the recession was over (Fig. 6), liver cirrhosis rates continued to decline.

Fig. 23. Trends in age-standardized adult mortality due to alcohol-attributable liver cirrhosis for Belarus, Estonia, Latvia, Lithuania, the Republic of Moldova and Ukraine, 1990–2014



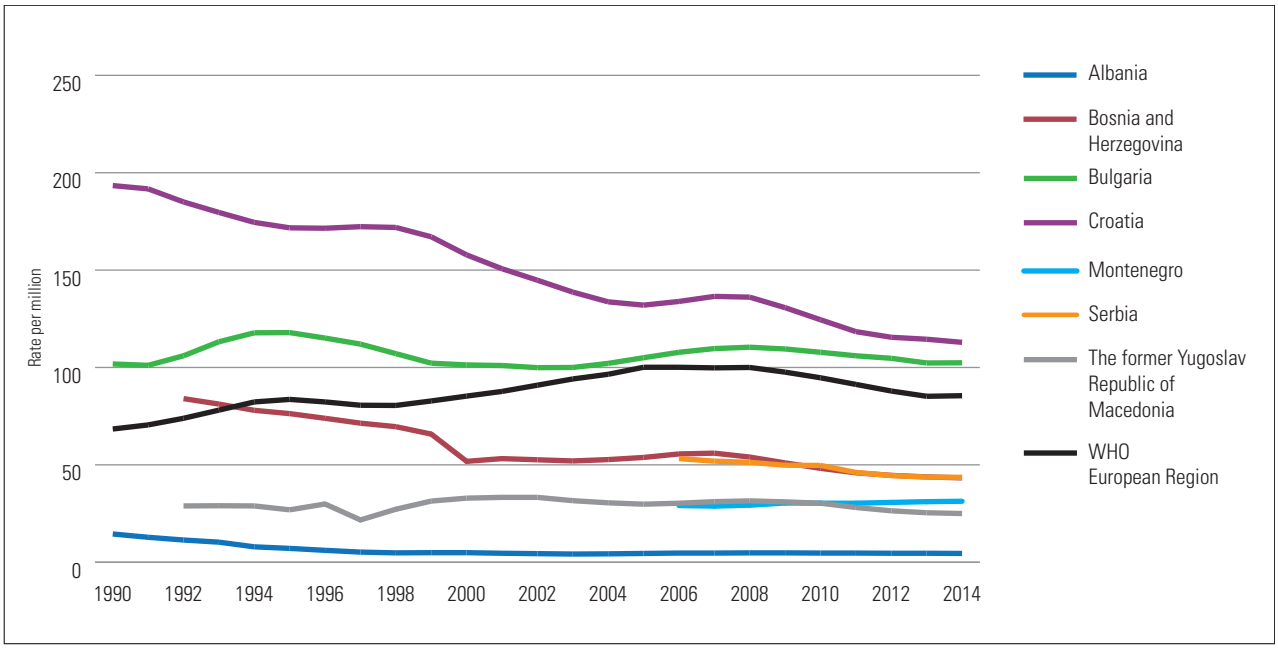
The Russian Federation seems to follow the trend of other eastern European countries with increase in liver cirrhosis rates over the past 25 years, surpassing the WHO European Region average around the year 2000, and decreasing again in recent years, albeit not down to the level of the Region (compare Fig. 24 and Fig. 23).

Fig. 24. Trends in age-standardized adult mortality due to alcohol-attributable liver cirrhosis the Russian Federation, 1990–2014



As with consumption (*see* Fig. 8), countries in central south-eastern Europe are both below and above the WHO European Region average for alcohol-attributable liver cirrhosis mortality (Fig. 25). Croatia has the highest rate, and has a relatively high production of spirits from fruits with stones (*see page 19*).

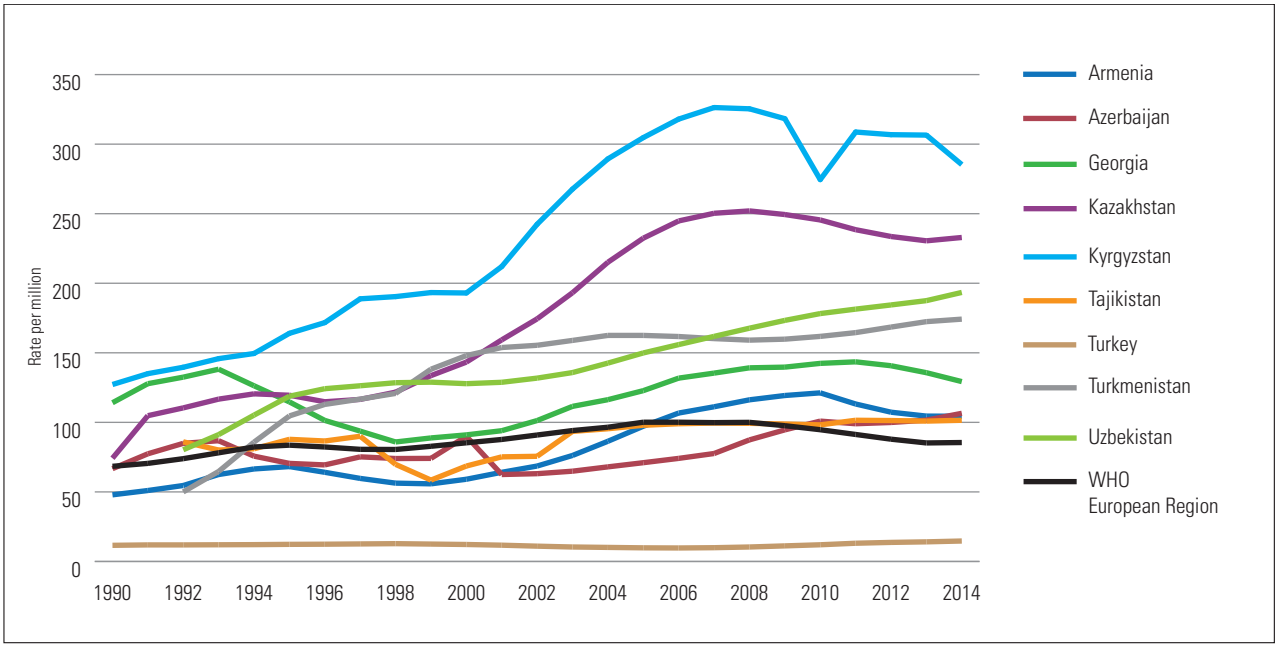
Fig. 25. Trends in age-standardized adult mortality due to alcohol-attributable liver cirrhosis for Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Serbia, and the former Yugoslav Republic of Macedonia, 1990–2014



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 (Fig. 26), even though their consumption was lower than the regional average (Fig. 9). As already mentioned, this phenomenon can be partly explained by liver cirrhosis due to risk

factors along with the use of alcohol, with alcohol also playing a role in the mortality. It should also be noted that the methodology used for comparative risk assessment did not adequately control for other risk factors.

Fig. 26. Trends in age-standardized adult mortality due to alcohol-attributable liver cirrhosis Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan, 1990–2014



BURDEN OF MORTALITY DUE TO ALCOHOL-ATTRIBUTABLE CANCER

Fig. 27–35 show the age-standardized mortality rates for alcohol-attributable cancer for the various clusters of countries. As indicated above, the overall variability in cancer mortality rates, both within and between countries, is much lower than for other cause-of-death categories; thus, the variation in mortality due to alcohol-attributable cancer 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-eastern WHO European Region countries were below the WHO European Region average, whereas most of the central-eastern EU and eastern European countries including the Russian Federation were above the EU average.

Fig. 27. Trends in age-standardized adult mortality due to alcohol-attributable cancer for Ireland and the United Kingdom, 1990–2014

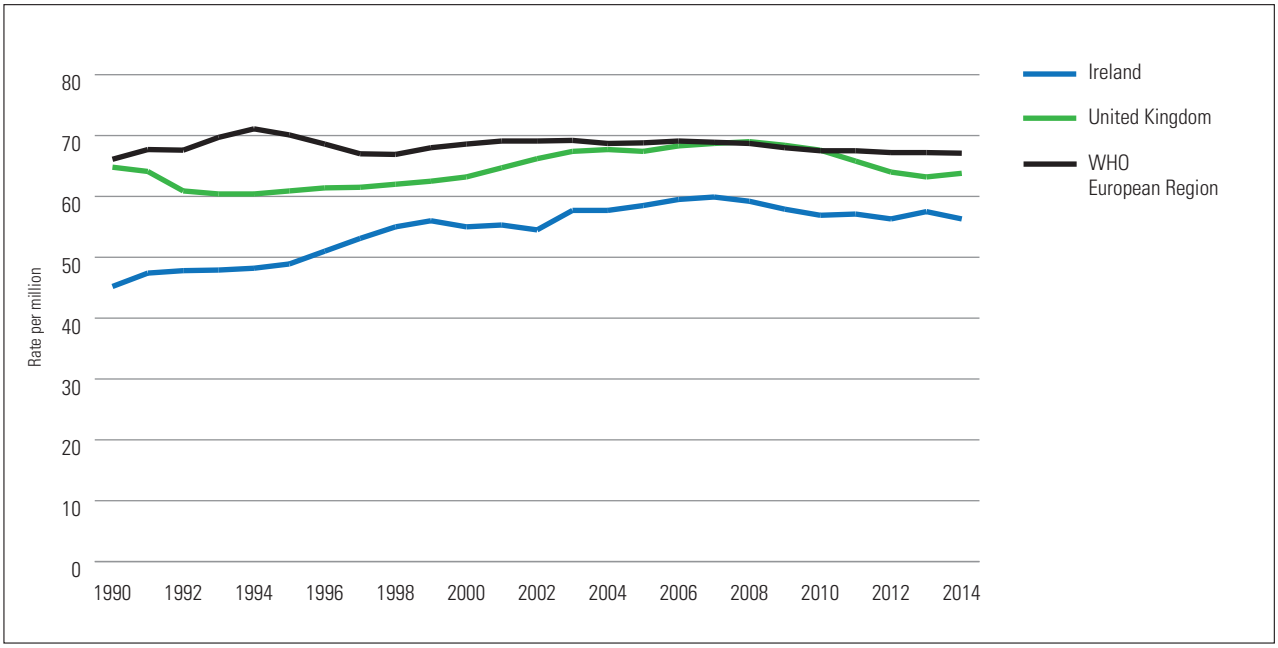


Fig. 28. Trends in age-standardized adult mortality due to alcohol-attributable cancer for Austria, Belgium, Denmark, France, Germany, the Netherlands and Switzerland, 1990–2014

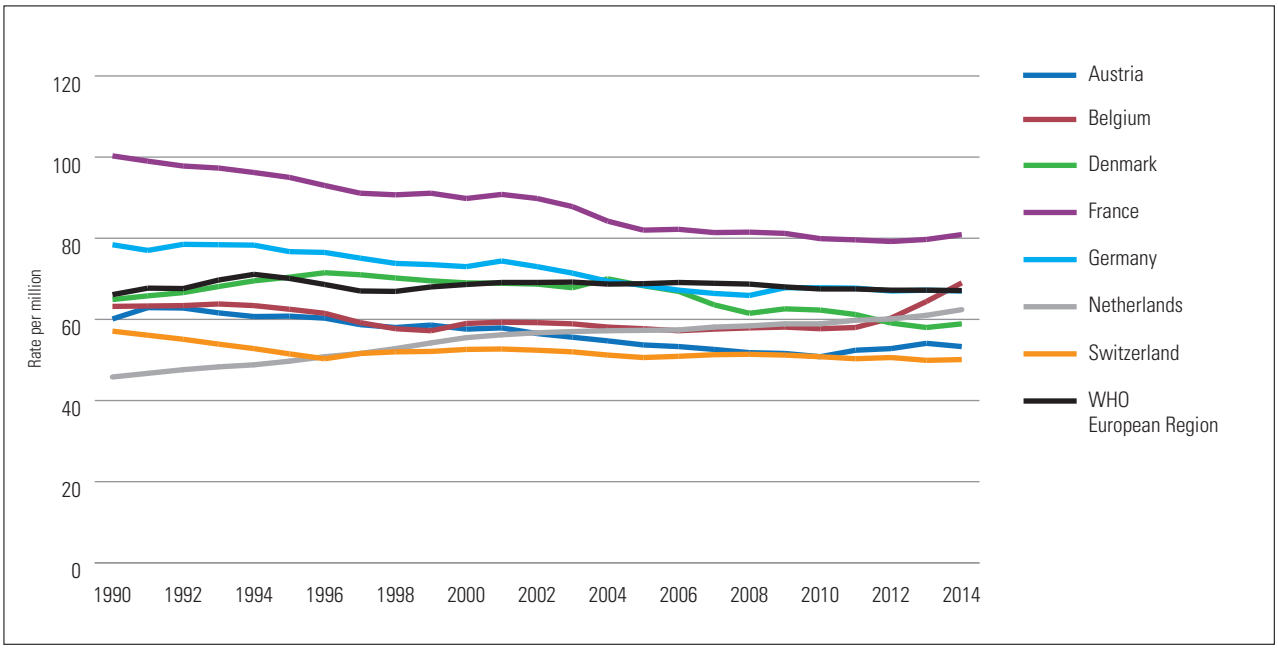


Fig. 29. Trends in age-standardized adult mortality due to alcohol-attributable cancer for Cyprus, Greece, Israel, Italy, Malta, Portugal and Spain, 1990–2014

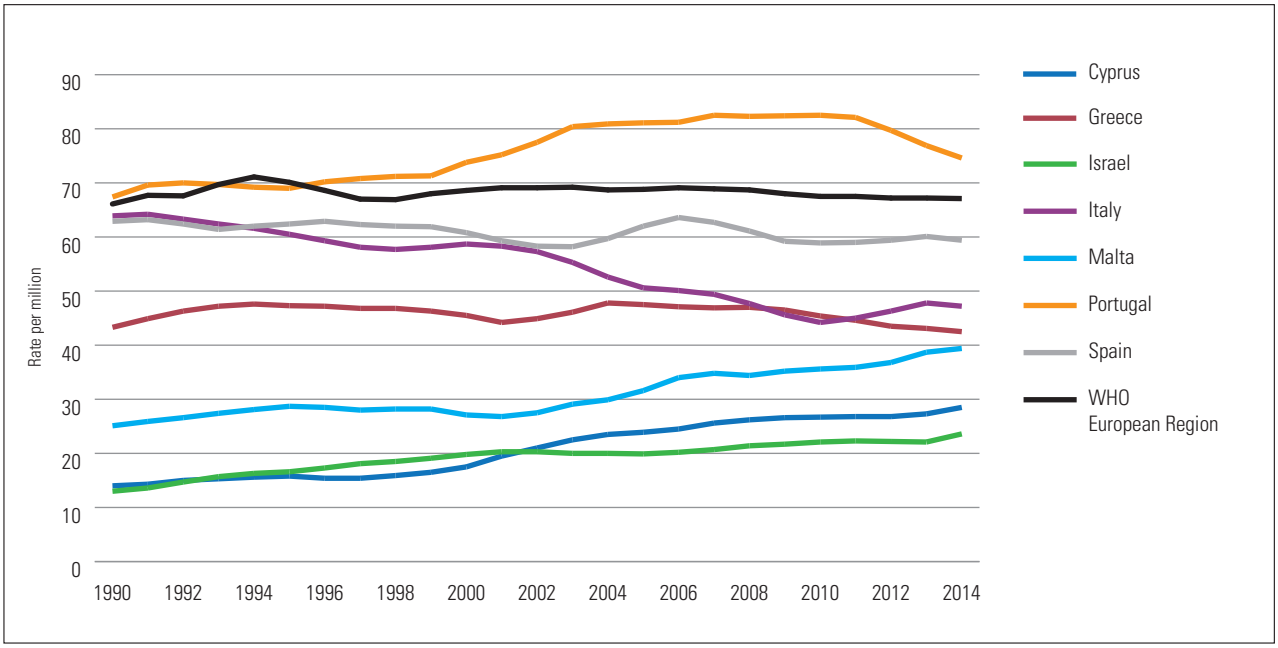


Fig. 30. Trends in age-standardized adult mortality due to alcohol-attributable cancer for the Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia, 1990–2014

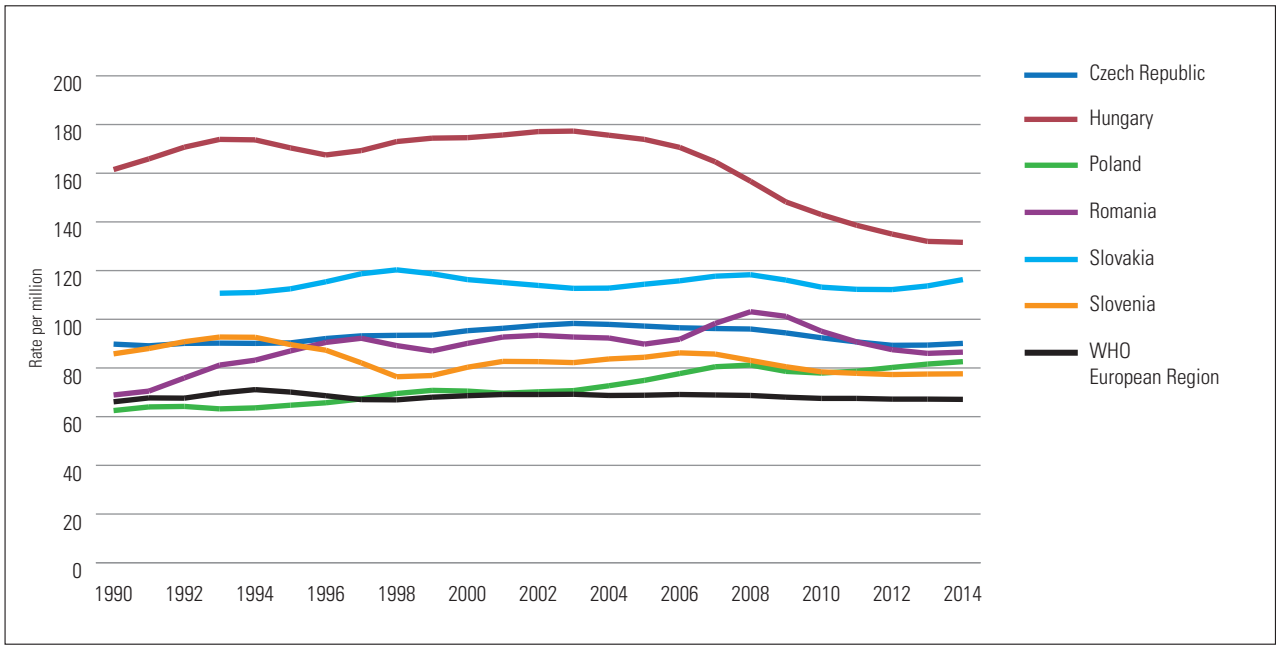


Fig. 31. Trends in age-standardized adult mortality due to alcohol-attributable cancer for Finland, Iceland, Norway and Sweden, 1990–2014

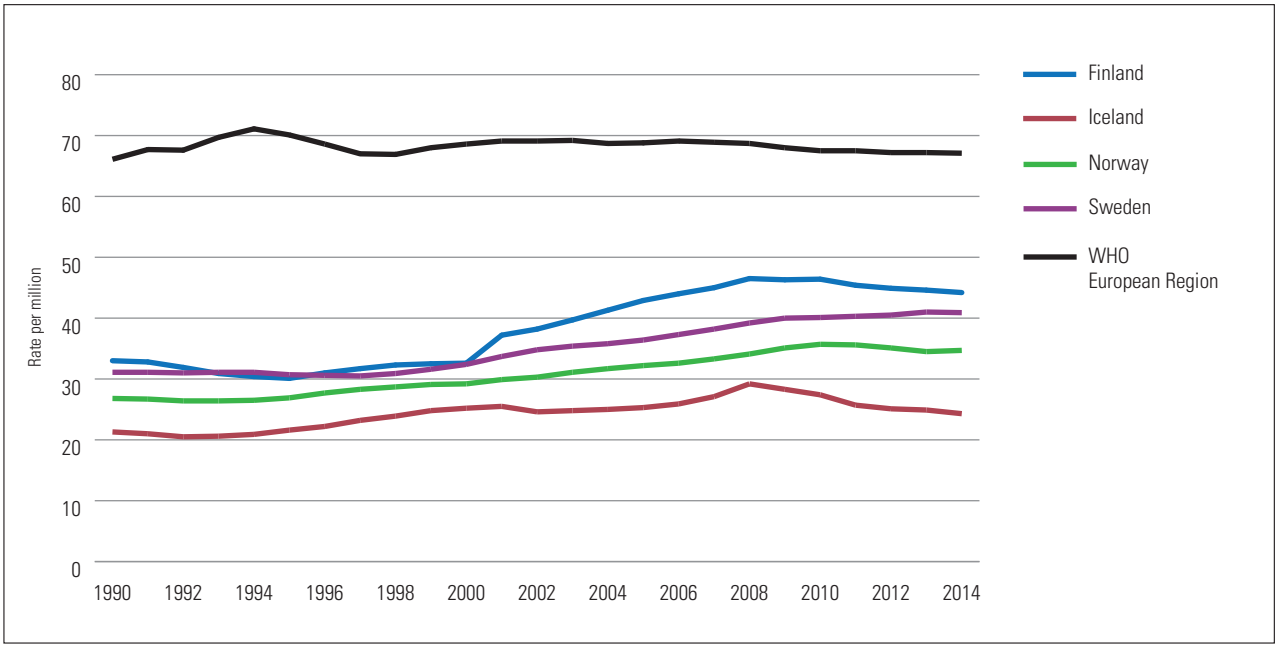


Fig. 32. Trends in age-standardized adult mortality due to alcohol-attributable cancer for Belarus, Estonia, Latvia, Lithuania, the Republic of Moldova and Ukraine, 1990–2014

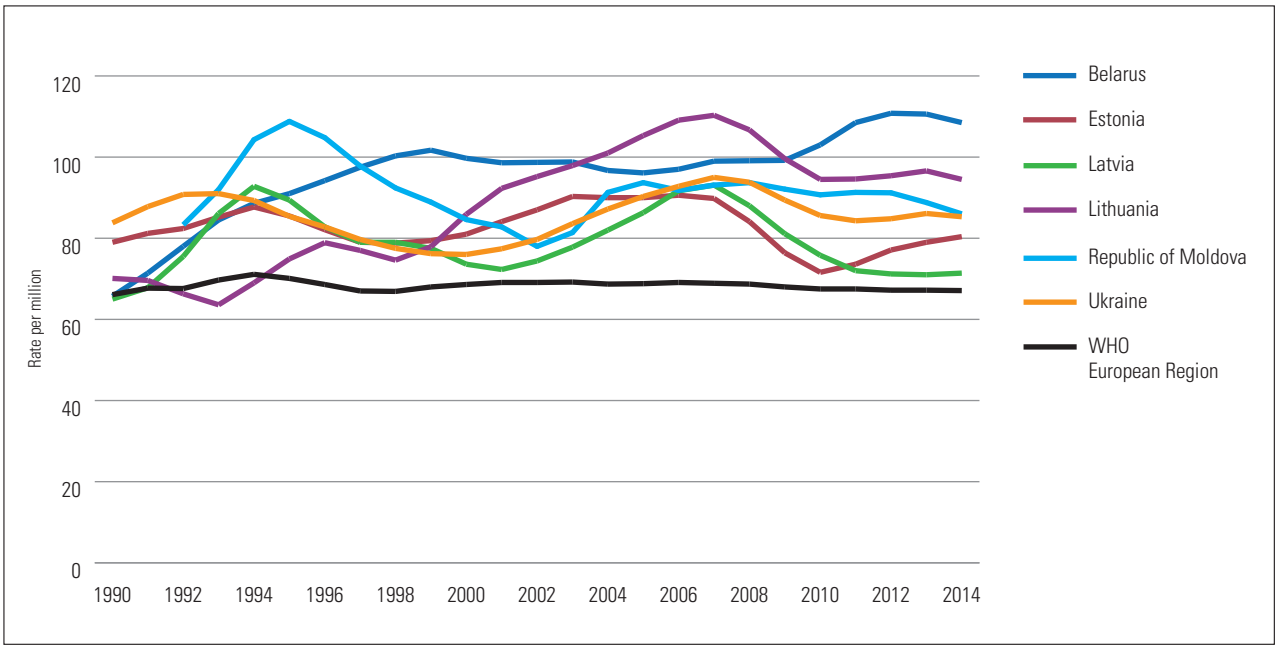


Fig. 33. Trends in age-standardized adult mortality due to alcohol-attributable cancer for the Russian Federation, 1990–2014

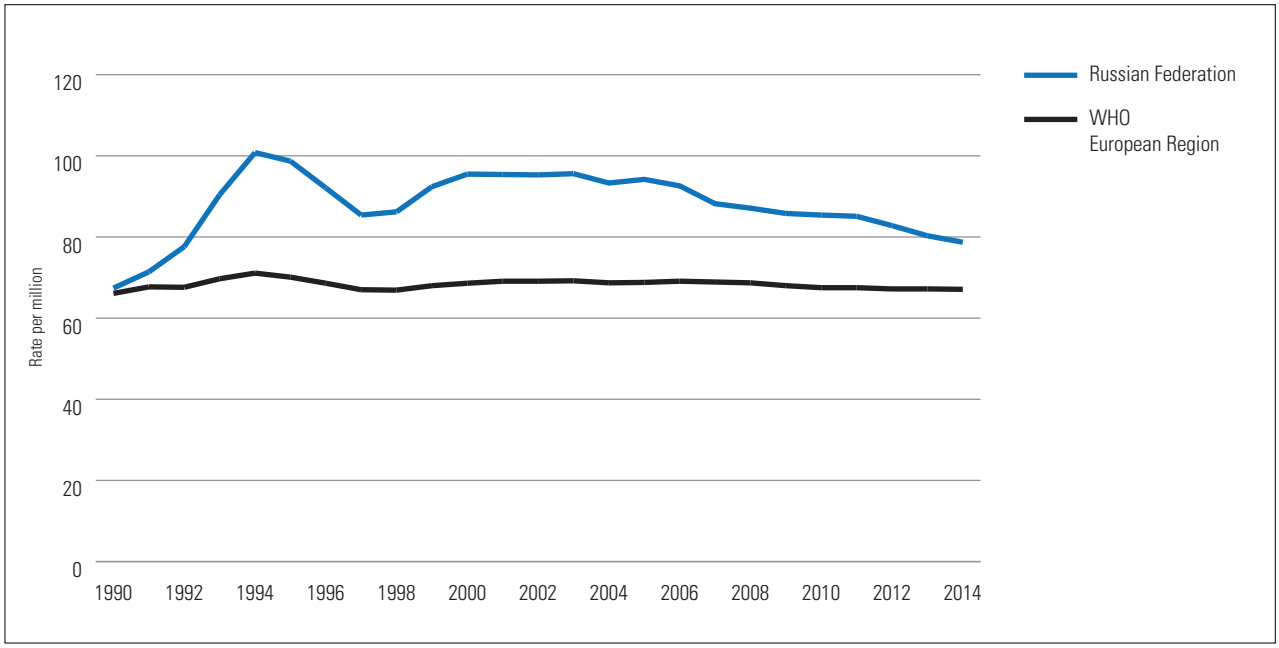


Fig. 34. Trends in age-standardized adult mortality due to alcohol-attributable cancer for Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Serbia and the former Yugoslav Republic of Macedonia, 1990–2014

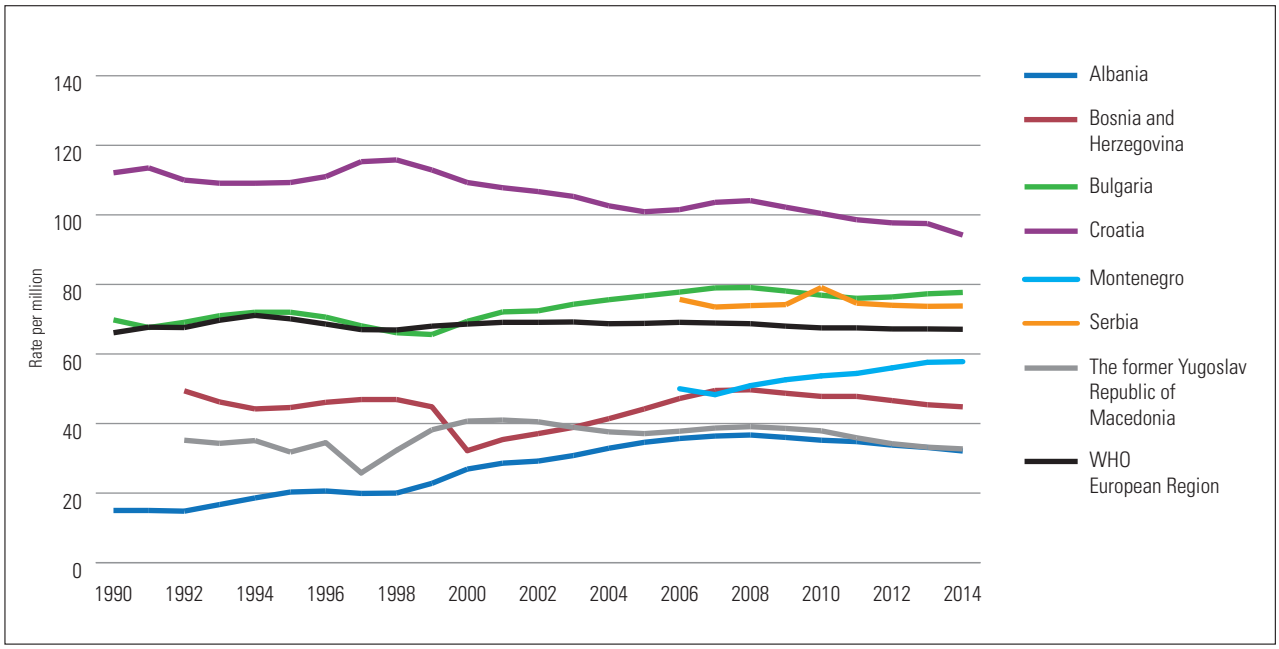
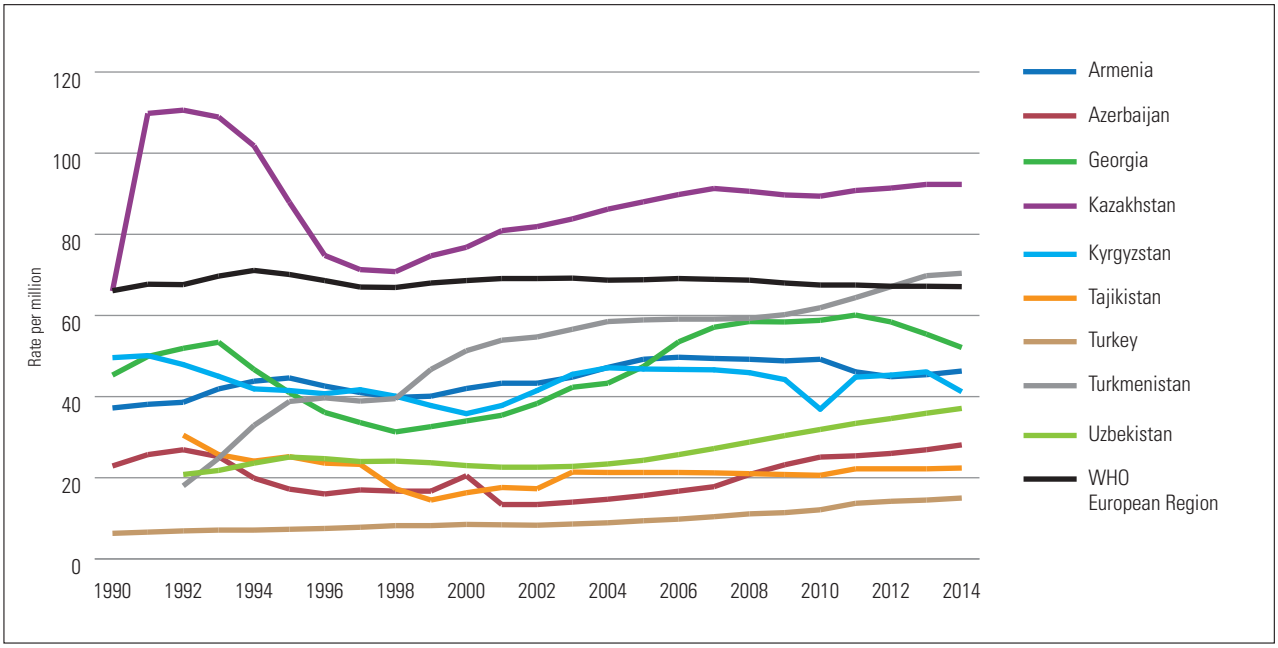


Fig. 35. Trends in age-standardized adult mortality due to alcohol-attributable cancer for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan, 1990–2014



BURDEN OF MORTALITY DUE TO ALCOHOL-ATTRIBUTABLE CARDIOVASCULAR DISEASES

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

Fig. 36. Trends in age-standardized adult mortality due to alcohol-attributable CVD for Ireland and the United Kingdom, 1990–2014

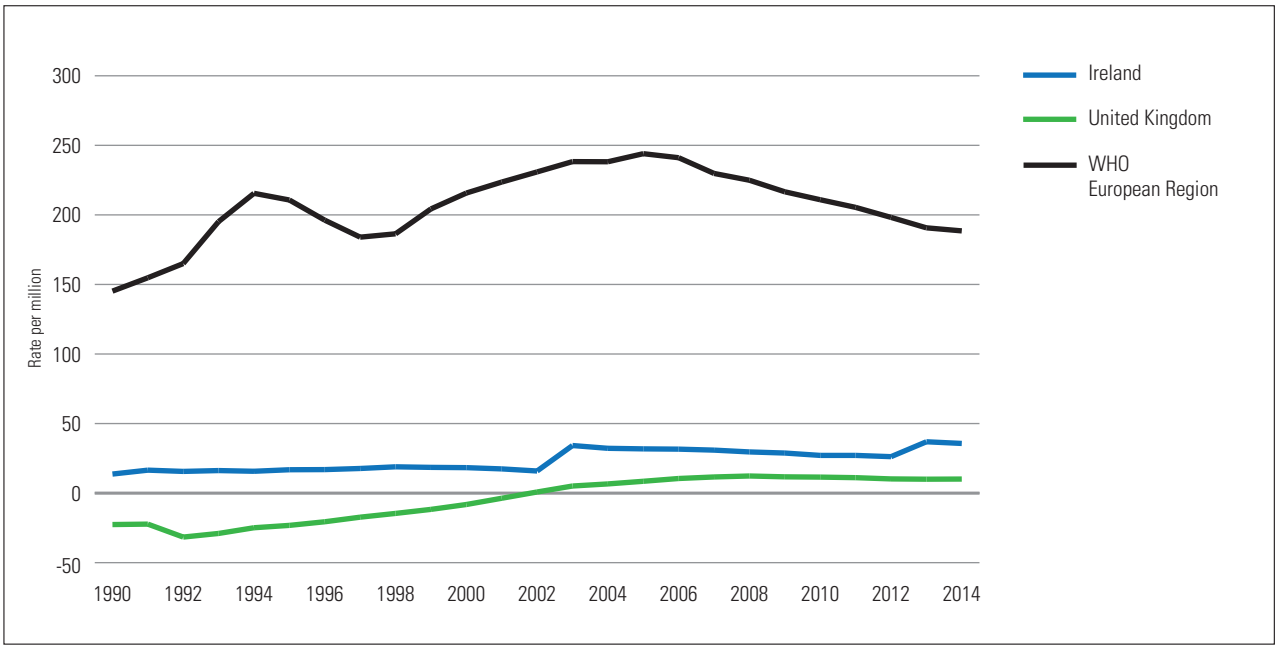


Fig. 37. Trends in age-standardized adult mortality due to alcohol-attributable CVD for Austria, Belgium, Denmark, France, Germany, the Netherlands and Switzerland, 1990–2014

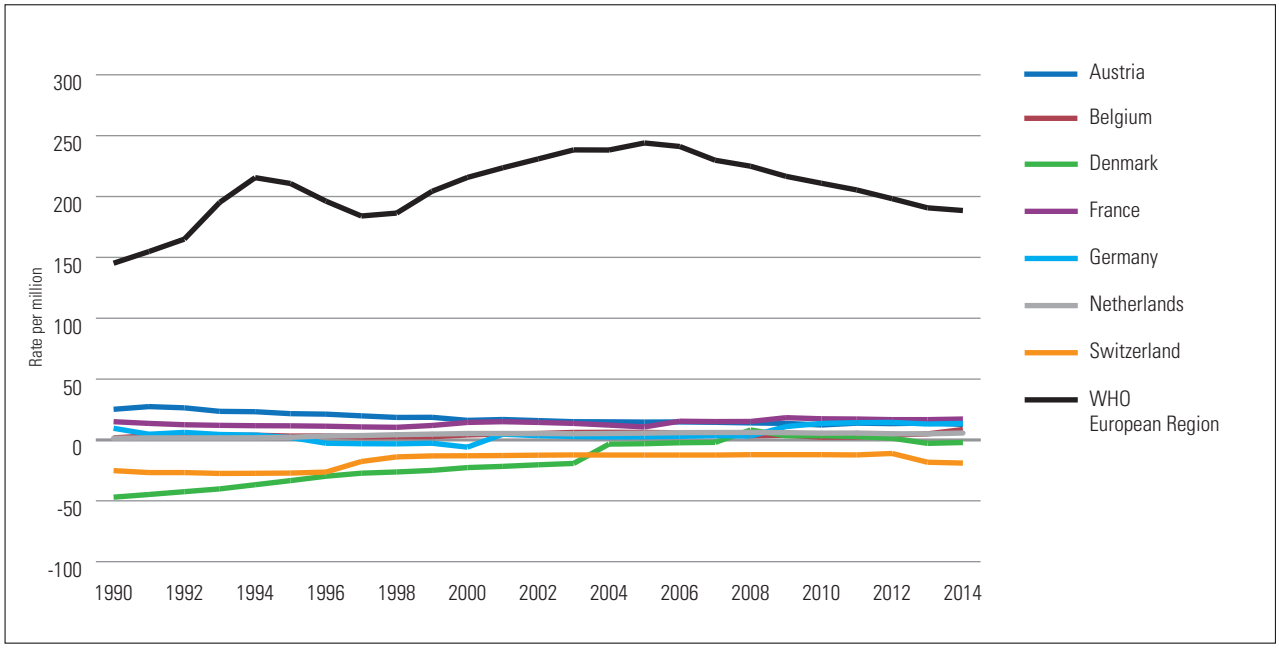


Fig. 38. Trends in age-standardized adult mortality due to alcohol-attributable CVD for Cyprus, Greece, Israel, Italy, Malta, Portugal and Spain, 1990–2014

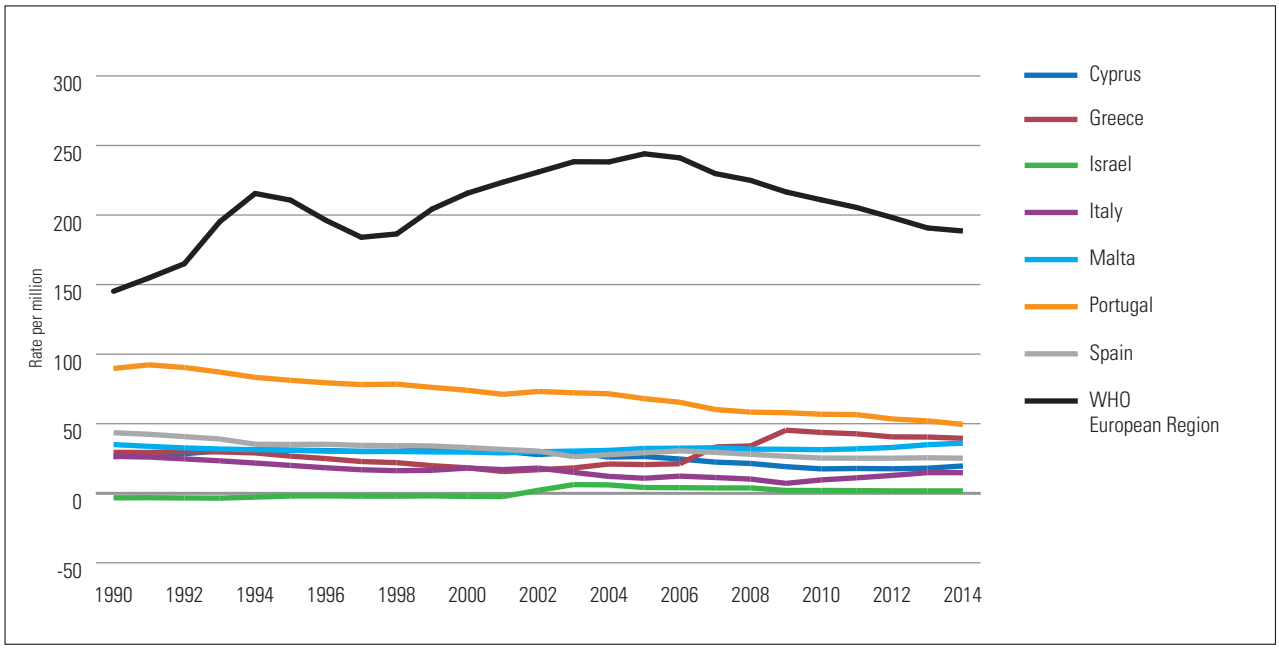


Fig. 39. Trends in age-standardized adult mortality due to alcohol-attributable CVD for the Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia, 1990–2014

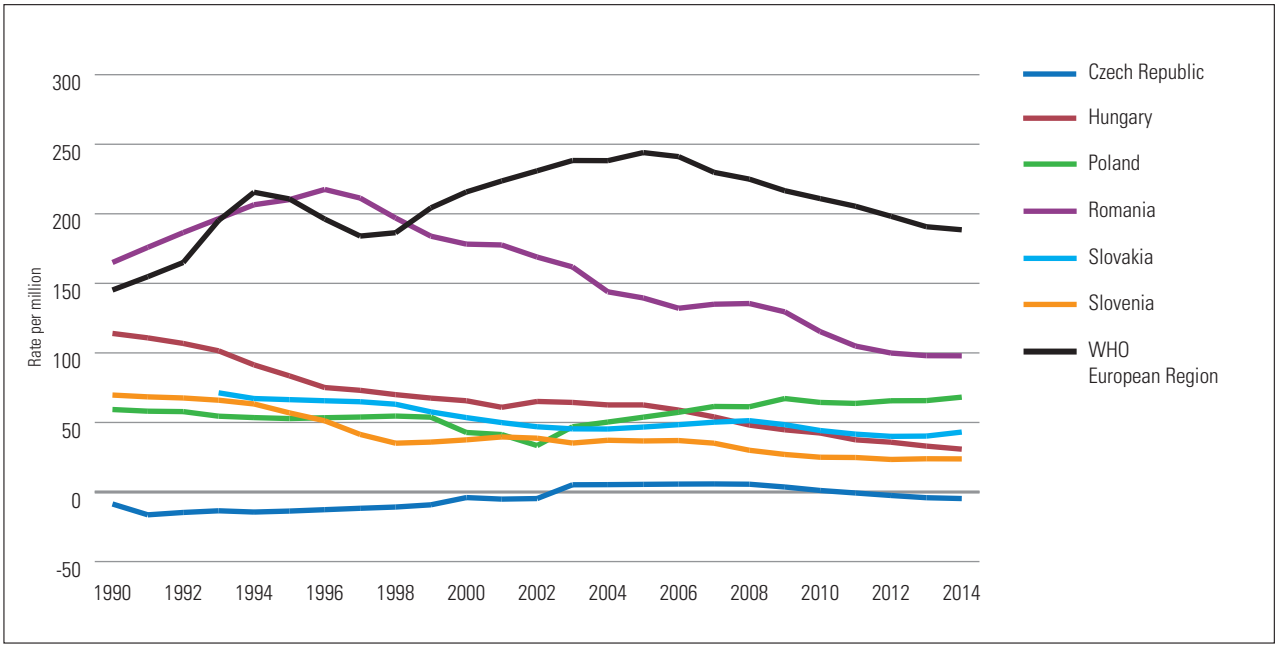


Fig. 40. Trends in age-standardized adult mortality due to alcohol-attributable CVD for Finland, Iceland, Norway and Sweden, 1990–2014

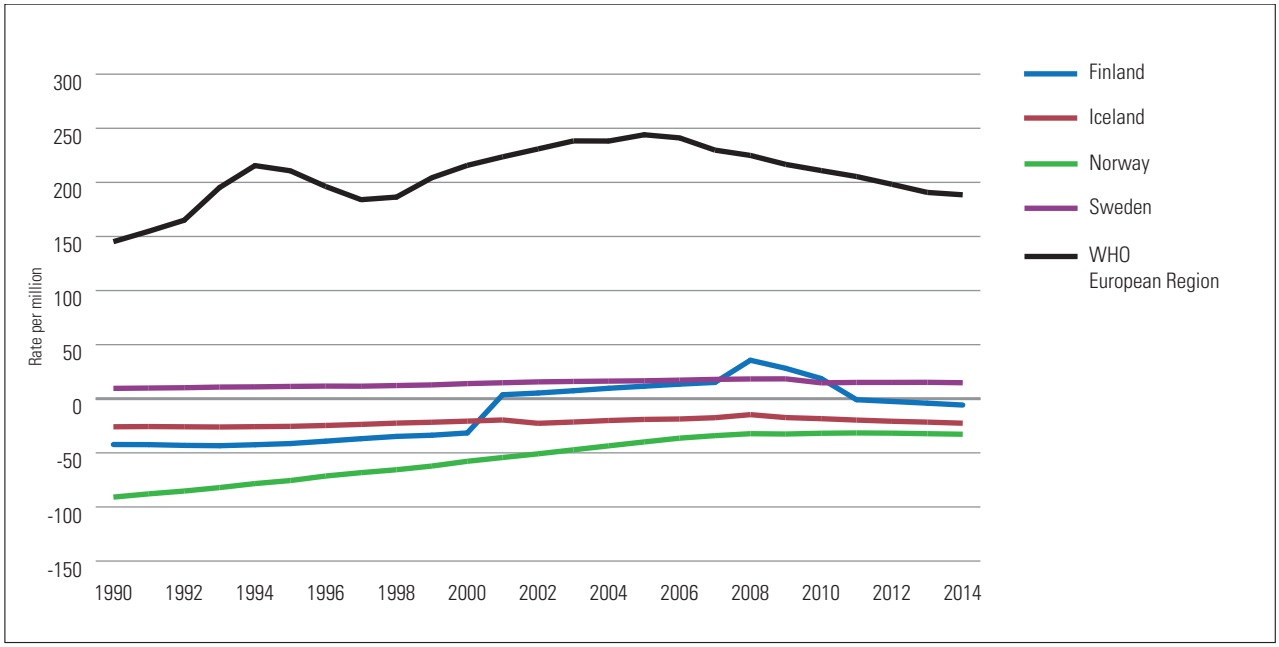


Fig. 41. Trends in age-standardized adult mortality due to alcohol-attributable CVD for Belarus, Estonia, Latvia, Lithuania, the Republic of Moldova and Ukraine, 1990–2014

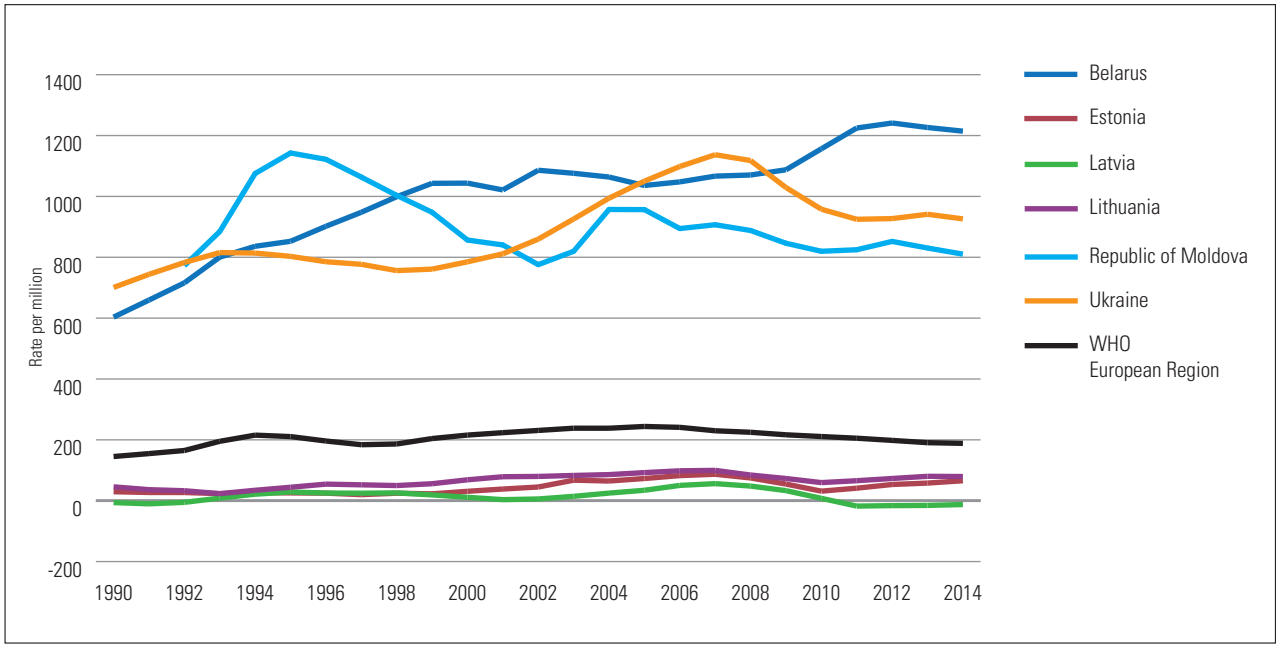


Fig. 42. Trends in age-standardized adult mortality due to alcohol-attributable CVD for the Russian Federation, 1990–2014

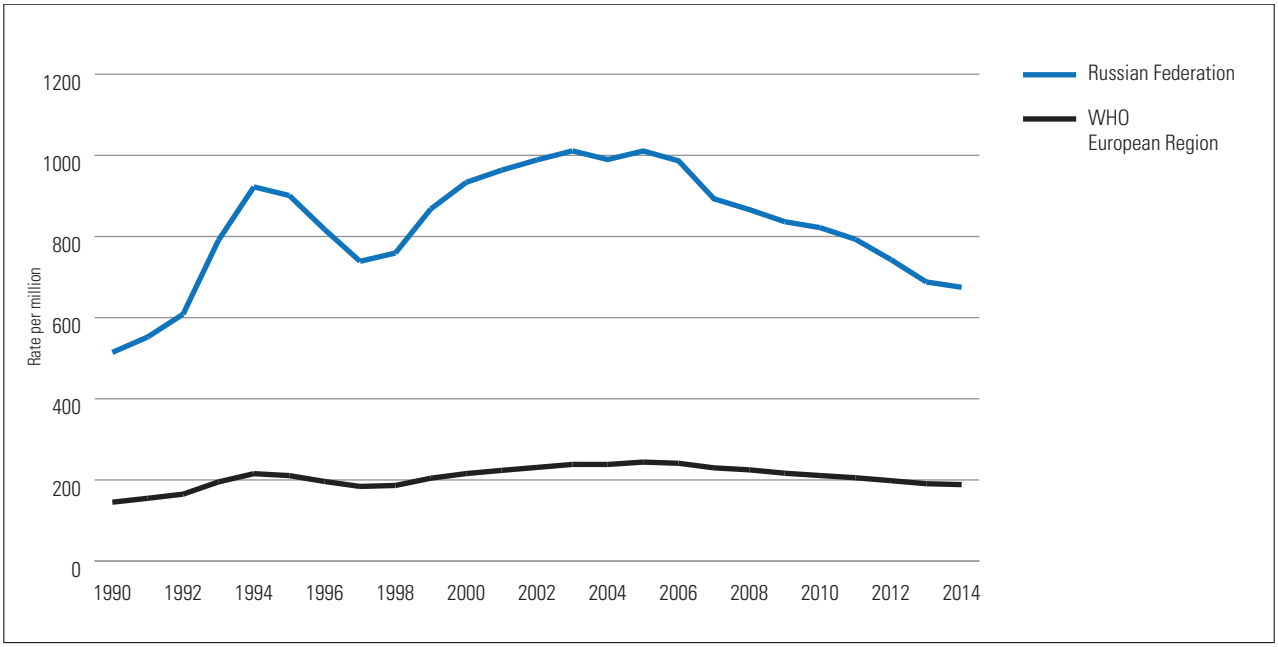


Fig. 43. Trends in age-standardized adult mortality due to alcohol-attributable CVD for Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Serbia and the former Yugoslav Republic of Macedonia, 1990–2014

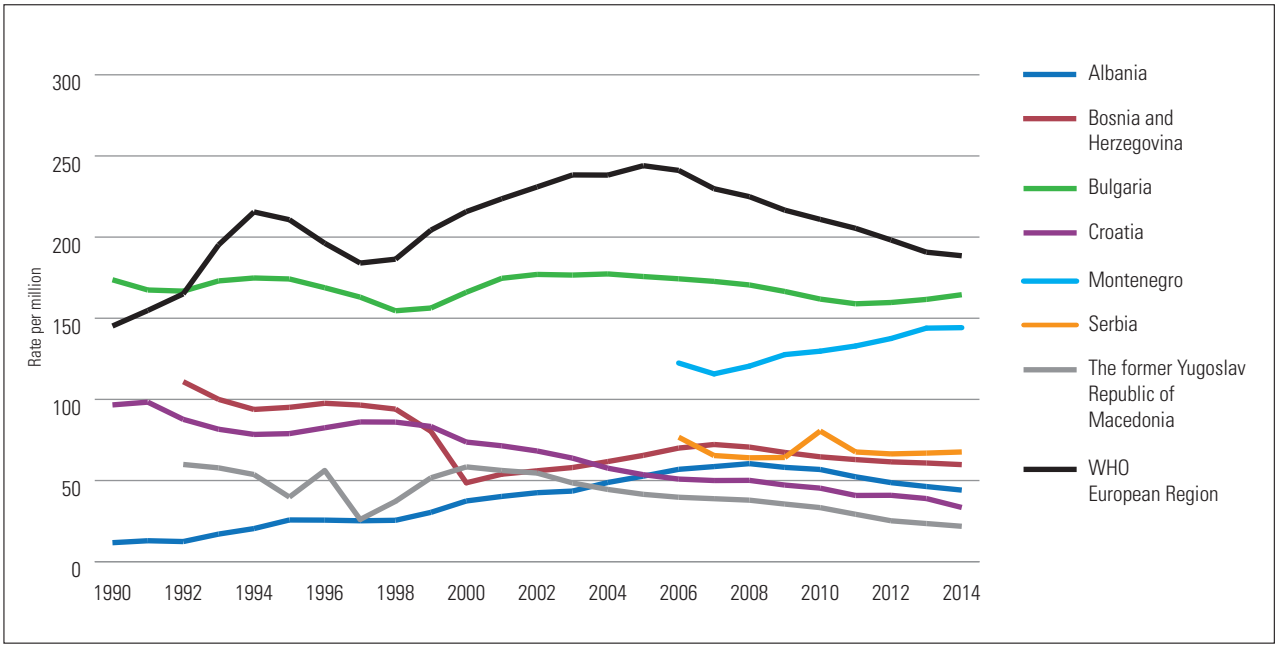
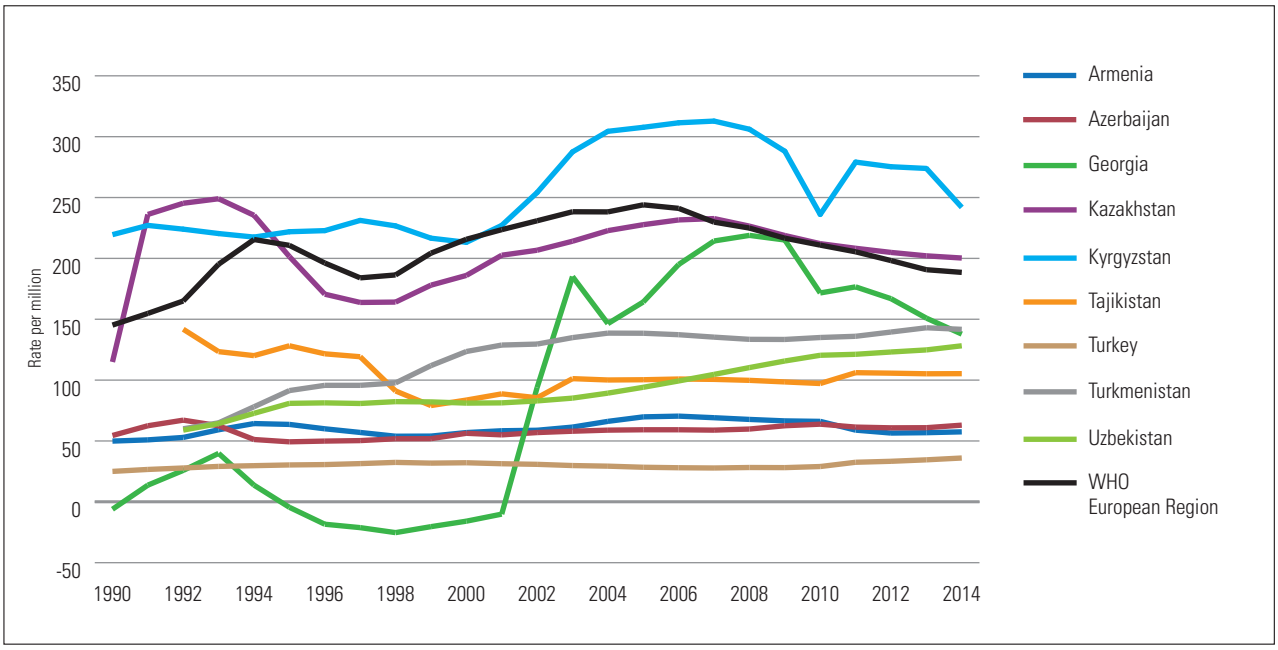


Fig. 44. Trends in age-standardized adult mortality due to alcohol-attributable CVD for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan, 1990–2014



BURDEN OF MORTALITY DUE TO ALCOHOL-ATTRIBUTABLE INJURY

The burden of mortality due to injury has been decreasing over the past decades, both globally and in Europe *(158)*. As Fig. 45–53 show for all injuries, Fig. 54–62 for intentional injury and Fig. 63–71 for unintentional injury, the same is true for mortality from alcohol-attributable injury,[18] albeit to a substantially lesser 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%).

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

Moreover, it is striking that the countries with the highest mortality due to alcohol-attributable injury seem to have a lesser reduction in mortality rates (*see also* for regions below) and, in some cases, the rates have even increased: for the WHO European Region, the standardized mortality rate for all alcohol-attributable injury decreased by 19%, but in the three countries with the highest such mortality, one had a marked increase (Belarus: +41%), one a slight decrease (the Russian Federation: –5%) and one about the average decrease (Ukraine: –17%). For intentional injury, the overall decrease was 5%, but in all the three countries, the age-standardized mortality due to alcohol-attributable intentional injury increased (Belarus: +61%; the Russian Federation: +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 the Russian Federation and Ukraine, respectively.

Fig. 45. Trends in age-standardized adult mortality due to alcohol-attributable injury for Ireland and the United Kingdom, 1990–2014

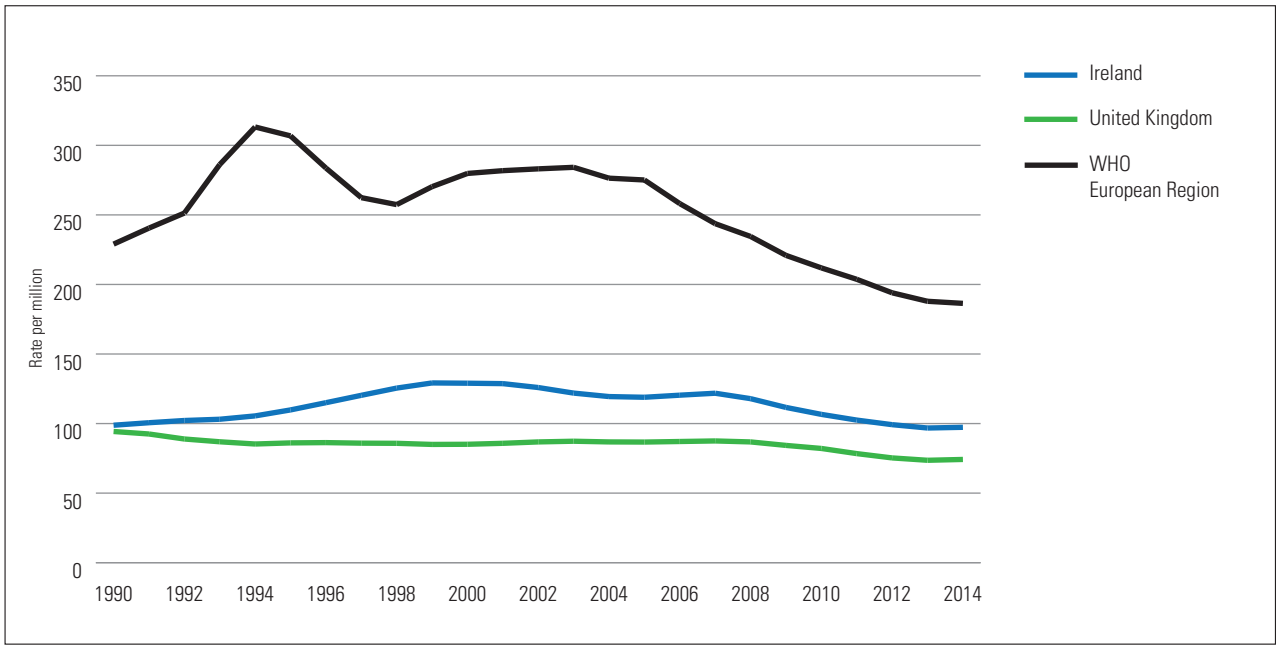


Fig. 46. Trends in age-standardized adult mortality due to alcohol-attributable injury for Austria, Belgium, Denmark, France, Germany, the Netherlands and Switzerland, 1990–2014

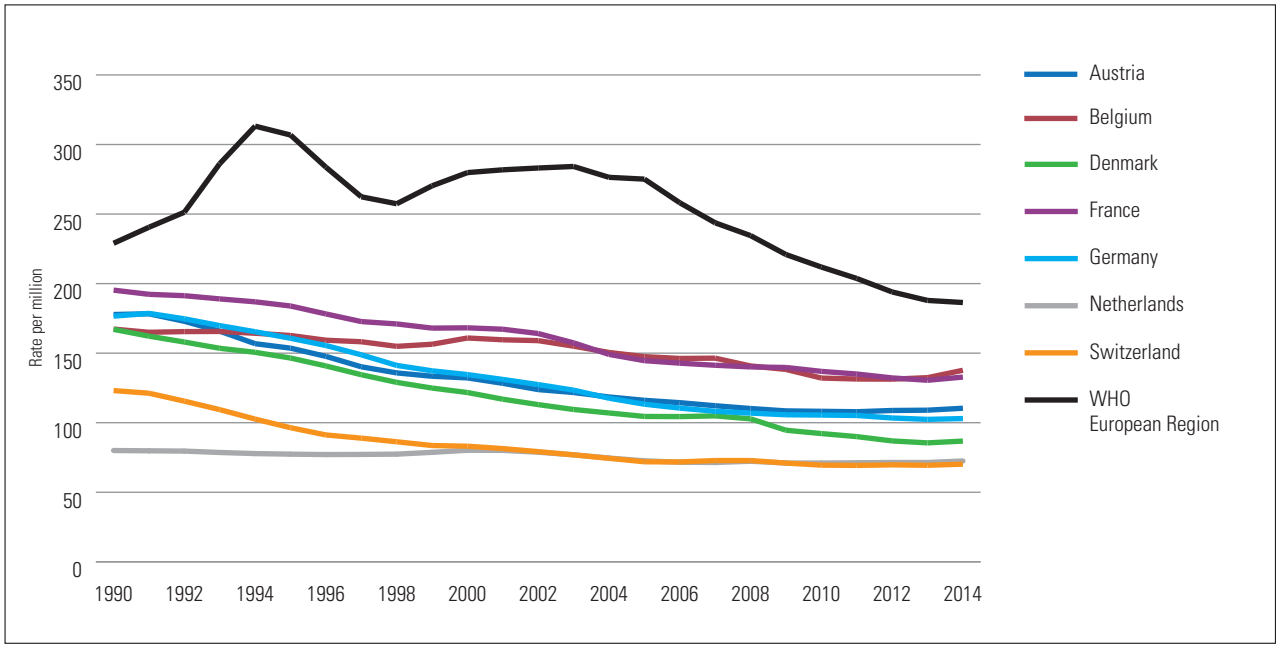


Fig. 47. Trends in age-standardized adult mortality due to alcohol-attributable injury for Cyprus, Greece, Israel, Italy, Malta, Portugal and Spain, 1990–2014

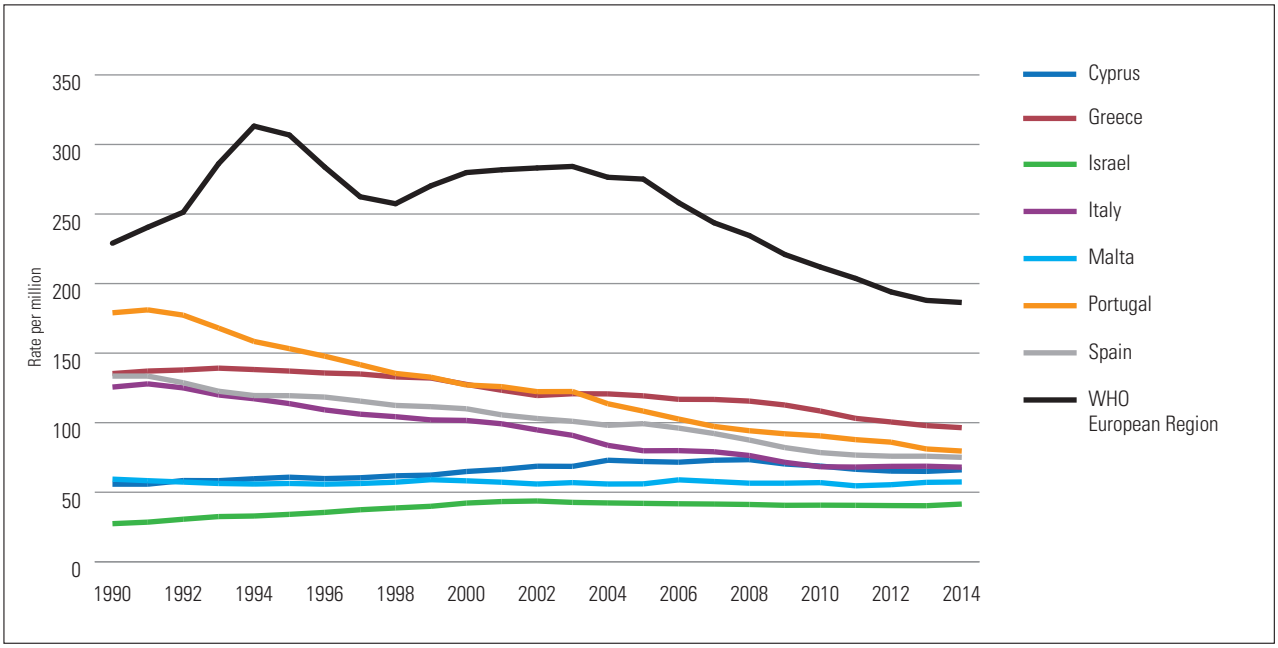


Fig. 48. Trends in age-standardized adult mortality due to alcohol-attributable injury for the Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia, 1990–2014

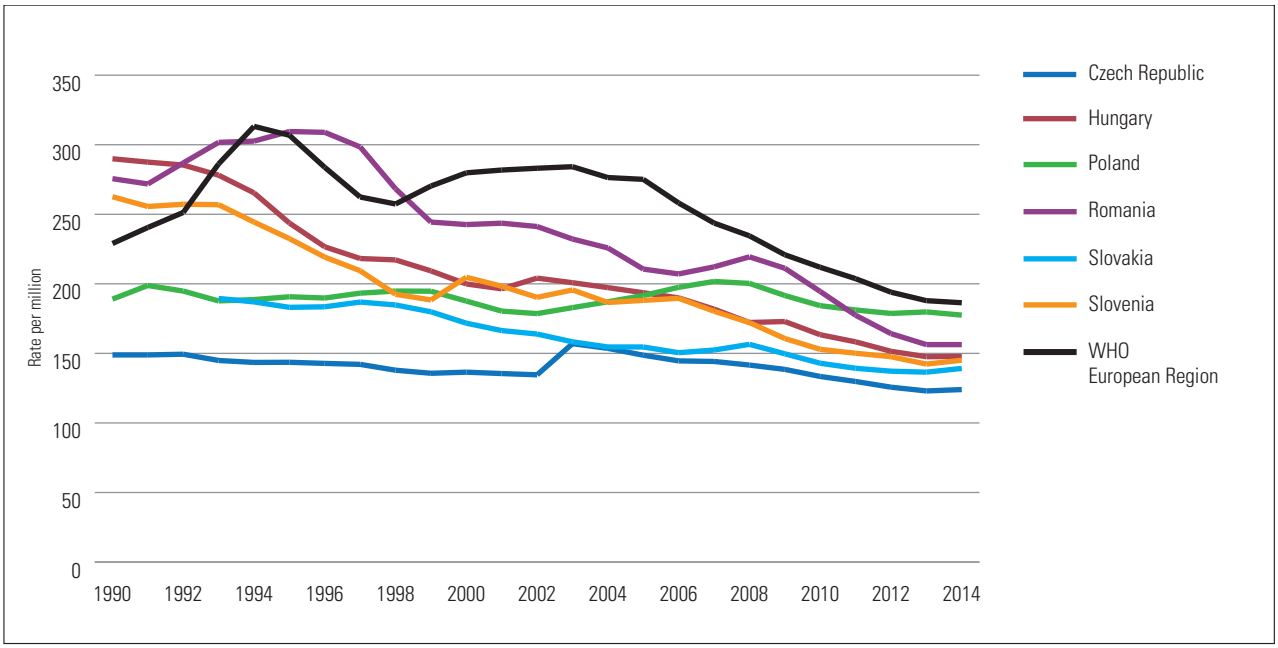


Fig. 49. Trends in age-standardized adult mortality due to alcohol-attributable injury for Finland, Iceland, Norway and Sweden, 1990–2014

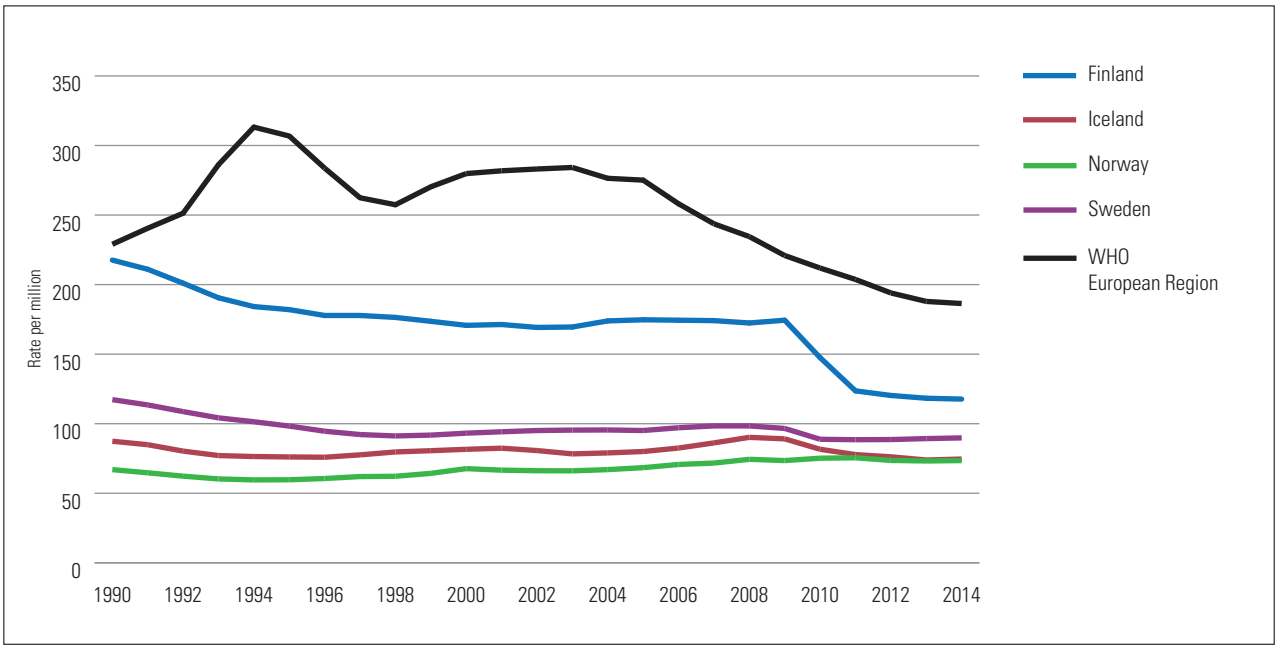


Fig. 50. Trends in age-standardized adult mortality due to alcohol-attributable injury for Belarus, Estonia, Latvia, Lithuania, the Republic of Moldova and Ukraine, 1990–2014

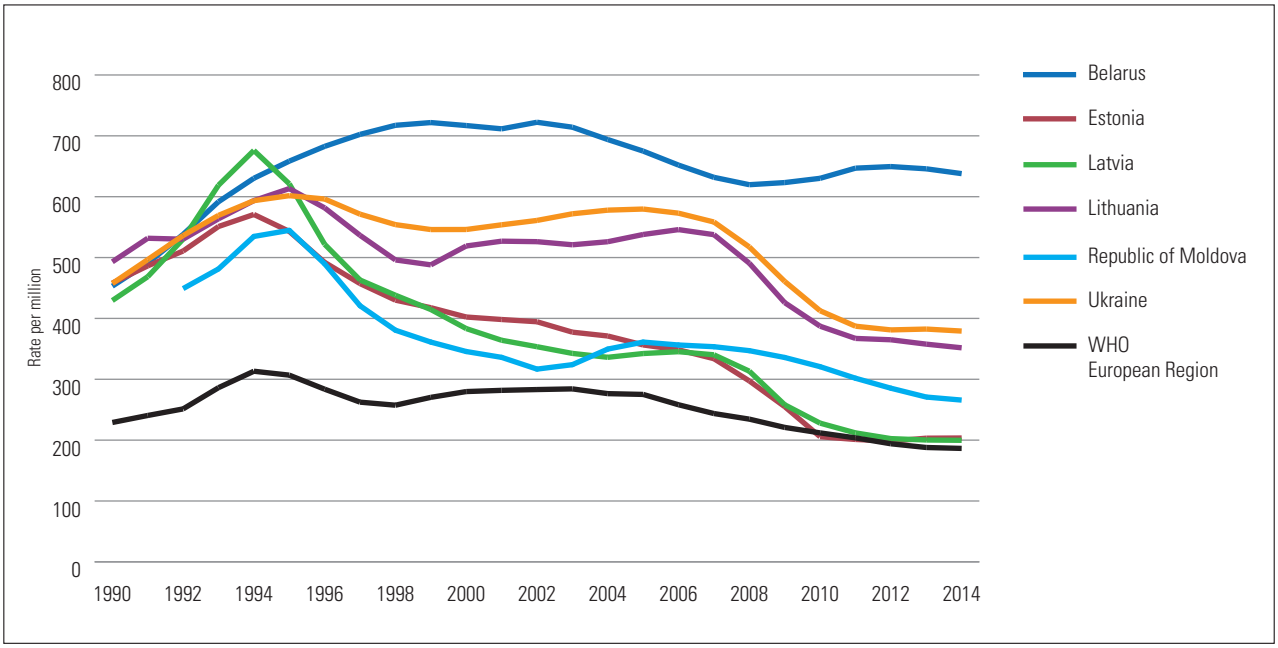


Fig. 51. Trends in age-standardized adult mortality due to alcohol-attributable injury for the Russian Federation, 1990–2014

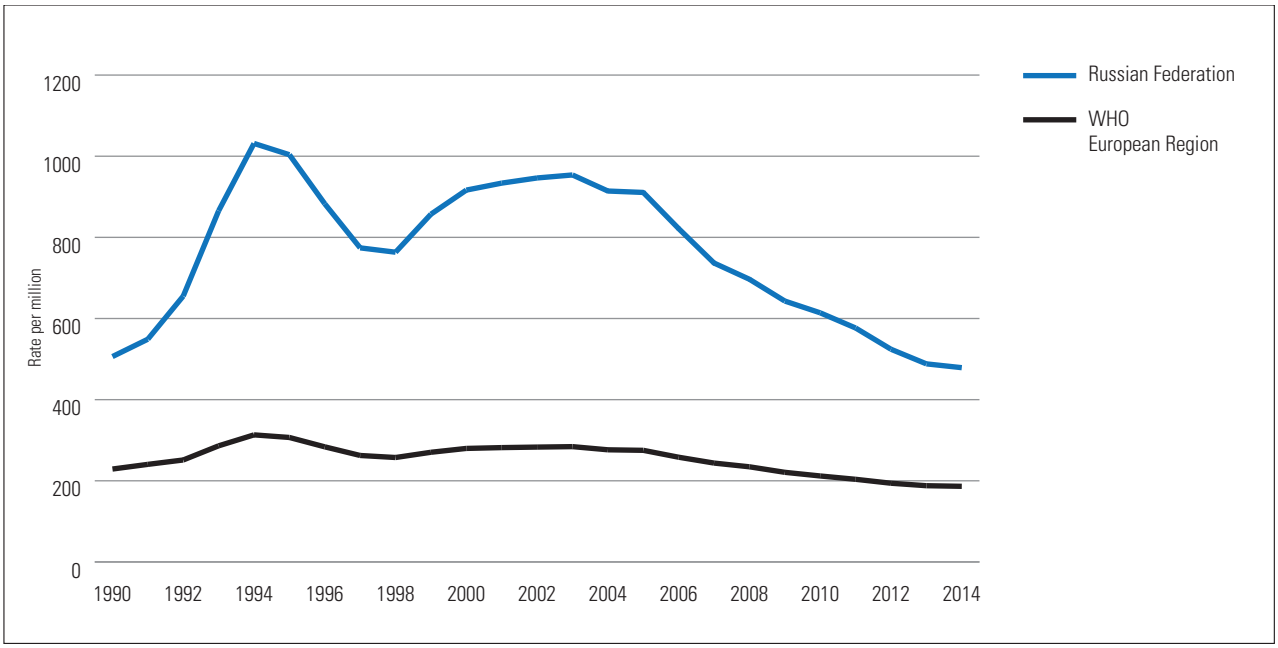


Fig. 52. Trends in age-standardized adult mortality due to alcohol-attributable injury for Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Serbia and the former Yugoslav Republic of Macedonia, 1990–2014

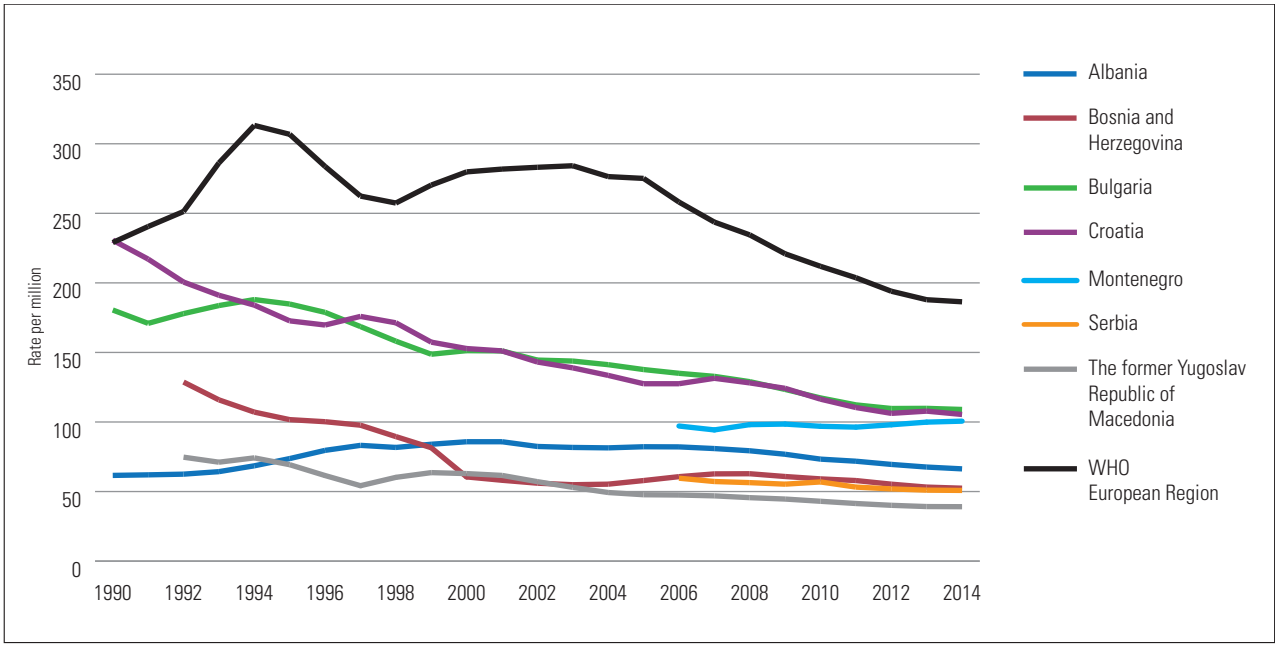
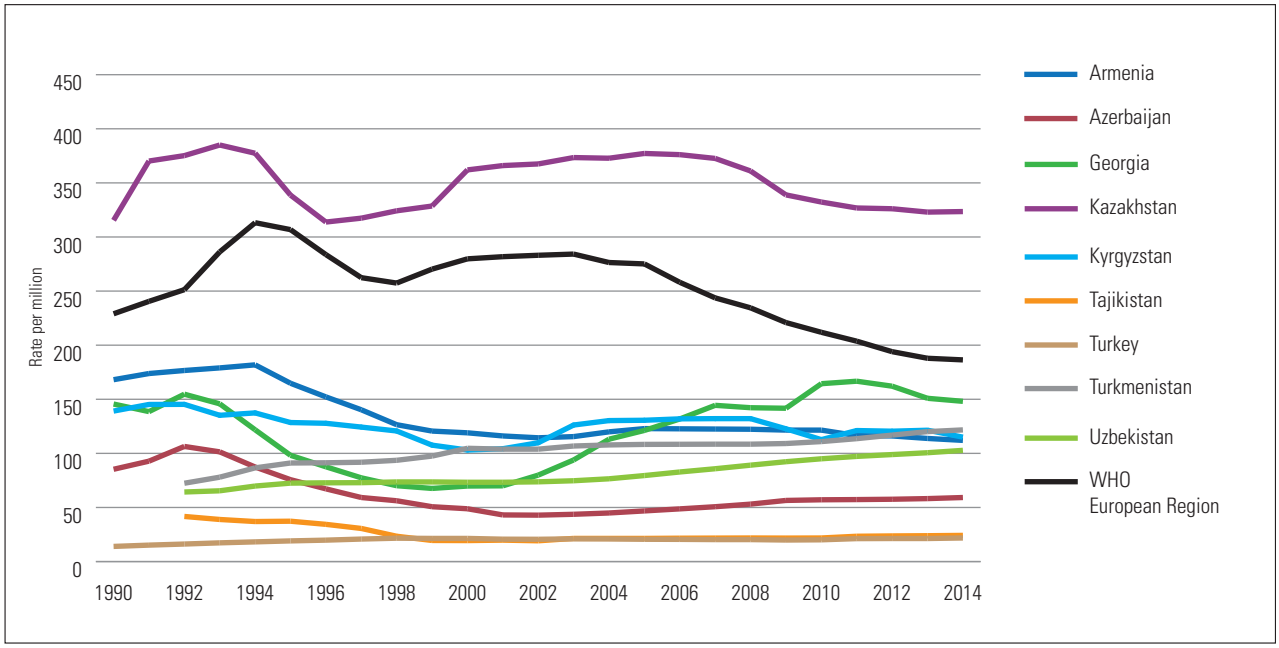


Fig. 53. Trends in age-standardized adult mortality due to alcohol-attributable injury for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan, 1990–2014



BURDEN OF MORTALITY DUE TO ALCOHOL-ATTRIBUTABLE UNINTENTIONAL INJURY

Fig. 54. Trends in age-standardized adult mortality due to alcohol-attributable unintentional injury for Ireland and the United Kingdom, 1990–2014

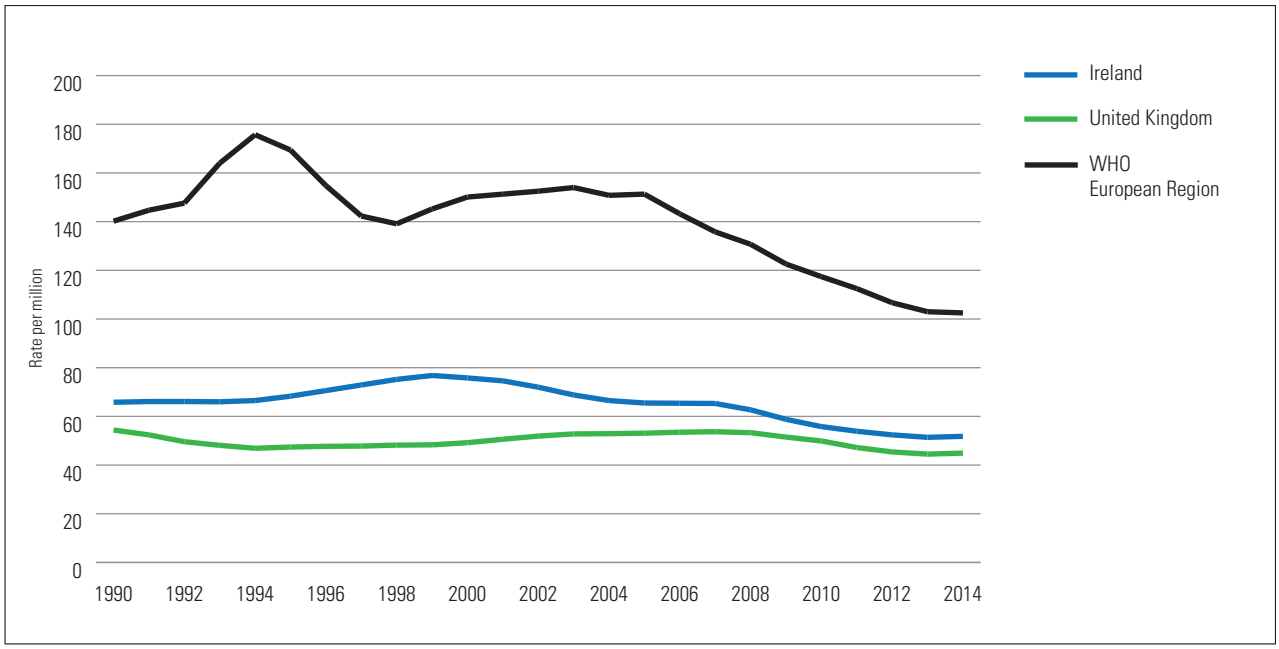


Fig. 55. Trends in age-standardized adult mortality due to alcohol-attributable unintentional injury for Austria, Belgium, Denmark, France, Germany, the Netherlands and Switzerland, 1990–2014

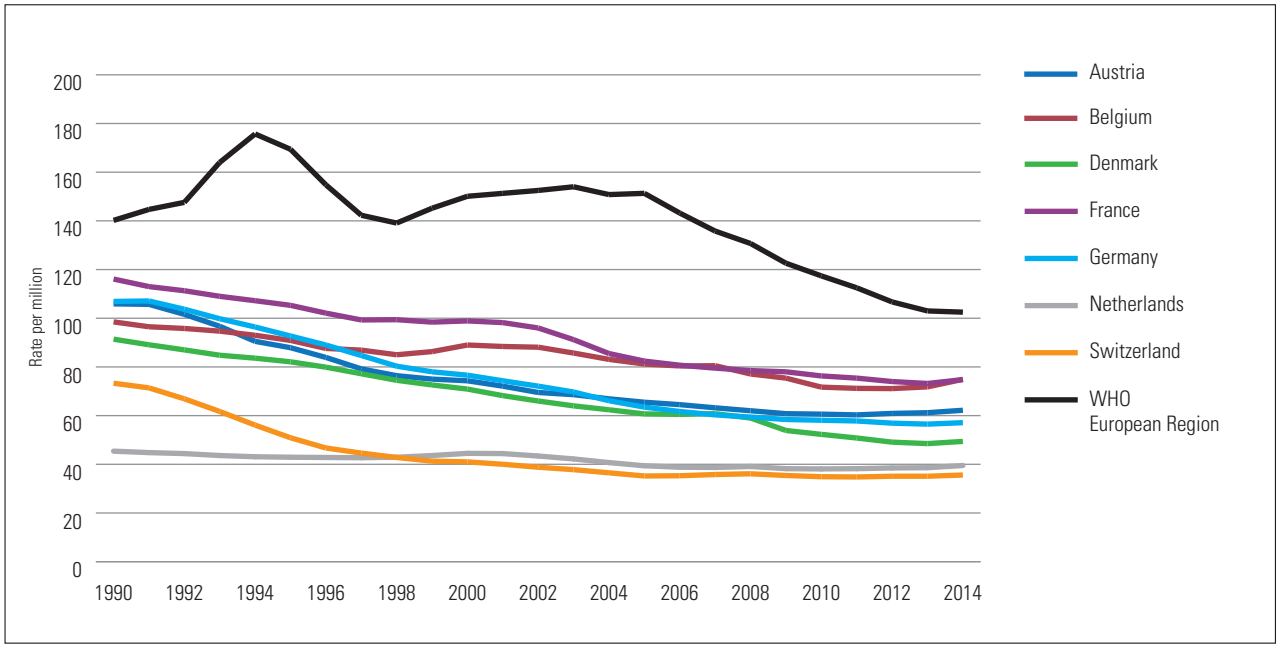


Fig. 56. Trends in age-standardized adult mortality due to alcohol-attributable unintentional injury for Cyprus, Greece, Israel, Italy, Malta, Portugal and Spain, 1990–2014

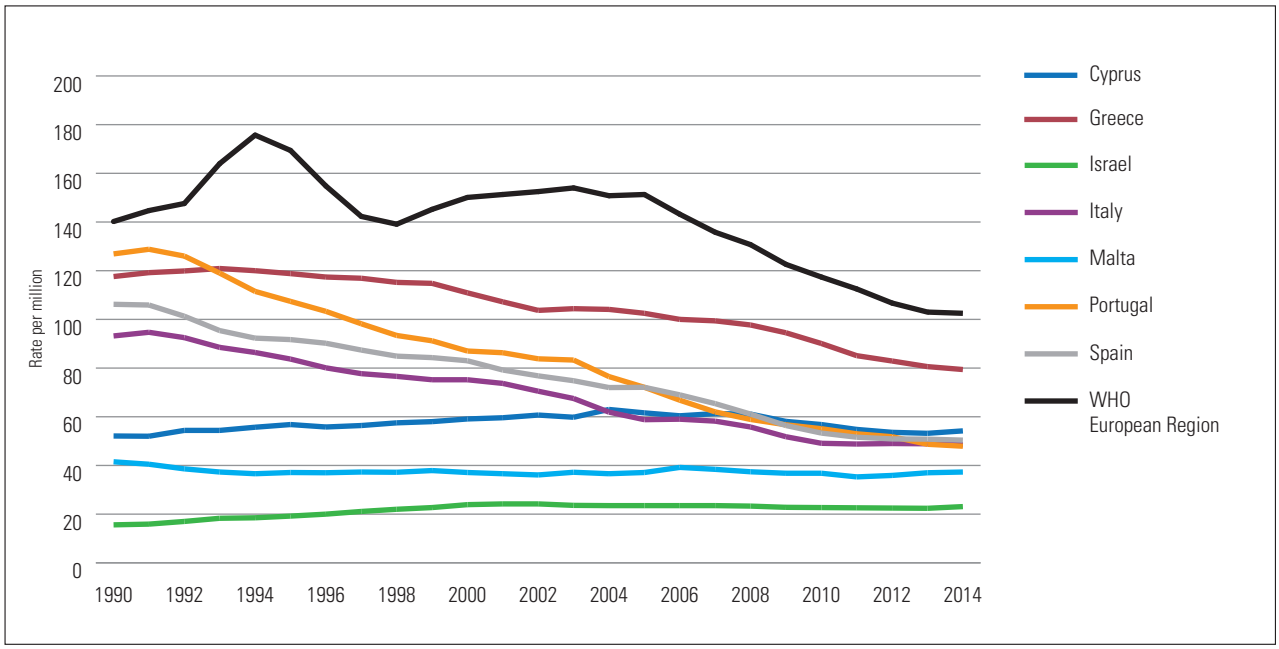


Fig. 57. Trends in age-standardized adult mortality due to alcohol-attributable unintentional injury for the Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia, 1990–2014

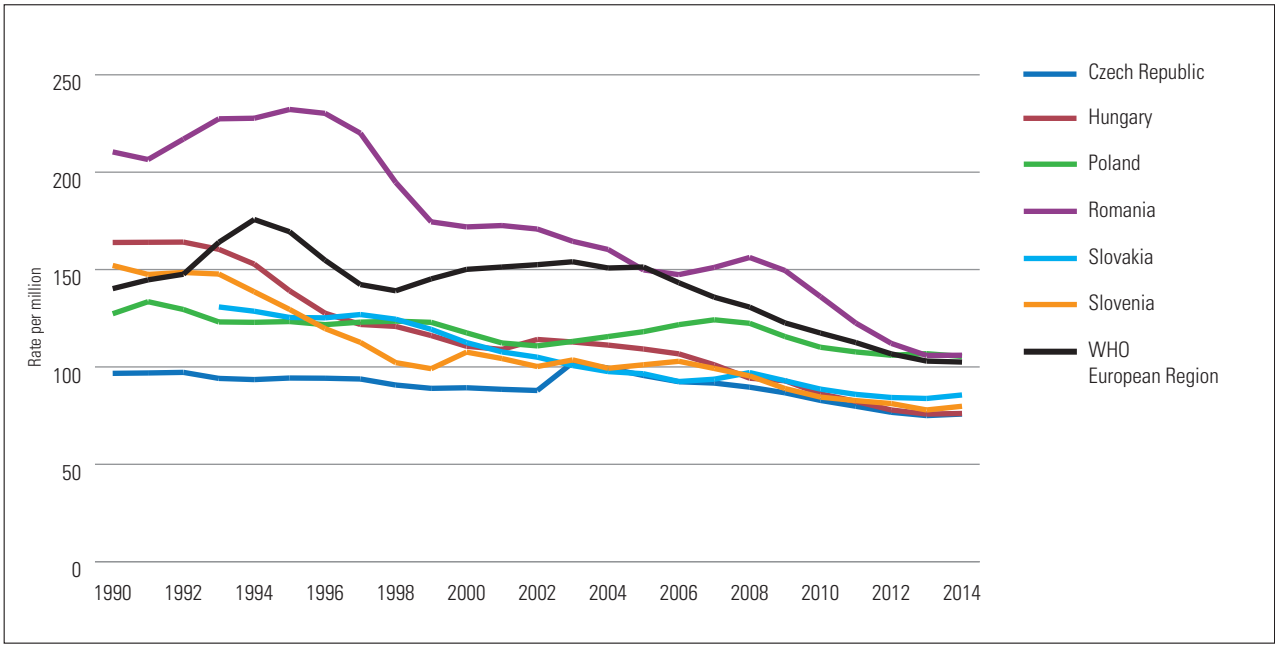


Fig. 58. Trends in age-standardized adult mortality due to alcohol-attributable unintentional injury for Finland, Iceland, Norway and Sweden, 1990–2014

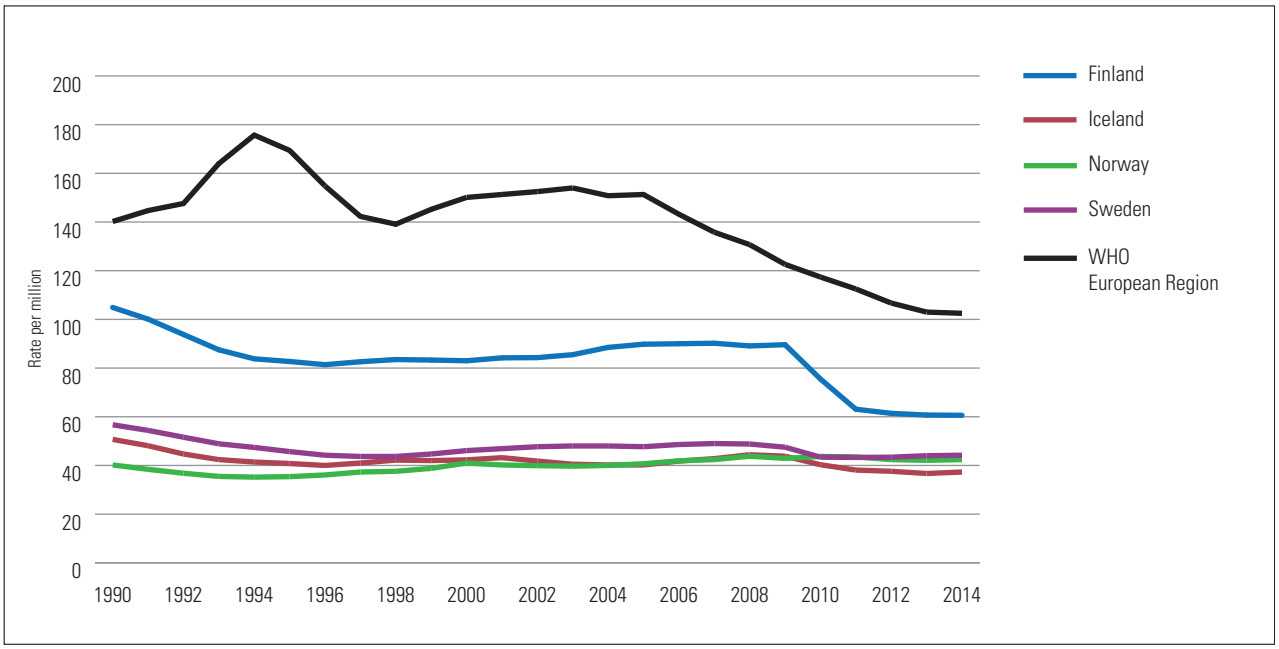


Fig. 59. Trends in age-standardized adult mortality due to alcohol-attributable unintentional injury for Belarus, Estonia, Latvia, Lithuania, the Republic of Moldova and Ukraine, 1990–2014

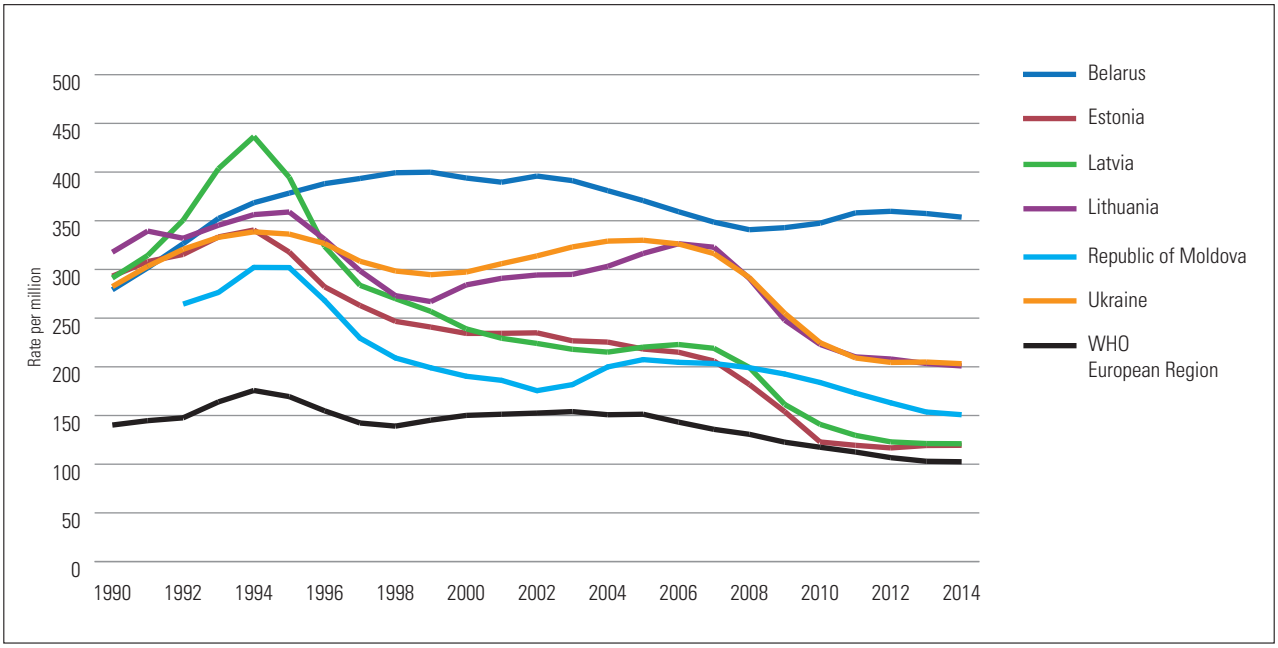


Fig. 60. Trends in age-standardized adult mortality due to alcohol-attributable unintentional injury for the Russian Federation, 1990–2014

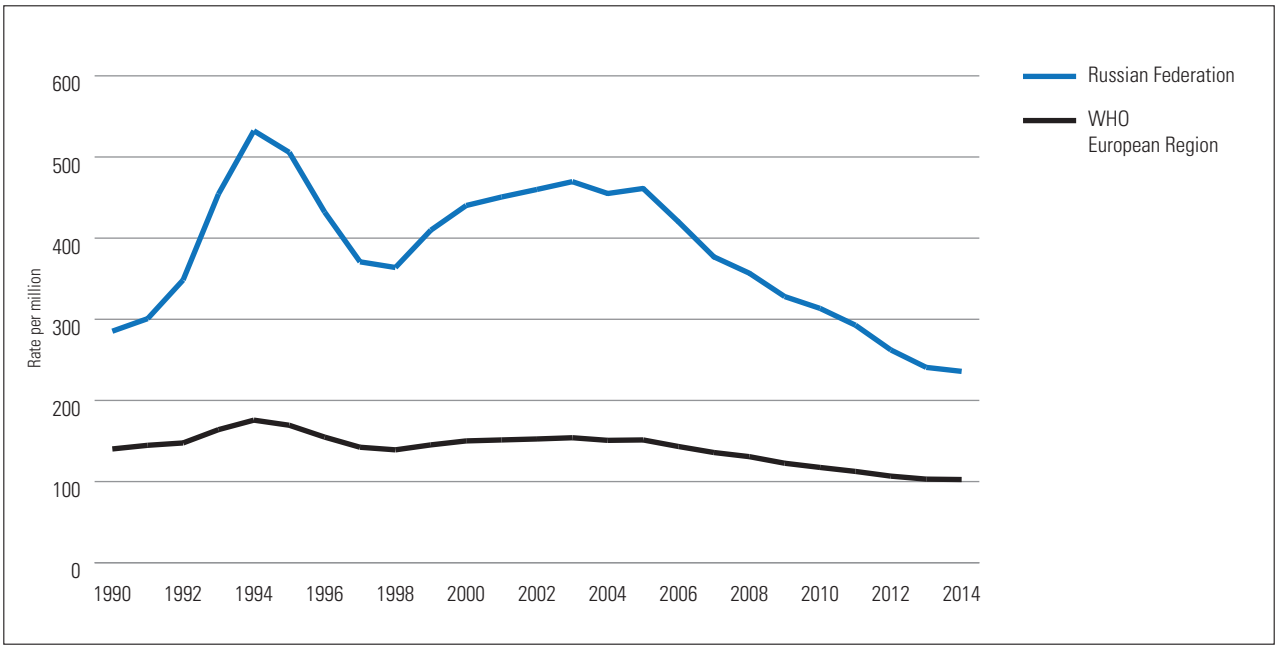


Fig. 61. Trends in age-standardized adult mortality due to alcohol-attributable unintentional injury for Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Serbia and the former Yugoslav Republic of Macedonia, 1990–2014

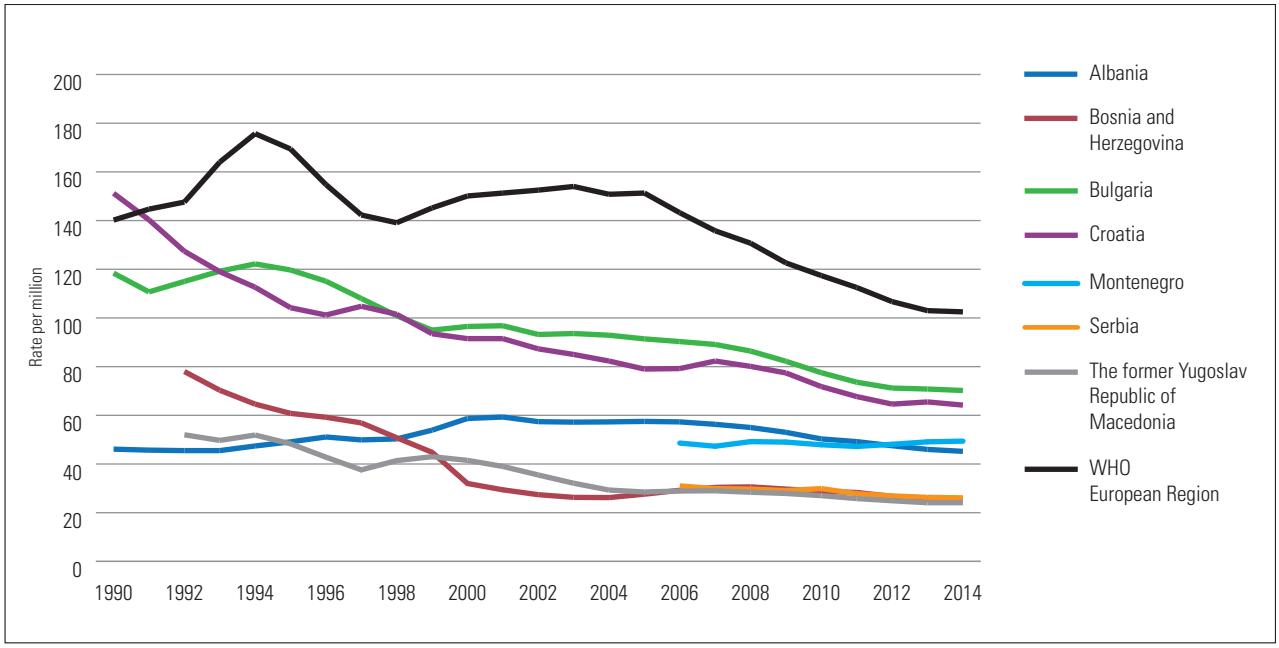
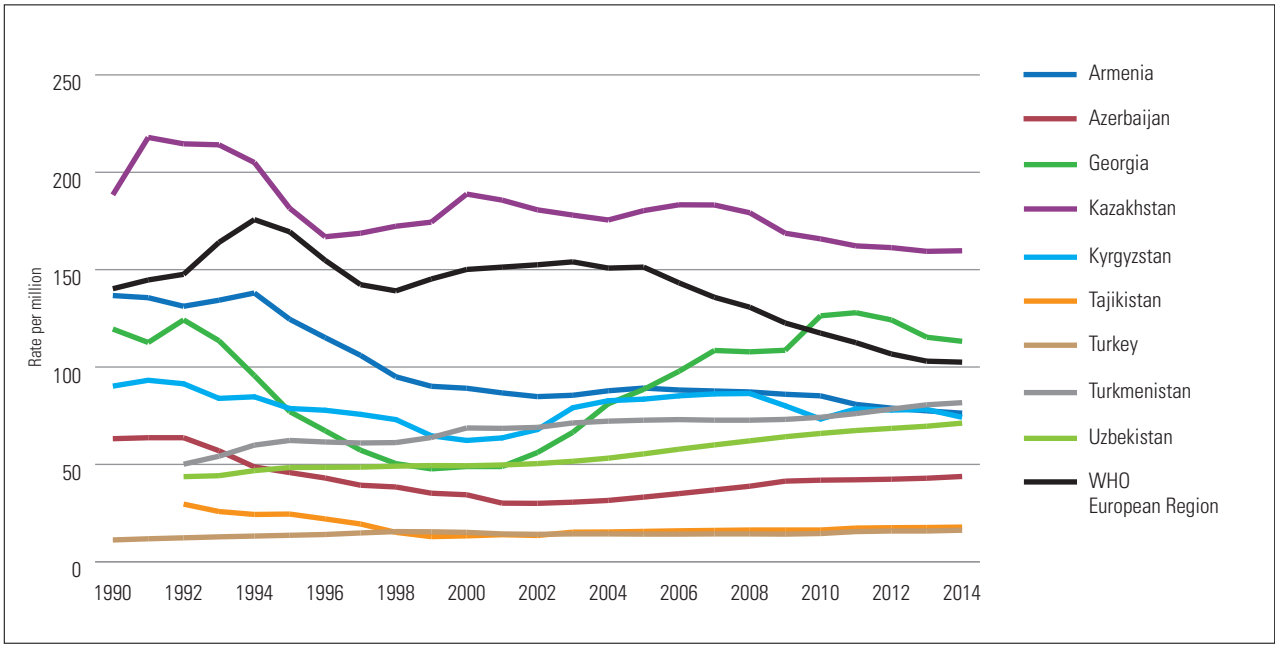


Fig. 62. Trends in age-standardized adult mortality due to alcohol-attributable unintentional injury forArmenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan, 1990–2014



BURDEN OF MORTALITY DUE TO ALCOHOL-ATTRIBUTABLE INTENTIONAL INJURY

Fig. 63. Trends in age-standardized adult mortality due to alcohol-attributable intentional injury for Ireland and the United Kingdom, 1990–2014

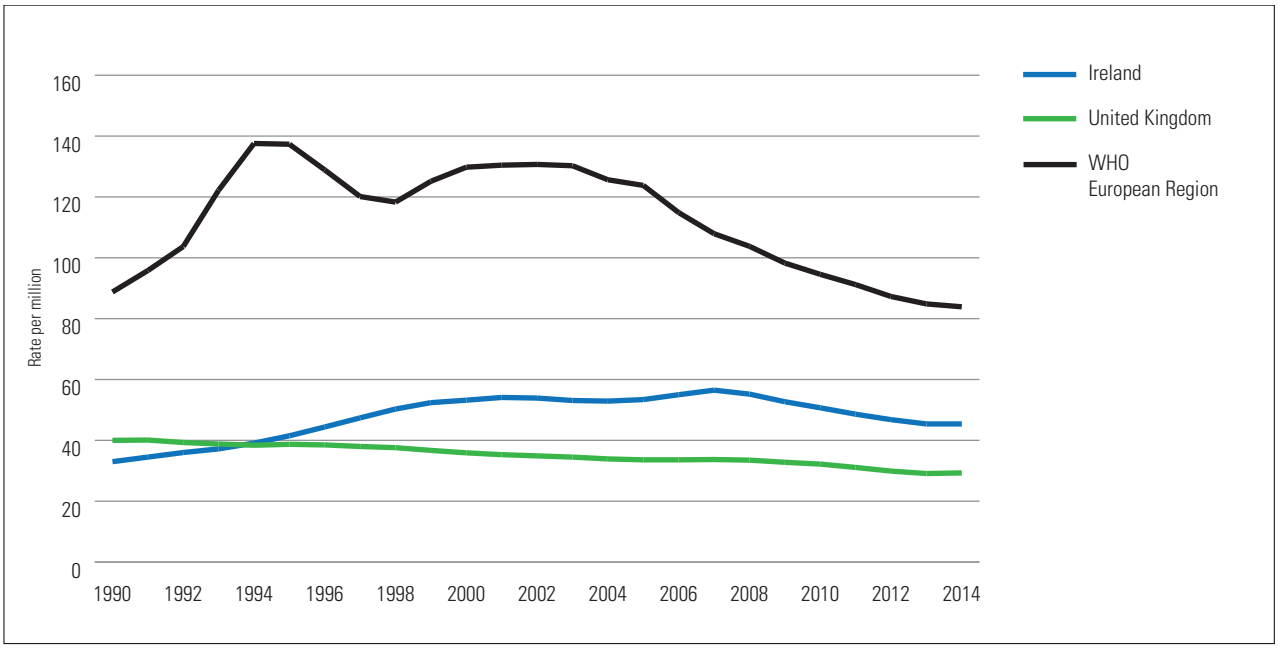


Fig. 64. Trends in age-standardized adult mortality due to alcohol-attributable intentional injury for Austria, Belgium, Denmark, France, Germany, the Netherlands and Switzerland, 1990–2014

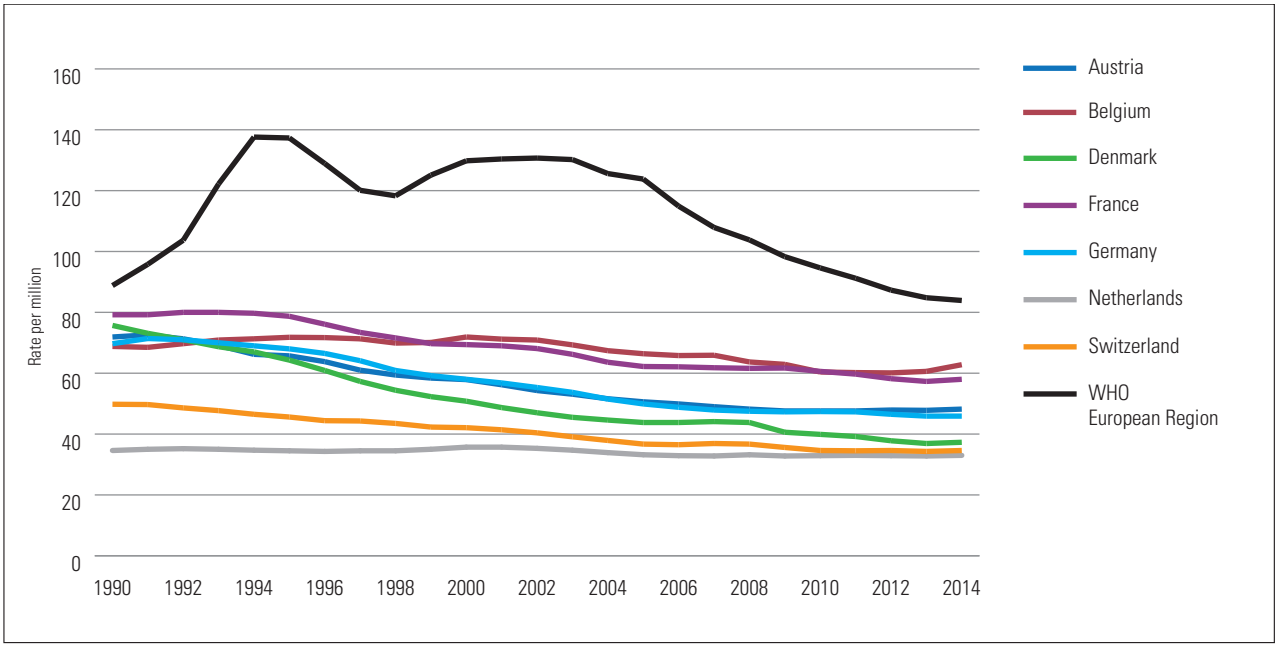


Fig. 65. Trends in age-standardized adult mortality due to alcohol-attributable intentional injury for Cyprus, Greece, Israel, Italy, Malta, Portugal and Spain, 1990–2014

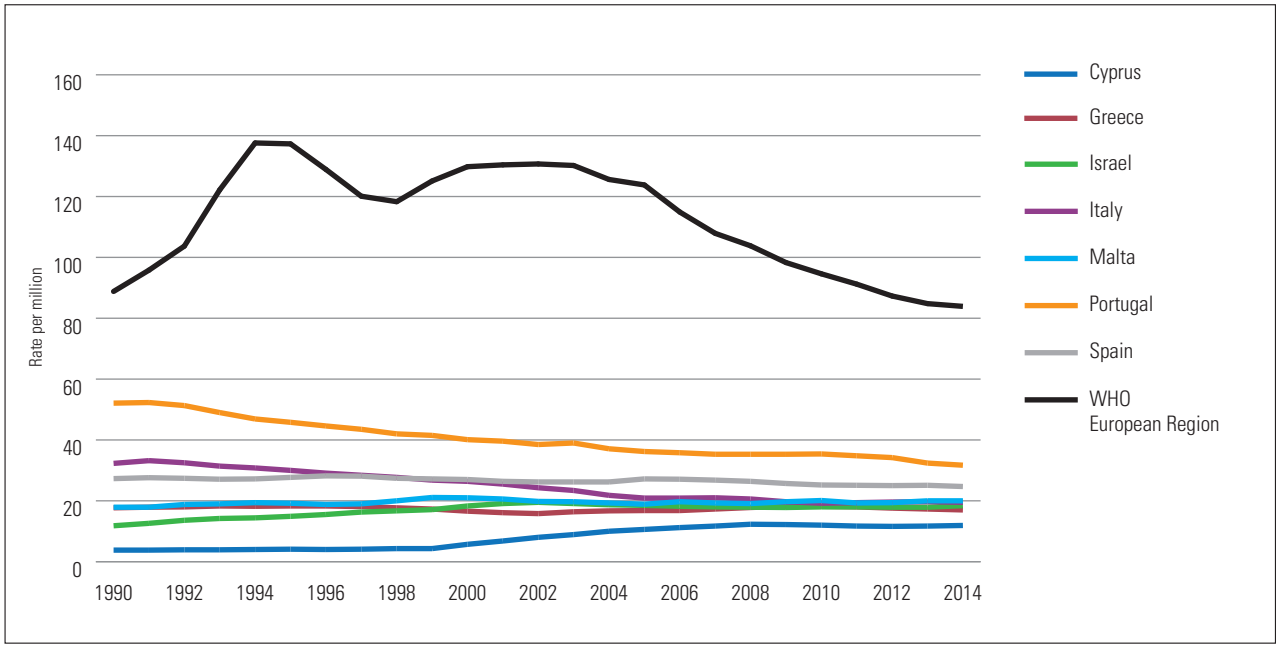


Fig. 66. Trends in age-standardized adult mortality due to alcohol-attributable intentional injury for the Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia, 1990–2014

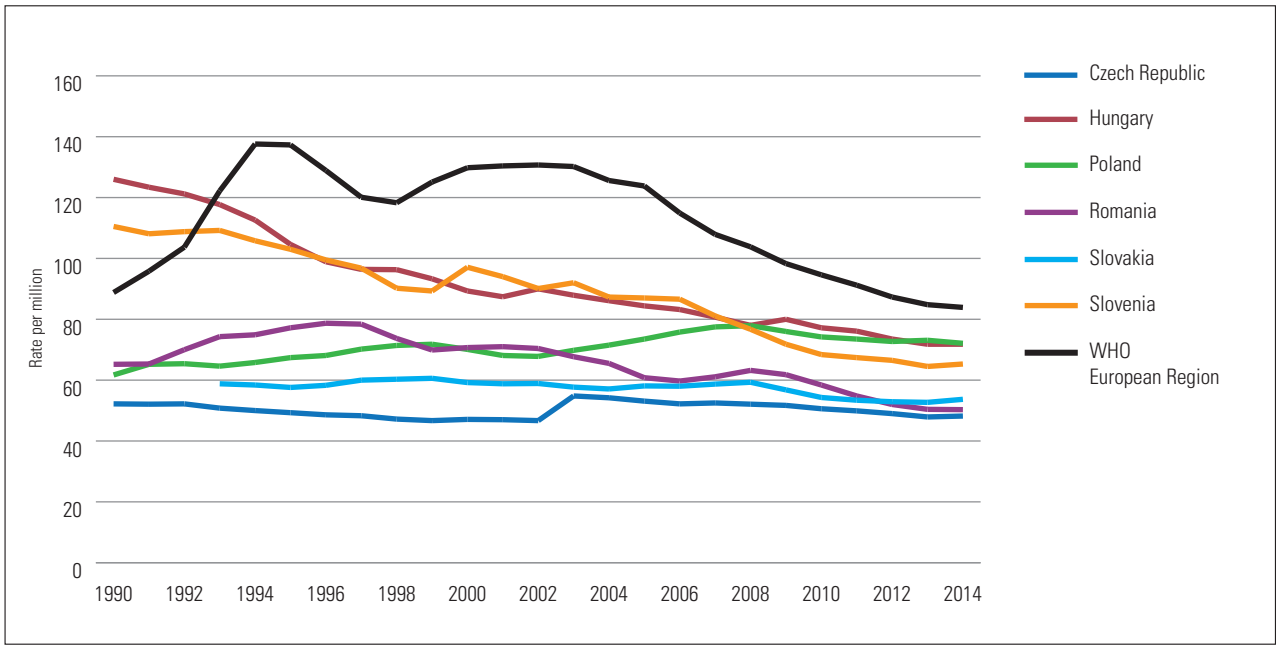


Fig. 67. Trends in age-standardized adult mortality due to alcohol-attributable intentional injury for Finland, Iceland, Norway and Sweden, 1990–2014

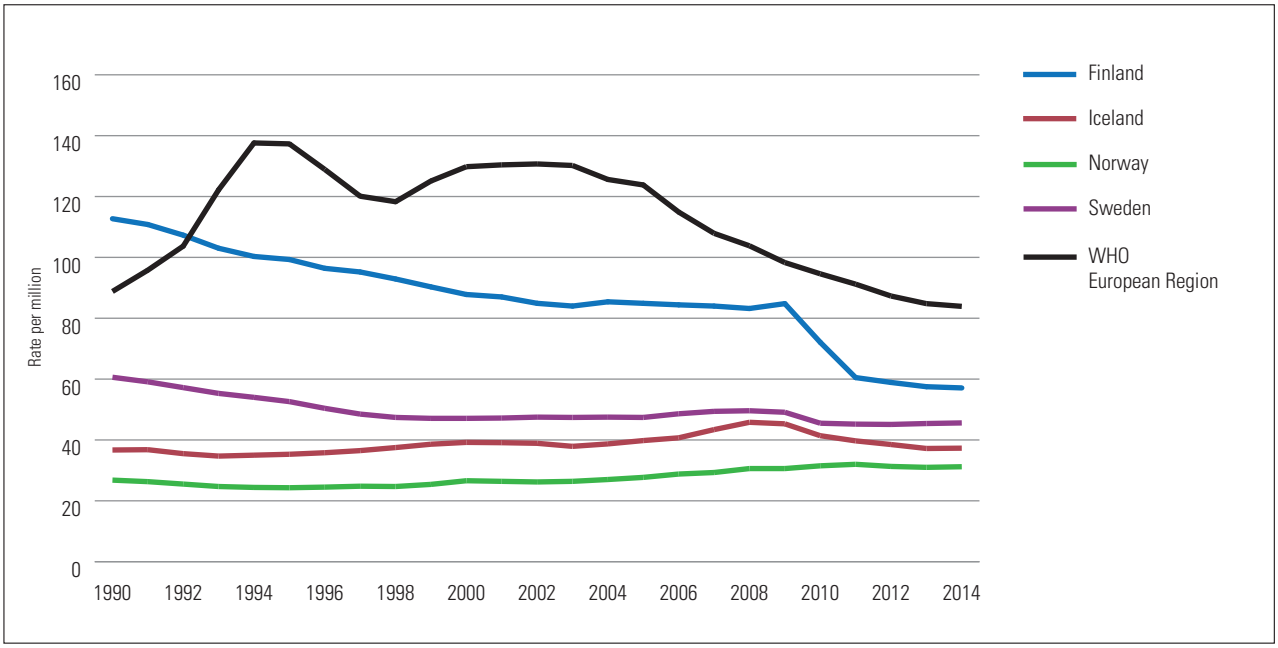


Fig. 68. Trends in age-standardized adult mortality due to alcohol-attributable intentional injury for Belarus, Estonia, Latvia, Lithuania, the Republic of Moldova and Ukraine, 1990–2014

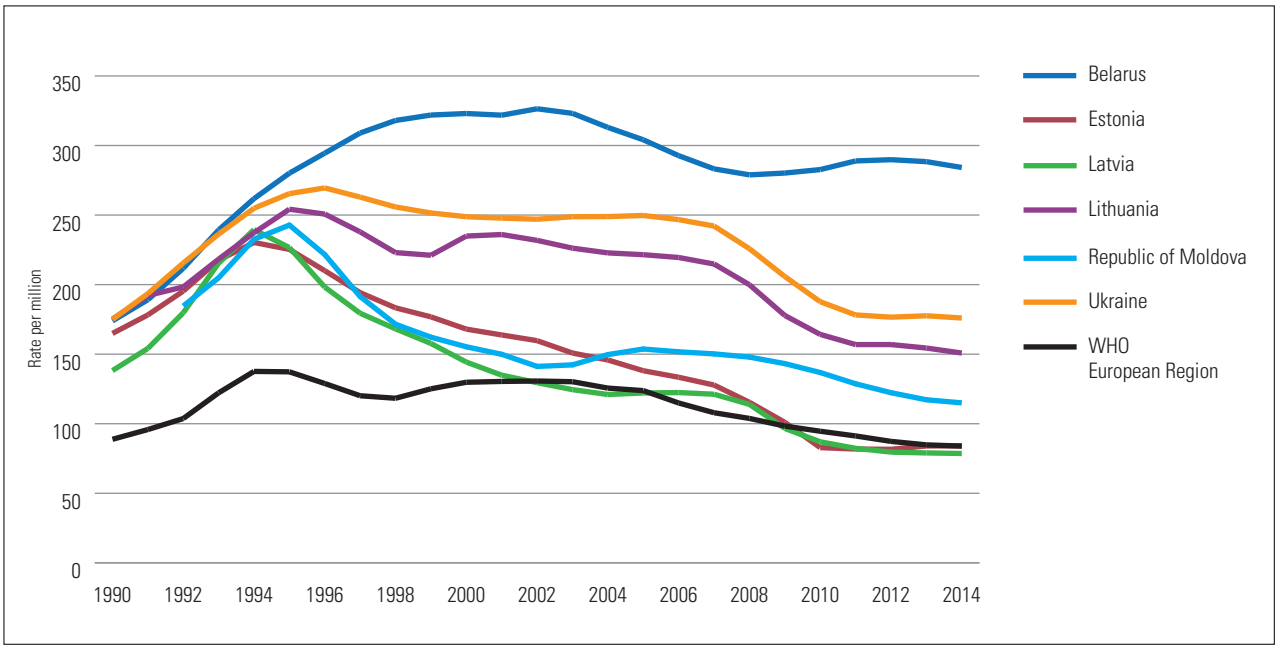


Fig. 69. Trends in age-standardized adult mortality due to alcohol-attributable intentional injury for the Russian Federation, 1990–2014

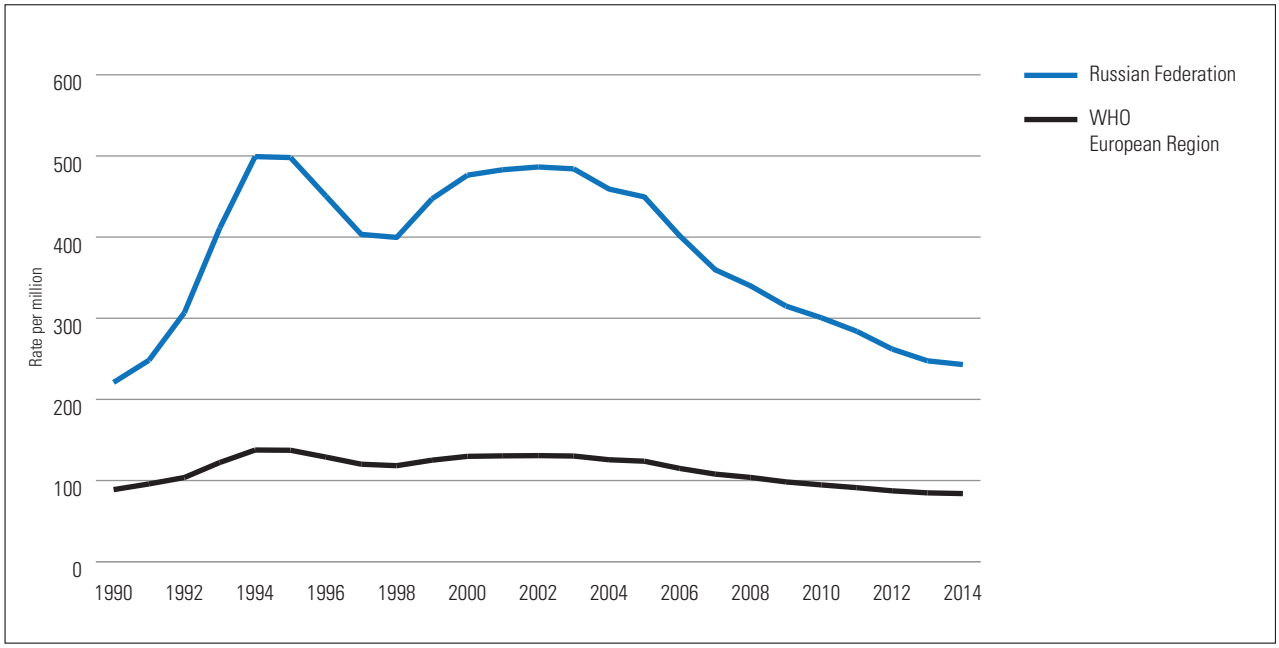


Fig. 70. Trends in age-standardized adult mortality due to alcohol-attributable intentional injury for Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Serbia and the former Yugoslav Republic of Macedonia, 1990–2014

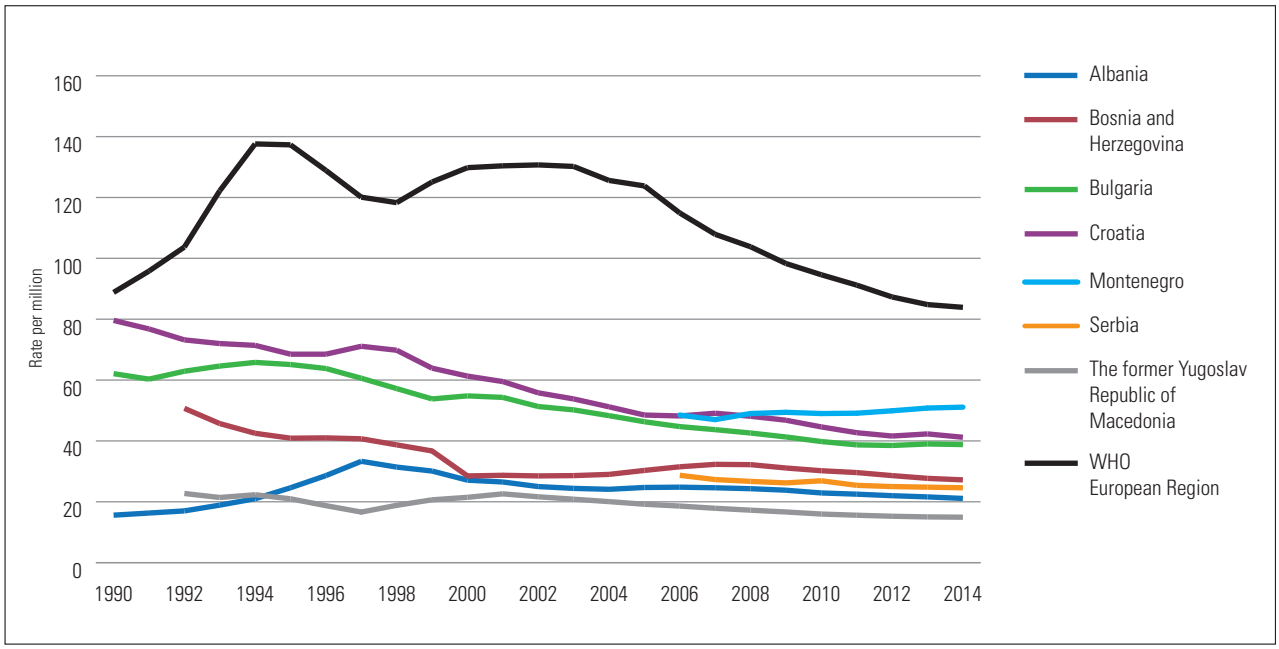
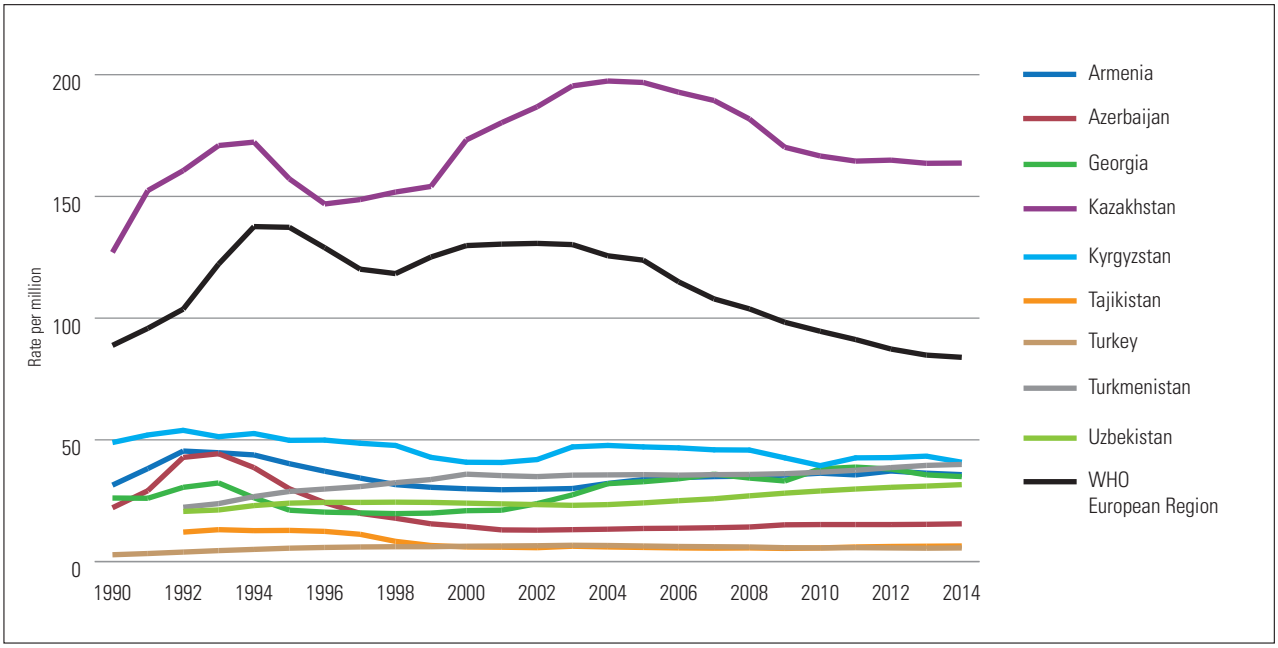


Fig. 71. Trends in age-standardized adult mortality due to alcohol-attributable intentional injury for Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan, 1990–2014



REGIONAL DIFFERENCES IN ALCOHOL-ATTRIBUTABLE MORTALITY

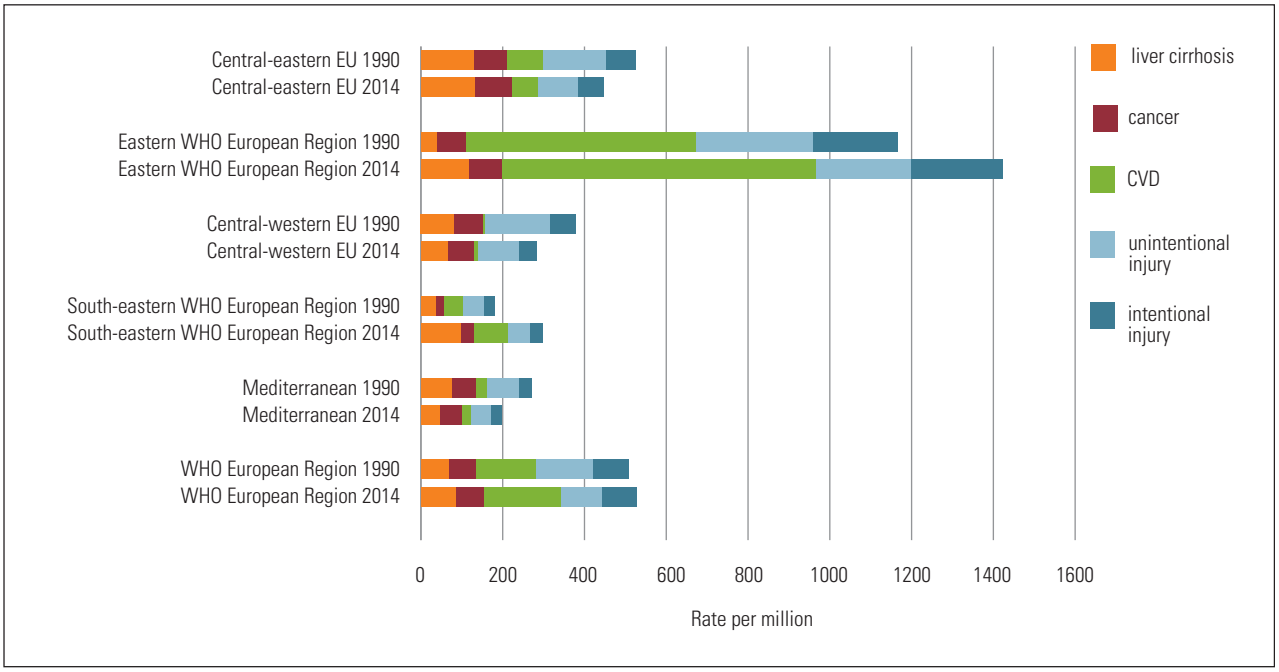
OVERALL TREND IN ALCOHOL-ATTRIBUTABLE MORTALITY BETWEEN 1990 AND 2014 BY MAJOR CAUSE-OF-DEATH CATEGORIES

Fig. 72 gives an overview of the age-standardized alcohol-attributable mortality rates per million by major categories of cause of death at the beginning and the end of the observation period, i.e. 1990 and 2014. For the WHO European Region as a whole, there was higher alcohol-attributable mortality in 2014 than in 1990 (+4%), even though the overall consumption decreased slightly over this time period (*see* Fig. 10). The increase in attributable mortality burden was mainly driven by the mortality trends in the eastern WHO European Region (+22%) and in the south-eastern part of the WHO European Region (+65%, albeit from a relatively low level in 1990). On the other hand, alcohol consumption decreased in more affluent countries such as most parts of the EU, more in the Mediterranean (–27%) and the central-western (–25%) than in the central-eastern regions (–15%).

The increase in the burden of alcohol-attributable mortality in the WHO European Region, despite a small decrease in overall per capita consumption, is due to a number of reasons: first and foremost, the exponential increase in mortality risk for many cause-of-death categories with increasing levels of average consumption *(159–161)*, which led to a substantial increase in alcohol-attributable mortality, especially in regions where already high consumption levels per drinker further increased (*see* the eastern WHO European Region in Fig. 13 and 14). Second and related to this, heavy drinking occasions have a specific detrimental effect on cardiovascular and injury mortality, over and above the level of drinking (*see also* next paragraph). Finally, the Russian Federation and surrounding countries can be characterized by an overall raised adult mortality rate and low life expectancy *(141,162)*, which had even led to a separate mortality stratum in the WHO classification *(163,164)*.

The decrease in alcohol-attributable mortality in the central-eastern EU countries was due to an overall decline in mortality rates in this region *(141,162)*. Even with stable alcohol-attributable fractions or slightly increasing alcohol-attributable fractions, such a decline results in lower standardized rates.

Fig. 72. Comparisons of age-standardized alcohol-attributable mortality for major causes of death, 1990 vs 2014, in the WHO European Region and selected subregions



In terms of composition of causes of alcohol-attributable death (*see* Fig. 72), as indicated before, mortality rates due to cancer seem to be relatively stable. This is not surprising, given the considerable and varying lag time of two decades, especially of cancer sites where acetaldehyde plays a key role *(165–168)*. While alcohol consumption plays an important part in cancer mortality, any change in alcohol consumption and thus also the potential effects of alcohol policy measures, will be evident in the long term, as could be seen from the major short-term policy changes such as the Gorbachev-era anti-alcohol campaign, which had no effect on cancer rates *(169,170)*.

Mortality due to liver cirrhosis moves predictably and almost instantly with changes in consumption *(90)*, and is a good indicator of harmful drinking in a society *(171,172)* and thus is relevant for policy *(156)*. However, if liver cirrhosis is to be used for monitoring harm or alcohol use, the impact of hepatitis B and C infections have to be taken into account as well *(173)*, and the indicator should reflect the net impact of alcohol.

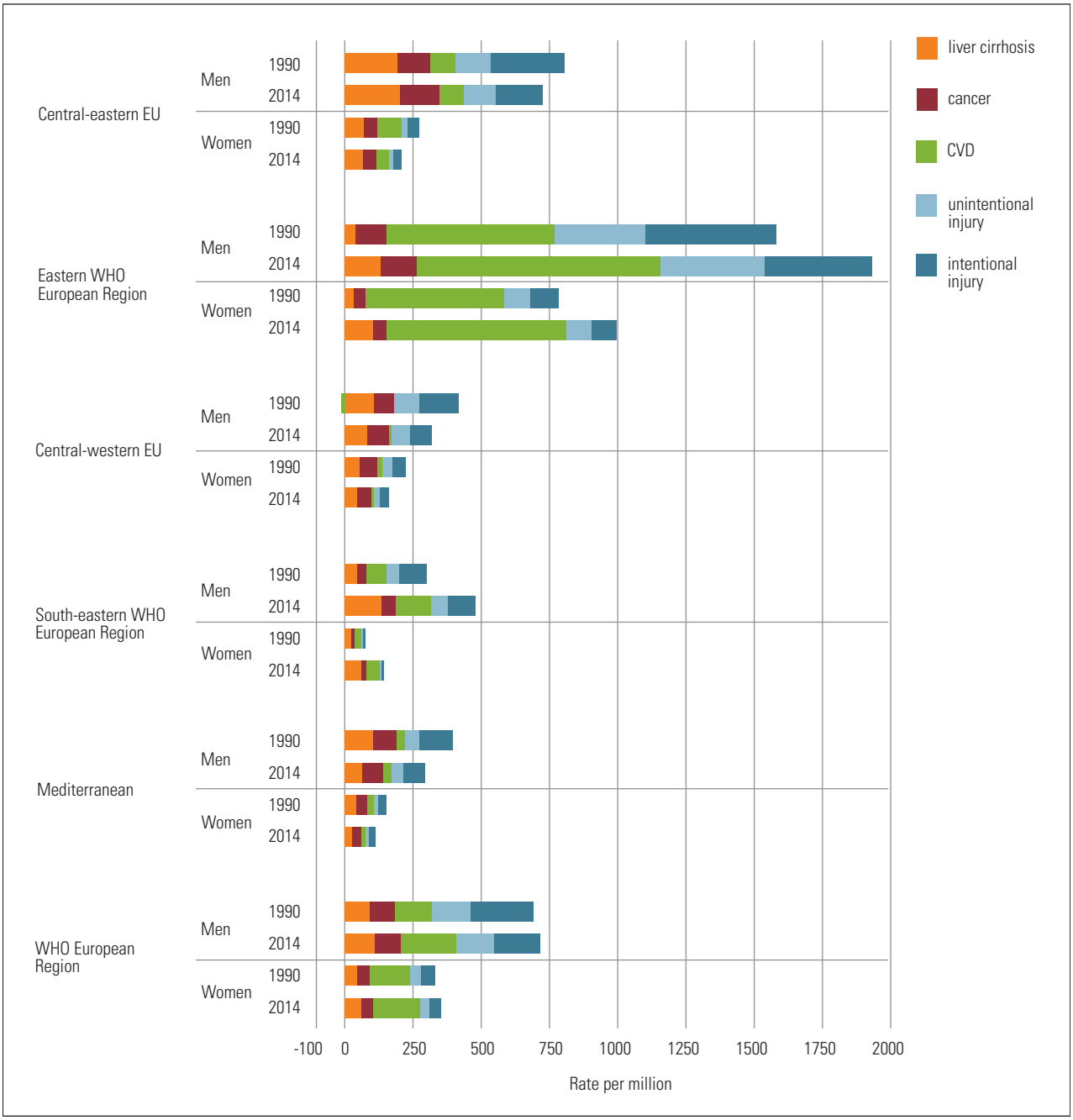
The main drivers of marked changes in the burden of alcohol-attributable mortality in the WHO European Region are CVD and injuries. As for cardiovascular mortality, alcohol consumption has no marked impact as long as drinking is maintained at moderate levels. The beneficial effects on ischaemic diseases *(104,174)*, described earlier, are almost negated by the detrimental effects on all other CVD *(96)*. As a result, in 2014, the proportion of alcohol-attributable cardiovascular mortality was less 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 as a whole, it was 10%). This cause-of-death category comprised 54% of all alcohol-attributable mortality in the eastern WHO European Region, and 36% in the WHO European Region as a whole. Cultures with both episodic and chronic heavy drinking will experience mainly detrimental effects, which are obviously most pronounced when very heavy binges are the dominant pattern of drinking for a large part of the population such as in the eastern WHO European Region during the observation period. (For individual large-scale studies, *see (5,54,175,176)*; for discussion, *see (110,177)*; for supporting aggregate-level studies, *see (178–181)*.)

Morbidity and mortality rates due to injury have been decreasing globally, including in the European Region *(158)*. The speed of this decline may be halted and even reversed by alcohol consumption (*see* Fig. 72 and below; for a historical comparison of alcohol poisoning deaths in the Russian Federation, *see (182)*). It needs to be mentioned that mortality due to alcohol-attributable unintentional injury (i.e. alcohol poisoning) may be underestimated in countries with a high prevalence of heavy binge drinking (e.g. the Russian Federation *(183–185)*; Estonia *(186,187)*). (For a discussion, *see (188,189)*.)

SEX-SPECIFIC TRENDS IN ALCOHOL-ATTRIBUTABLE MORTALITY BETWEEN 1990 AND 2014 BY MAJOR CAUSE-OF-DEATH CATEGORIES

Fig. 73 shows the alcohol-attributable cause-of-death rates separately by sex. In all countries, more alcohol is consumed by men compared to women, as men abstain less (*see* Fig. 13 and 14 for European Region and subregions). As a consequence, alcohol-attributable mortality is higher in men than in women. Overall, the ratio of male-to-female age-standardized rates of alcohol-attributable mortality for the WHO European Region is about 2:1 and has not changed much over the past 25 years (1990: 2.1:1; 2014: 2.0:1). The ratio varies for different causes of death (*see* Fig. 74–78 below), and by region, however. Whereas in most regions the ratio is around 2:1, countries in the south-eastern part of the European Region and Mediterranean countries have higher ratios. This reflects, in part, 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 to 0.44; $t = 5.4$; $P < 0.001$); the higher the gender inequality, the lower the proportion of alcohol consumed by women).[19]

Fig. 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 subregions



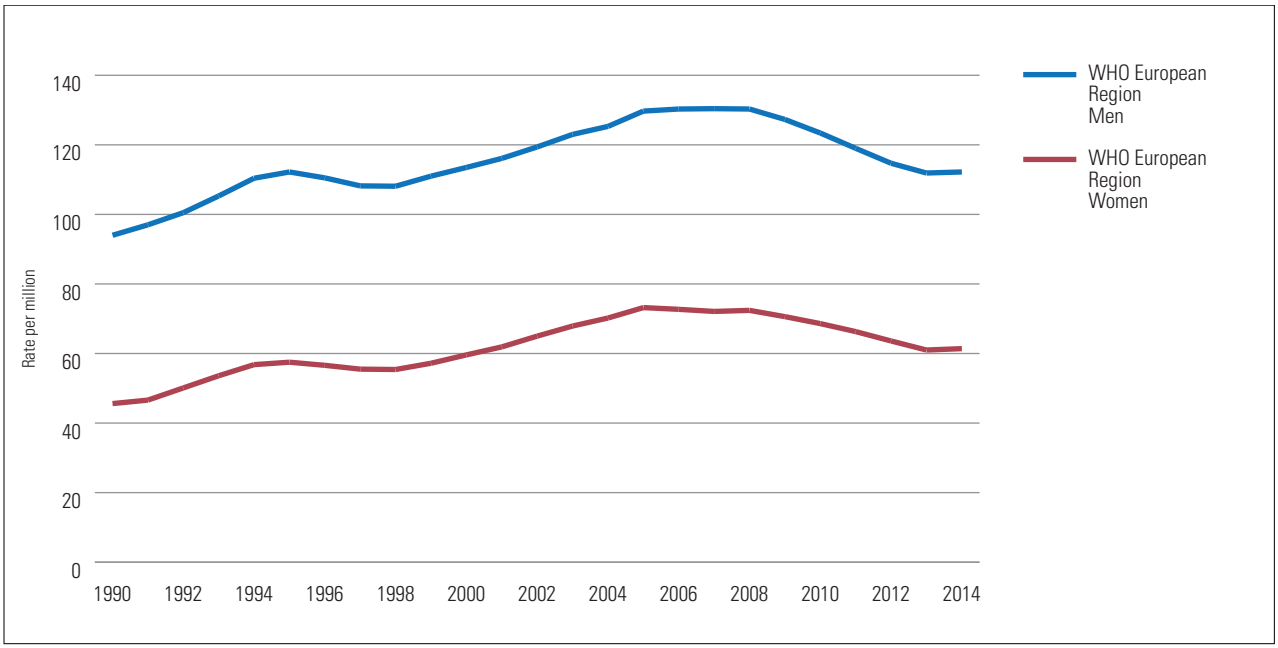
[19] Own calculations based on data for the WHO *Global status report on alcohol and health (1)* and the UN Gender Inequality Index *(190)*.

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 (*see* Fig. 74–78).

Fig. 74 shows that standardized mortality rates due to liver cirrhosis fluctuate over time in concert, with rates among men about twofold higher than among women, 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 (142)* for lifetime exposure; and *(87)* for dose–response relationships between average drinking and liver cirrhosis mortality). However, there are also clear sex differences in acceleration of the risks for liver cirrhosis: women have a much higher risk of mortality due to liver cirrhosis for the same amount of drinking *(87)*.

Overall, mortality due to liver cirrhosis increased till about 2007 for both sexes, and decreased thereafter, as did per capita consumption (*see* Fig. 10), but 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 before Fig. 23 for eastern European countries).

Fig. 74. Trends in age-standardized rates of adult mortality due to alcohol-attributable liver cirrhosis in the WHO European Region, comparing men and women, 1990–2014



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

For CVD 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 study period, women had a higher rate of cardiovascular mortality compared to men (Fig. 76). As discussed earlier, the different levels and patterns of drinking have different impacts on cardiovascular mortality, and these impacts also differ by sex. Most importantly, for the curvilinear dose–response relationships between average volume of drinking and ischaemic heart disease outcomes, the relative minimum (i.e. the largest beneficial effect) is at lower alcohol exposure levels for women than for men *(101,103)*.

Fig. 75. Trends in age-standardized rates of adult mortality due to alcohol-attributable cancer in the WHO European Region, comparing men and women, 1990–2014

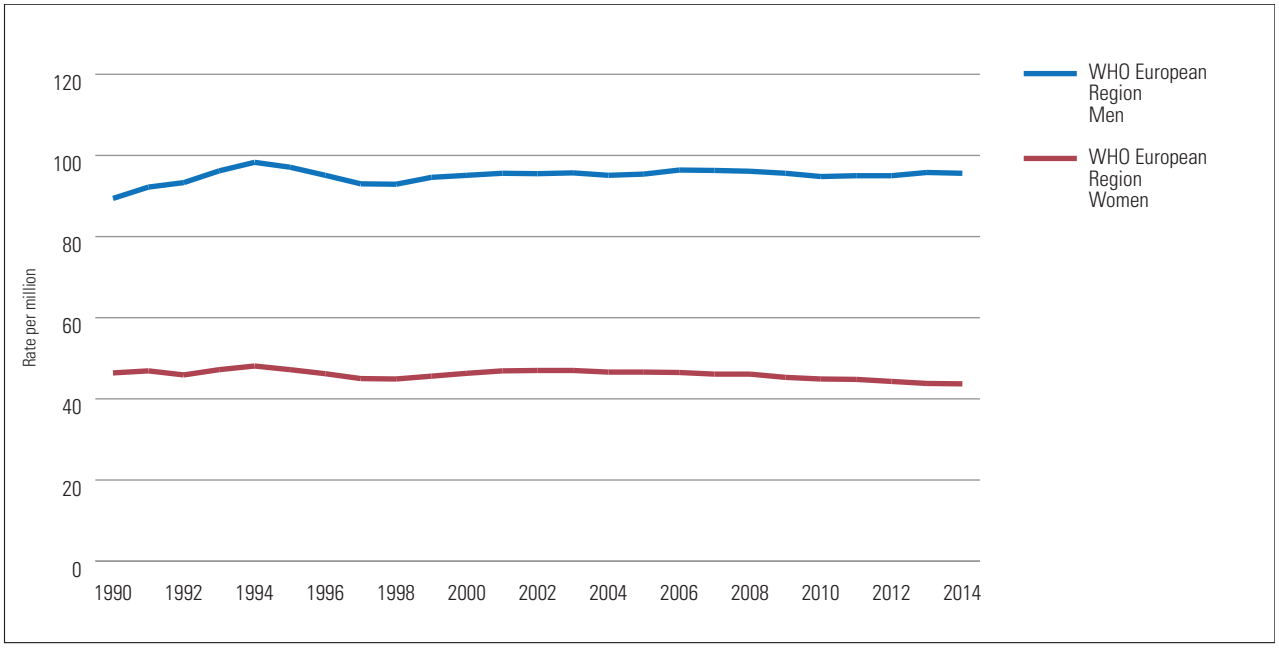


Fig. 76. Trends in age-standardized rates of adult mortality due to alcohol-attributable CVD in the WHO European Region, comparing men and women, 1990–2014

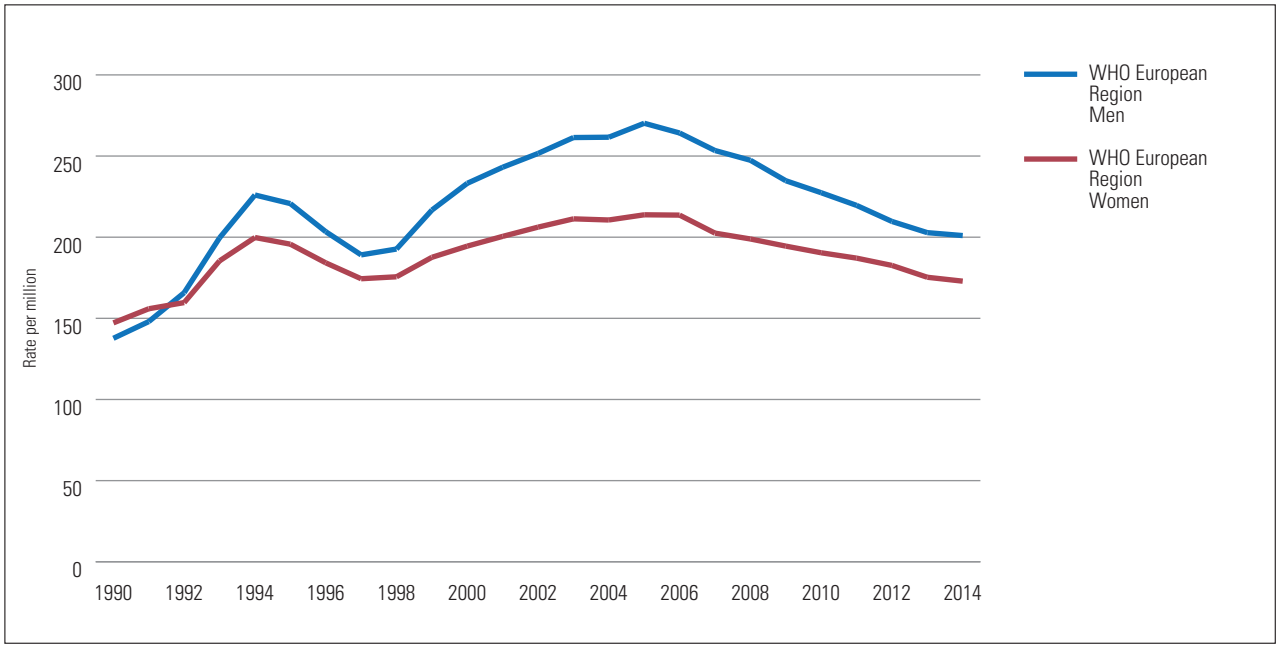


Fig. 77 and 78 compare standardized mortality ratios of unintentional (Fig. 77) and intentional injury (Fig. 78) by sex. First, the ratios are much higher (unintentional between 4.1 and 4.7; intentional between 3.6 and 4.4) compared to other causes of death, reflecting the overall higher injury risk for men compared to women, which was consistent for some time in all countries and regions globally *(158,191)*.

Fig. 77. Trends in age-standardized rates of mortality due to alcohol-attributable unintentional injury in the WHO European Region, comparing men and women, 1990–2014

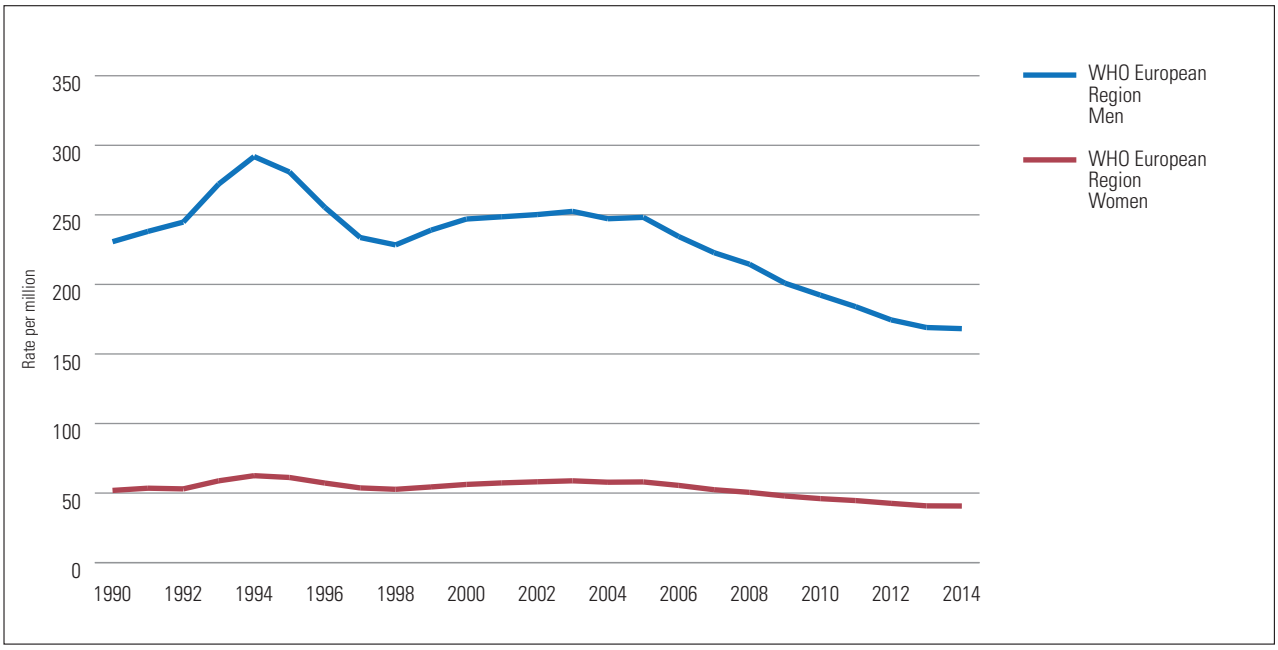
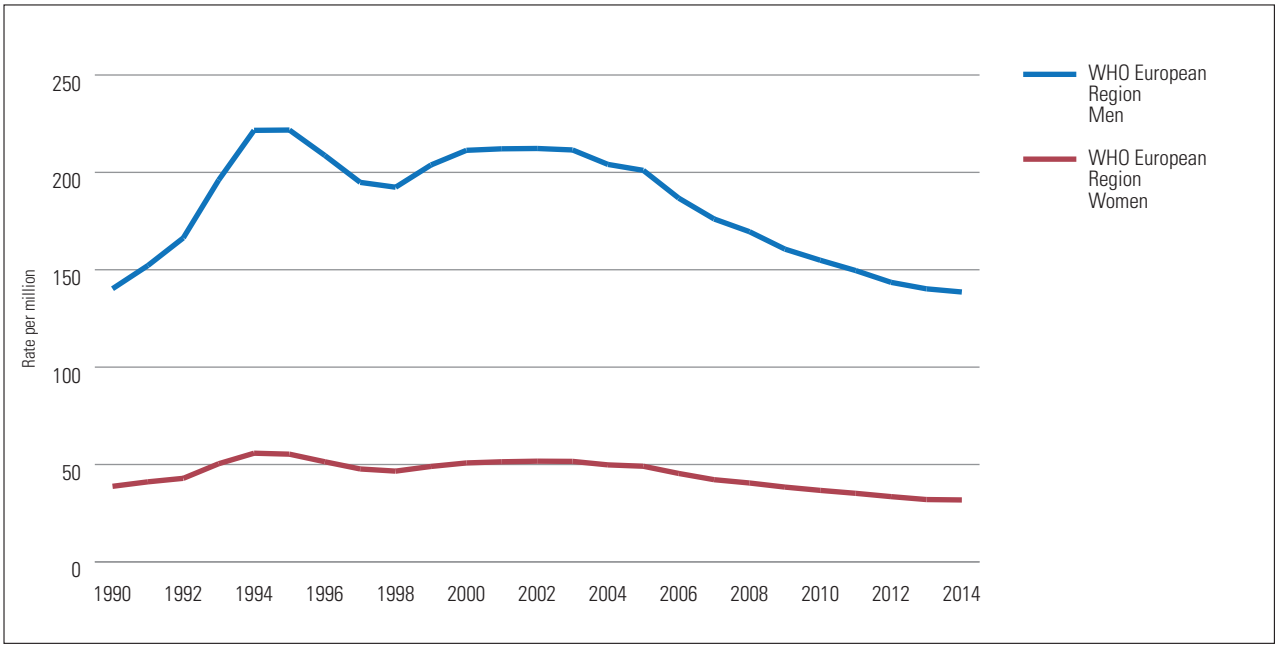


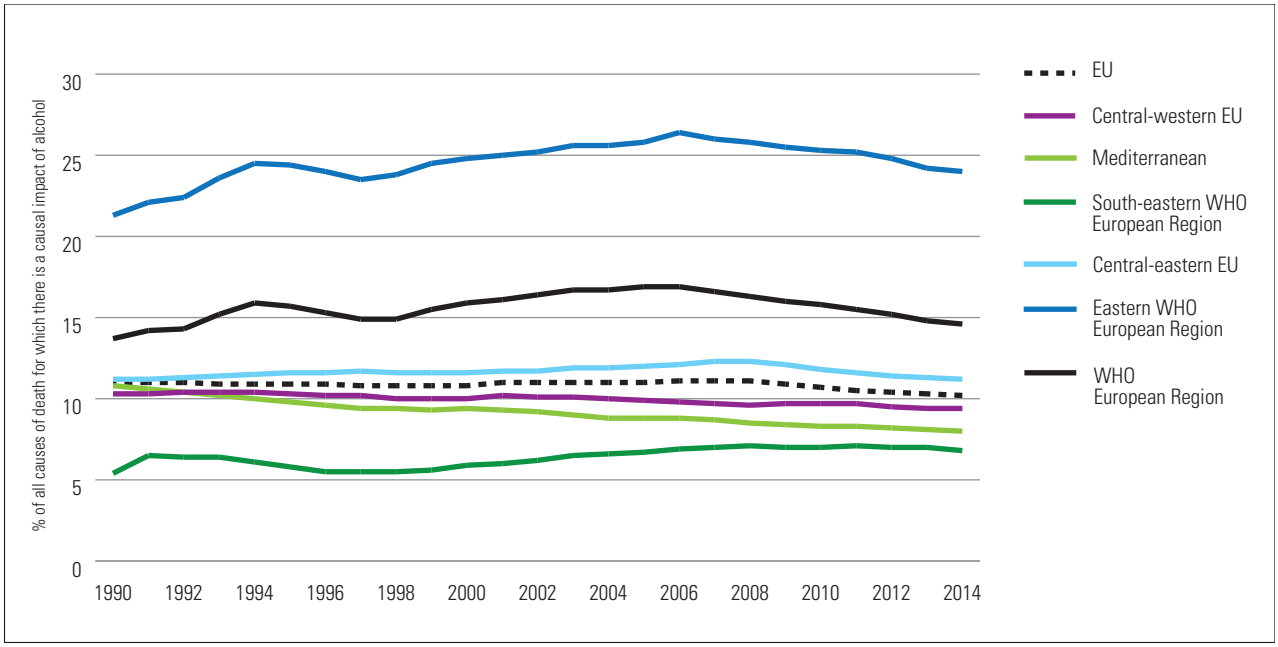
Fig. 78. Trends in age-standardized rates of mortality due to alcohol-attributable intentional injury in the WHO European Region, comparing men and women, 1990–2014



TRENDS IN ALCOHOL-ATTRIBUTABLE FRACTIONS OF MORTALITY

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

Fig. 79. Trends in alcohol-attributable fractions of mortality in the WHO European Region and selected subregions, 1990–2014



As expected by the formula on attributable risk, the values closely follow the adult per capita alcohol consumption trends (*see* Fig. 10), albeit with a 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* Fig. 79).

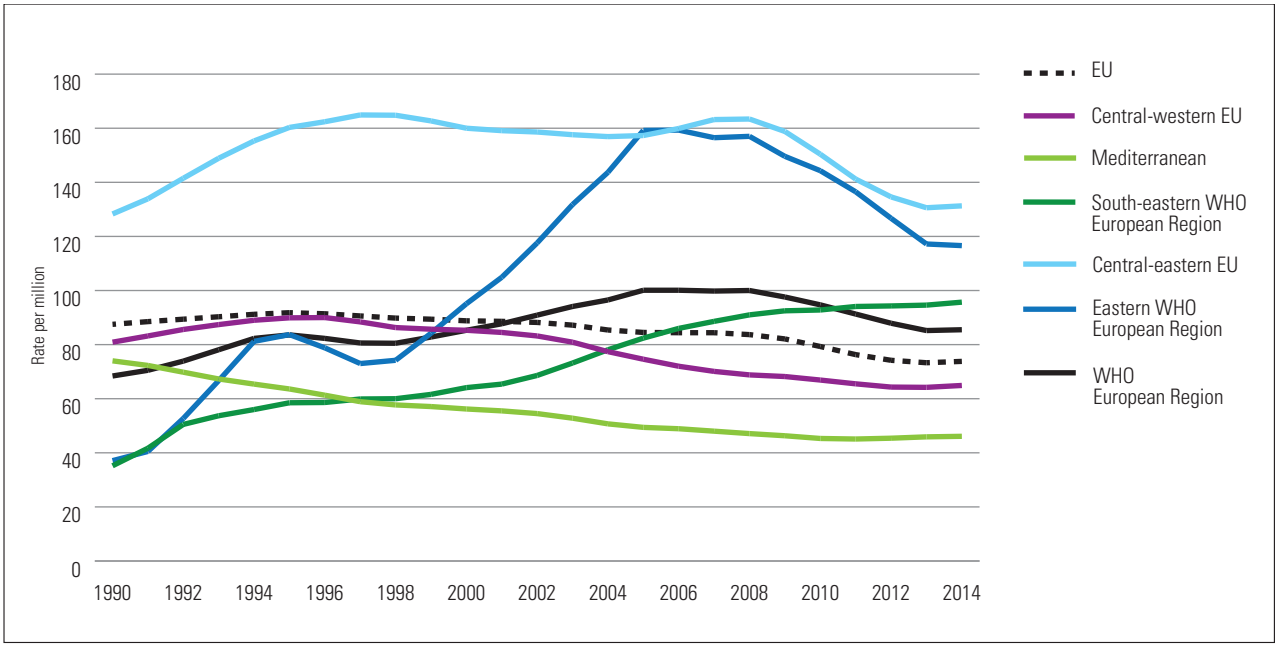
REGIONAL TRENDS IN AGE-STANDARDIZED RATES OF MAJOR CAUSE-OF-DEATH CATEGORIES, 1990–2014

Standardized liver cirrhosis rates have been and are the highest in central-eastern EU (*see* Fig. 80), a region with high overall consumption. However, consumption alone would not be enough to explain the rates. As indicated earlier, this is also the region where spirits based on fruits with pits are traditionally consumed (Hungary, Romania, Slovakia and Slovenia *(90,141)*). Alternatively, short-chain aliphatic alcohols contained in unrecorded products have been hypothesized as a possible explanation *(192)*; but *see (193,194)*.

The increase in mortality due to alcohol-attributable liver cirrhosis in the south-eastern part of the WHO European Region is of concern. While some of this mortality may be overestimated based on global risk functions derived from meta-analyses, which may not apply to these countries with high rates of mortality due to hepatitis-attributable liver cirrhosis, 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 *(89)*. Relatively small amounts of alcohol may thus lead to a high risk of mortality in already damaged livers *(87)*.

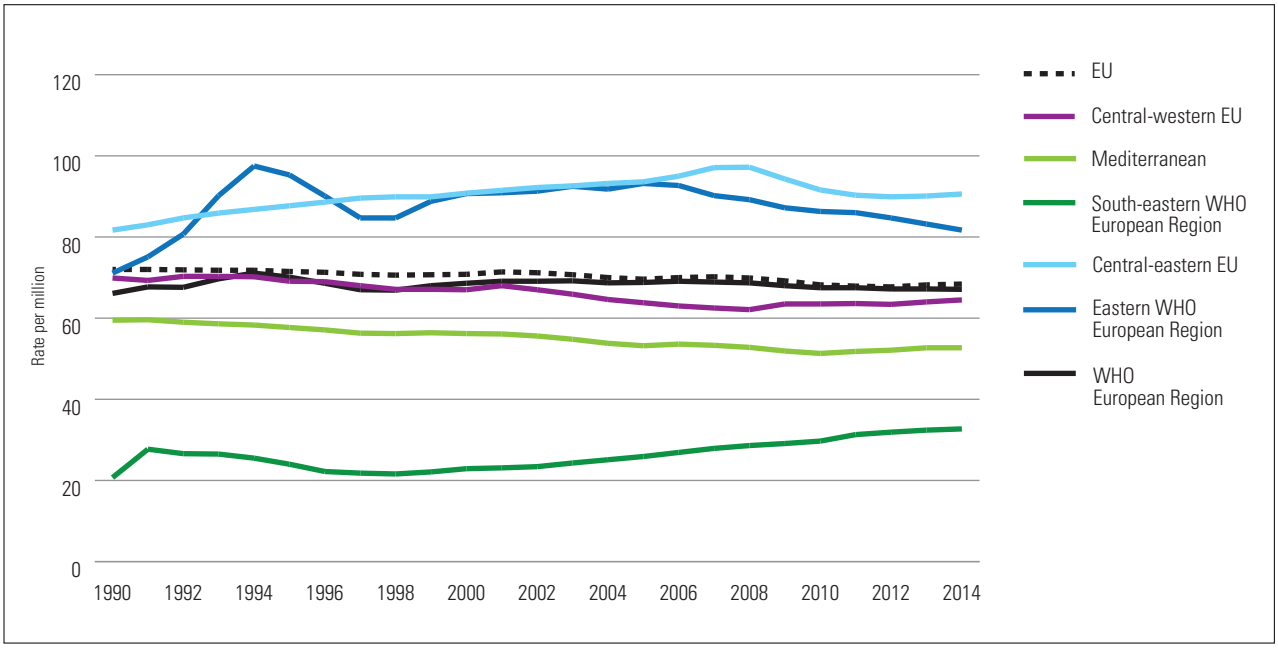
Otherwise, the reduction in standardized liver cirrhosis mortality rates in the past few years, even in countries where consumption has not been going down, should be researched further.

Fig. 80. Trends in age-standardized rates of adult mortality due to alcohol-attributable liver cirrhosis in the WHO European Region and selected subregions, 1990–2014



Alcohol-attributable cancer mortality rates have shown relatively small variations over the observation period within regions, and predictably, the rates between regions reflect the consumption level, with the south-eastern WHO European Region having markedly lower consumption and lower alcohol-attributable cancer mortality (Fig. 81).

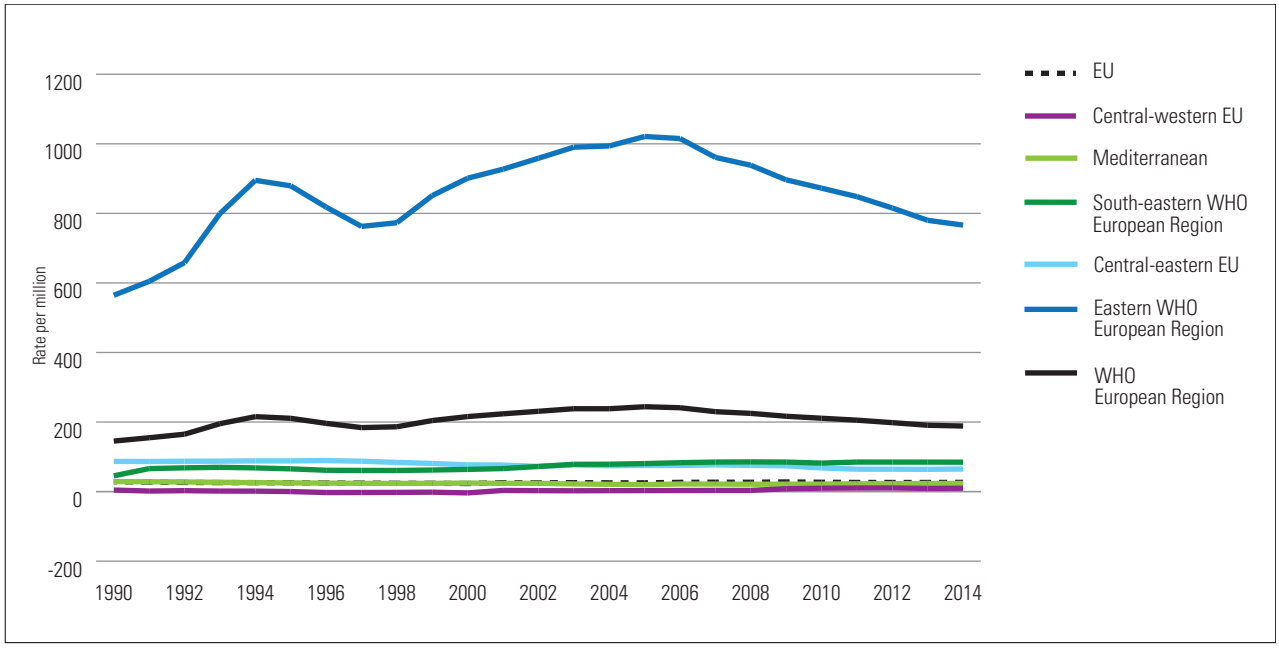
Fig. 81. Trends in age-standardized rates of adult mortality due to alcohol-attributable cancer in the WHO European Region and selected subregions, 1990–2014



Alcohol-attributable cardiovascular mortality varies widely between and within regions over time (Fig. 82). Cardiovascular causes of death, especially ischaemic categories, are impacted by fluctuations in heavy drinking occasions, and thus even relatively small changes in the level of consumption, which increase irregular or chronic heavy drinking, will have a 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 *(170)* and, in association, deaths due to "circulatory disease" decreased, which was the code used for cardiovascular causes of death in the Soviet Union in 1987 (–9% in men from 1984, –6% in middle-aged women) *(169)*. Cardiovascular

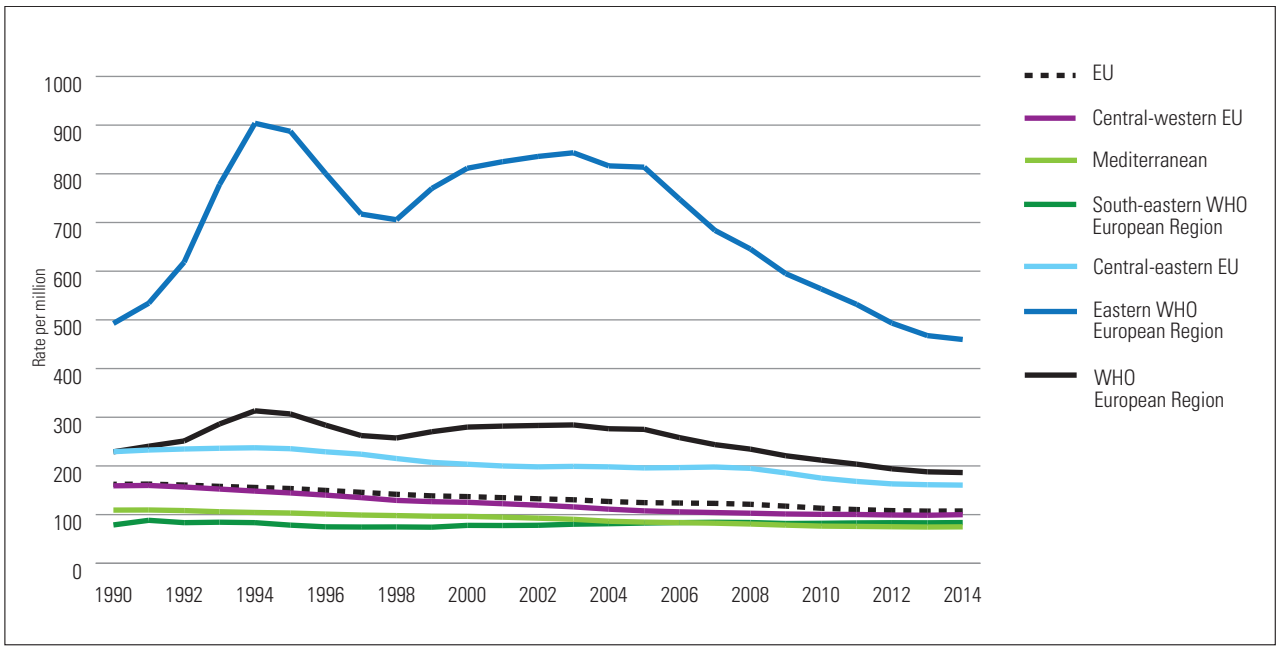
mortality changes were reversed when alcohol consumption increased again *(169,170)* (for discussions of causality and implications, *see (156,177,195,196)*).

Fig. 82. Trends in age-standardized rates of adult mortality due to alcohol-attributable CVD in the WHO European Region and selected subregions, 1990–2014



Mortality rates due to alcohol-attributable injury can be characterized by a dichotomy between a few countries (Belarus, Estonia, Kazakhstan, Latvia, Lithuania, the Republic of Moldova, the Russian Federation and Ukraine; *see* Fig. 50, 51 and 53) concentrated in a particular region (the eastern WHO European Region, *see* Fig. 83) with similar drinking levels and patterns, 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 the north-east of the EU, over the Russian Federation to Kazakhstan in the south-eastern part of the WHO European Region.

Fig. 83. Trends in age-standardized rates of mortality due to alcohol-attributable injury in the WHO European Region and selected subregions, 1990–2014



Overall, the same patterns prevail for unintentional and intentional injury mortality (*see* Fig. 84 and 85), with the difference that the central-eastern part of the EU is much closer to the WHO European Region average for unintentional injury 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 with the Russian Federation and the surrounding countries with similar drinking levels and patterns. As has been shown in Fig. 45–53, there are still marked between-country differences even within the EU, and to reduce mortality due to injury, other EU countries could benchmark with countries like Italy or Cyprus (*see* Table 1).

Fig. 84. Trends in age-standardized rates of mortality due to alcohol-attributable unintentional injury in the WHO European Region and selected subregions, 1990–2014

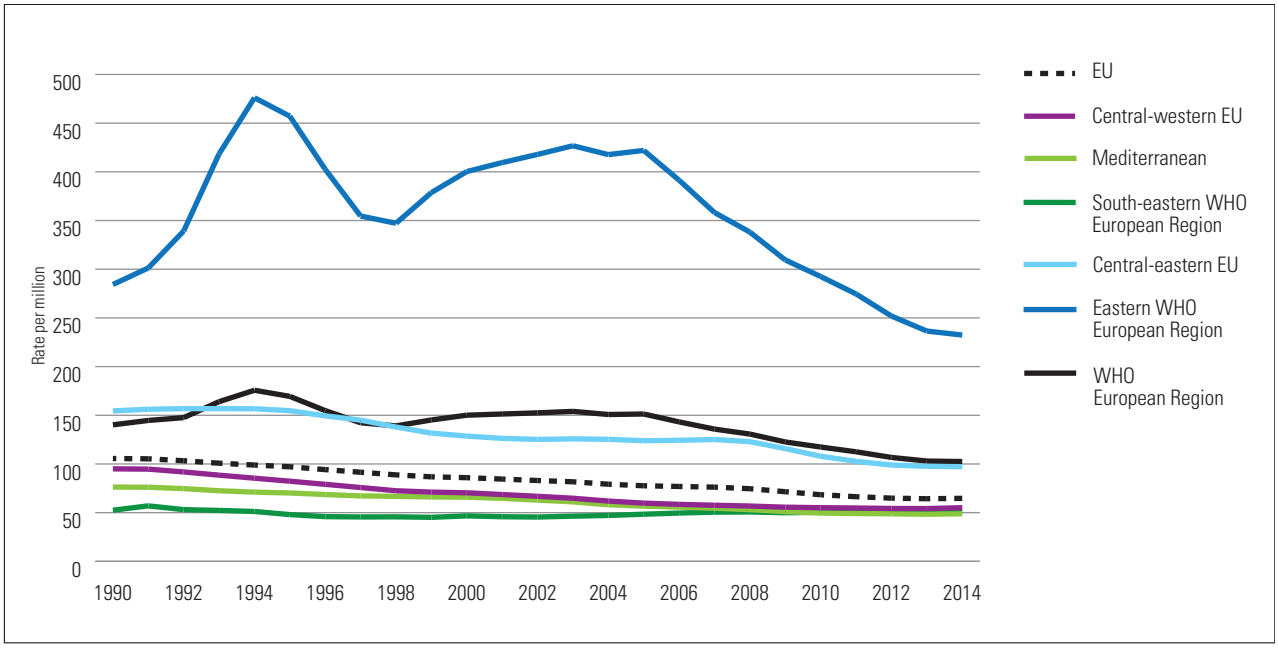
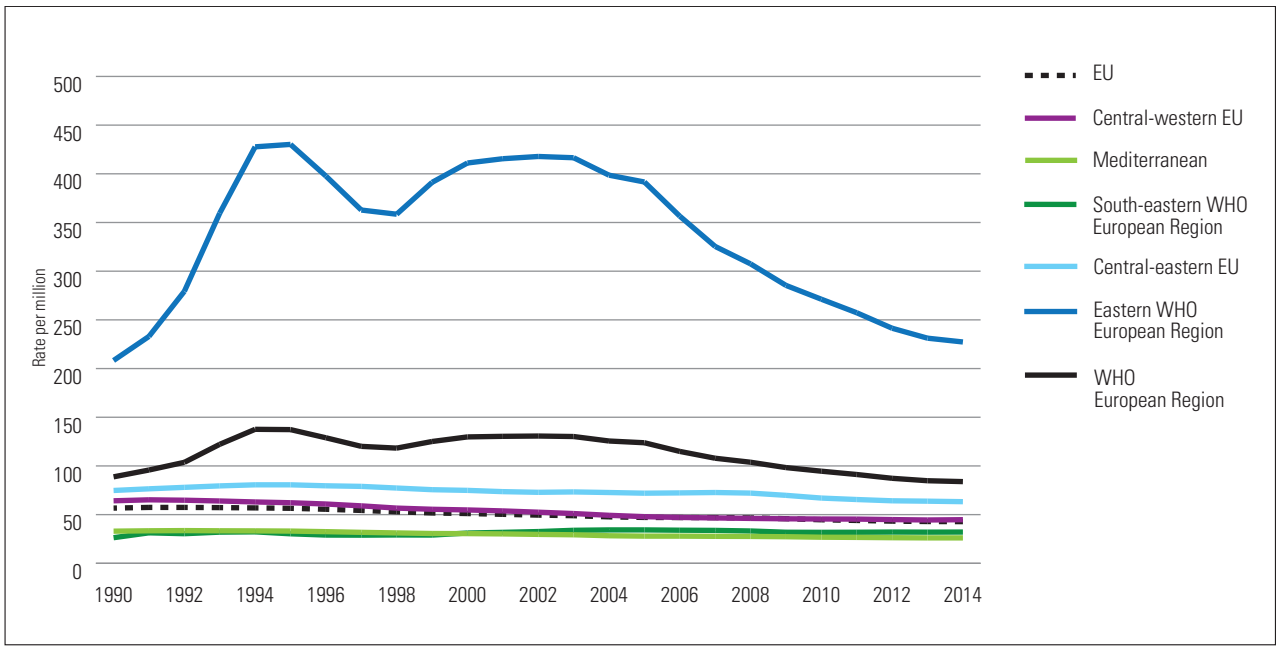


Fig. 85. Trends in age-standardized rates of mortality due to alcohol-attributable intentional injury in the WHO European Region and selected subregions, 1990–2014



CONCLUSION: THE NEED FOR AN ALCOHOL POLICY

Even though alcohol consumption in Europe dates back a long time, the past decades have shown that, despite historical traditions, modern drinking patterns can change quickly and sustainably. The decrease in alcohol consumption in the traditional wine-producing and wine-drinking countries of the Mediterranean region over the past 40 years or so may serve as an illustration of this point *(1,61–63,197)*. It has been shown that this decrease in consumption in the Mediterranean countries resulted in a large reduction in alcohol-attributable mortality, which had marked effects on life expectancy *(141)*. 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 *(53,57,169,170)*.

Some of the changes in drinking patterns and subsequent harm reflect 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 is inconsistent with the demands of the twenty-first century modern economy (for some empirical evidence, *see (198)*). Other changes were caused or enforced by alcohol policies.

Certainly, effective *(10,199,200)* and cost-effective policies *(201–203)* are available to further minimize the burden of alcohol consumption in European societies. However, even though such policies have been proposed for many years *(204,205)* as well as various European action plans (*see (9)* for the last iteration), relatively little has changed in the Region, and 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 have been public health successes in countries, as shown above, and these countries could be used as benchmarks, but there have also 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 *(156)*.

In order to initiate policies, up-to-date epidemiological data are needed, integrated into a monitoring and surveillance system *(171,172)*. Time is of the essence here, and if relevant data are available to decision-makers within a short period of one or maximum two years, they will serve the purpose much better *(206)*. This report hopes to stimulate the establishment of monitoring and surveillance systems at 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 *(13,207)*), but should additionally include liver cirrhosis and injury burden.

So what would be the policy conclusions from this report, and epidemiological findings on alcohol 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 Europe, those who choose to drink should limit their consumption to under 20 g/day *(68,208)*, corresponding to a yearly consumption of 11.6 litres of pure alcohol. However, this upper threshold for drinking is lower than the current mean drinking level among drinkers in Europe both for men (19.4 litres pure alcohol) and for women (12.9 litres pure alcohol). The question is how to shift the current drinking level to one that would incur the least harm.

Drinking guidelines have become popular in recent years (*see* recent efforts in Australia, Canada, the United Kingdom and the EU *(209–212)*) 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 *(213)*. However, their effectiveness in changing actual drinking habits is questionable *(214,215)*. Nevertheless, the development of guidelines reflecting best evidence provides 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 (*(13,216)*, *see also* footnote 2), i.e. reduction in availability, increase in taxation, and ban on marketing and advertising, have not been overly popular with governments, and there are no signs that this trend will stop.[20] How could epidemiology

[20] There is surprisingly little research on how the "best buys" of availability and taxation need to be shaped in light of different environments, as characterized by the level and availability of unrecorded alcohol in different countries *(see (217)* for a discussion about African countries; and *(218)* 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.

help in improving the situation? There is still a knowledge gap among the general population about alcohol's impact on mortality, especially for cancer *(219)*. This knowledge gap should be closed, but knowledge may not necessarily change behaviour, 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 mortality due to alcohol-attributable injury, as this indicator has been decreasing more slowly than injury mortality in general. This opens specific prevention opportunities, such as programmes 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 *(199,220,221)*. Drink–driving measures have been standard in many countries *(1)*, but can be further 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 19 January 2016, *see (222)*; for a first report on the scientific evidence, *see (223)*).

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 at the county level, following adoption of the programme, there was a 12% reduction in arrests for repeat driving under the influence of alcohol and a 9% reduction in arrests for domestic violence *(224)*. Equally important would be to develop programmes 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, replicated in other countries.

With respect to reduction in alcohol-attributable mortality in the WHO European Region, the most urgent policy needs relate to those countries that have by far the largest burden, characterized by relatively frequent very heavy binge drinking episodes, such as the eastern WHO European Region. While there are indications that some of the recent policy changes in the Russian Federation have had success *(57,225)* (but *see (56)*), more is needed. One of the most promising measures against binge drinking is minimum pricing schemes *(226,227)*, but most of the arguments for this measure are based on modelling studies with limited empirical evidence from Canadian provinces *(228,229)*. The chances of successfully transferring such policies to all of the eastern European countries with a large proportion of unrecorded consumption, which is especially important for binge drinking in the most vulnerable populations *(22,230–232)*, is questionable. Another study from Russia *(233)* is not a counter-example, as it only deals with home-produced alcohol and not with surrogate alcohol such as medicinal alcohol or industrial alcohol. Obviously, once recorded consumption is reduced by as much as was done in the Soviet Union in the 1980s *(170)*, increases in unrecorded consumption do not matter that much, but for slight reductions in recorded consumption, potential compensations by increase in unrecorded consumption do matter, given the fact that unrecorded alcohol, especially surrogate alcohol, tends to be considerably cheaper *(22,24,234)*.

Thus, it would be important to find local solutions to reduce heavy drinking occasions in countries with a large proportion of unrecorded consumption. It is interesting that in the 24/7 sobriety programme, effects on mortality were found, which were most pronounced for cardiovascular mortality *(235)*. Such a programme could be adopted in the eastern WHO European Region. Reduction of average alcoholic strength in beverages may also be considered *(11)*, and the Russian government is trying this strategy by favouring beverages with a lower ethanol content via taxation (e.g. beer versus vodka; *see also (57,233)*). Taxation is one important tool of an alcohol policy, and different taxation schemes can be used for different purposes, such as switching beverage preferences *(236–238)*, reducing alcoholic content in certain beverages *(11,239,240)*, increasing the age of onset of drinking or keeping abstention rates high *(241,242)*. For a more general overview of the effects of alcohol taxation, *see (243)*.

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 a large number of heavy drinking occasions, a disproportionate burden of alcohol-attributable morbidity and mortality will result. Reduction in alcohol consumption among heavy drinkers plays a key role. If proven effective policies such as reduction in availability, increase in price via taxation, and ban on marketing and advertisements do not work out to be feasible, reducing the consumption of the heaviest drinkers via brief interventions or treatment could have a population health impact *(202,244)* (*see also (159,245)*).[21] In most of the other countries of 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 a relatively short time *(10,156)*.

No matter what policies the respective governments choose, reducing the alcohol-attributable burden of mortality in Europe is an urgent matter. It is needed to reduce not only individual suffering and harm to others around the drinker, but also the economic burden attributable to alcohol *(77,247,248)*.

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

[21] There are other evidence-based ways to impact on heavy drinkers specifically, such as rationing schemes *(246)* or the above-cited sobriety enforcement *(224,235)*, but realistically, brief interventions and treatment will be the most discussed policy options in the current environment of the WHO European Region *(9)*.

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