CHAPTER 2. WHAT ALCOHOL CAN DO TO EUROPEAN SOCIETIES

Jürgen Rehm, Gerrit Gmel, Maximilien X. Rehm, Emanuele Scafato, Kevin D. Shield

Summary

Alcohol consumption has been identified as a risk factor for burden of disease and social harm. As the European region features a level of alcohol consumption which ranks among the highest globally, the countries of the European Union show a high level of alcohol-attributable harm. In the EU, in 2004, almost 95,000 men and more than 25,000 women between 15 and 64 years of age were estimated to have died of alcohol-attributable causes prematurely. This means that 1 in 7 male and 1 in 13 female premature deaths were caused by alcohol. These are net numbers, already taken into consideration the protective effect of alcohol on ischemic disease and diabetes. Moreover, as alcohol consumption contributes substantially to morbidity and disability as well, the overall alcohol-attributable burden of disease is high. In 2004, over 4 million disability-adjusted life years (DALYs), i.e., years of life lost either due to premature mortality or due to disability, were estimated to be caused by alcohol consumption, corresponding to 15% of all DALYs in men and 4% of all DALYs in women. Most of the health harms related to alcohol are caused by heavy drinking. The high toll of alcohol-attributable burden requires alcohol policy countermeasures including a monitoring system that is capable of evaluating change. While the tools for such a monitoring system exist, it is not possible to implement fully, as almost all countries lack comparable routine data on burden of disease such as DALYs. As DALYs are not part of the routine statistics in Europe, it is proposed to develop a monitoring system for alcohol-attributable harm, which includes other non-fatal indicators and summary measures of health.

Introduction

Alcohol is a major risk factor for burden of disease (Rehm et al., 2009b, World Health Organization, 2009, Lim et al., 2012) and social harm (Gmel and Rehm, 2003). As Europe is the highest consuming region for alcohol in the world, alcohol-attributable burden is high there as well (Rehm et al., 2009b, World Health Organization, 2009). The European Union (EU) at the core of Europe is no exception to this; alcohol consumption in the EU is more than twice the global average and alcohol-attributable burden by far exceeds the global average as well (Anderson and Baumberg, 2006, Rehm et al., 2011b, Rehm et al., 2012a, Shield et al., 2012, Rehm et al., 2012b).

Determination of alcohol-attributable harm, both in terms of burden of disease (= health harm) and social harm was one of the major goals of our work package within the AMPHORA project. However, we did not want to stop at describing the burden, but try to help establish and implement an epidemiological monitoring and surveillance system which would enable regional, national and international policy makers to quantify the harm associated with alcohol consumption, to identify key areas where most of the harm occurred and thus to lay the basis for specific policy measures, both in the field of prevention and treatment. This goal is in accordance with the WHO Global Strategy to Reduce the Harmful Use of Alcohol (World Health

Organization, 2010) and the corresponding action plan of WHO European Region for the years 2012 to 2020 (http://www.euro.who.int/data/assets/pdf_file/0018/150552/RC61_R4.pdf ; http://www.euro.who.int/en/what-we-do/health-topics/disease-prevention/alcohol-use/publications/2011/wd13-european-action-plan-to-reduce-the-harmful-use-of-alcohol-20122021).

What we did

We used the methodology of the Comparative Risk Assessment for alcohol within the Global Burden of Disease and Injury 2005/2010 Study (GBD) to estimate alcohol-attributable mortality and burden of disease (for exposure see (Rehm et al., 2010b, Kehoe et al., 2012); for risk relations see (Rehm et al., 2010a)). In addition, we tried to develop guidelines for monitoring and surveillance based on efforts of the EU, the World Health Organization and the GBD study (Rehm and Scafato, 2011).

There was not a clear standardised model for social harms (as there is for health harms), so we tried to develop part of such a model for harm to others based on the Australian study (for the estimates for Europe and background see (Rehm et al., 2012b, Shield et al., 2012); for the Australian study see (Laslett et al., 2011)).

What we found

In the following we will give a summary of the results of alcohol-attributable burden of disease and injury (based on (Rehm et al., 2011b, Shield et al., 2012, Rehm et al., 2012b)), alcohol-attributable harms to others (based on (Rehm et al., 2012b)) and of the recommendation for monitoring and surveillance (based on (Rehm and Scafato, 2011)).

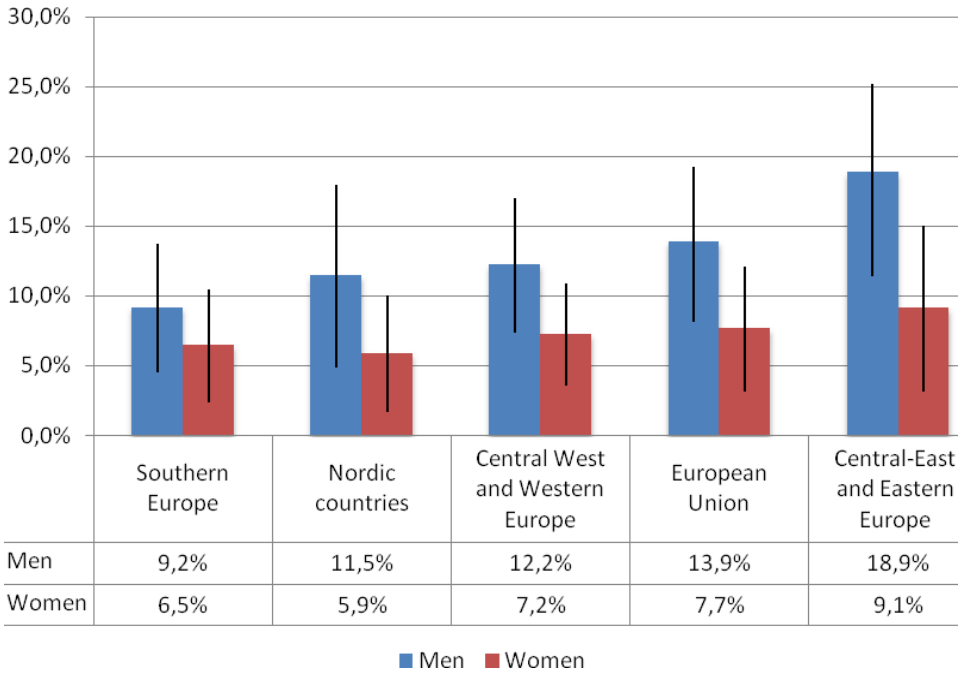
Alcohol-attributable burden of disease

Overall, alcohol-attributable mortality is high. In 2004, 13.9% (95% CI: 8.1% to 19.2%) of all premature deaths in men in the EU were estimated to be attributable to alcohol consumption, corresponding to an overall toll of about 95,000 deaths (94,500; 95% Confidence Interval–CI: 55,500 to 130,500), or one in 7 premature deaths. Premature deaths here are defined as deaths in the age group between 15 and 64 years of age. For women, the corresponding numbers were 7.7% (95% CI: 3.1% to 12.1%), corresponding to 25,000 premature deaths (95% CI: 10,500 to 40,000) or one in 13 of these deaths being caused by alcohol. For both sexes combined, the proportion of alcohol-attributable deaths amounted to 11.9% of all deaths (95% CI: 6.5% to 16.9%). There were clear regional variations[1] (Figure 1).

The proportion of alcohol-attributable deaths in Central-Eastern and Eastern Europe is much higher than in the Southern region of the EU, for men more than twice as high. Three reasons can be given for the difference: first, the volume of drinking is higher in Central-Eastern and Eastern European countries. Second, the drinking pattern, i.e. how alcohol is consumed is more detrimental: more irregular drinking with high variation (i.e., more binge drinking occasions with higher volume per occasion), more drinking to intoxication and less drinking with meals (Popova et al., 2007). Finally, these countries have lower economic wealth (as measured in GDP-PPP) and alcohol has been shown to have relatively more impact in poorer populations (Rehm et al., 2009a).

1 The regional coding used is based on average volume and patterns of drinking. Central east and Eastern Europe includes 10 countries: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia. Nordic countries includes 5 countries: Denmark, Finland, Iceland, Norway, Sweden. Central west and Western Europe includes 9 countries: Austria, Belgium, France, Germany, Ireland, Luxembourg, Netherlands, Switzerland, UK. Southern Europe includes 6 countries: Cyprus, Greece, Italy, Malta, Spain, Portugal.

Figure 1. Proportion of all premature deaths (defined as deaths in people 15-64 years of age) in the EU caused by alcohol consumption by sex and region



	Southern Europe	Nordic countries	Central West and Western Europe	European Union	Central-East and Eastern Europe
Men	9,2%	11,5%	12,2%	13,9%	18,9%
Women	6,5%	5,9%	7,2%	7,7%	9,1%

Which diseases leading to death (i.e., which `causes of death`) are attributable to alcohol? If only the main categories of alcohol-attributable mortality are considered, the following picture emerges (Table 1): for men, liver cirrhosis and injury (both unintentional and intentional) make up more than 60% of all deaths; cancer, with more than 15%, is also an important alcohol-attributable cause of death. For women, cancer and liver cirrhosis alone make up more than two thirds of all alcohol-attributable deaths.

Overall, looking into alcohol-attributable deaths, it is clear that the detrimental effects by far outweigh the beneficial effects, which are mainly stemming from ischemic heart disease. Cancer mortality alone outweighs all of the beneficial effects: ischemic heart disease, ischemic stroke and diabetes. This seems to be in some contrast to the media reports and public knowledge on alcohol and its effects on cancers in many countries (e.g., (O'Dowd, 2011, Ipsos MRBI, 2012)).

In addition, the effect of alcohol on deaths from mental and neurological disorders seems low. There are two reasons for this: first, these disorders, especially mental disorders, are often more disabling than fatal (e.g., (World Health Organization, 2008); for alcohol use disorders see (Samokhvalov et al., 2010)), and if they lead to death, it is often indirectly (e.g., alcohol use disorders via liver cirrhosis; depression via suicide). Secondly, while there are clear and strong associations between alcohol, alcohol use disorders and other mental disorders, it has been virtually impossible to quantify the impact of alcohol on other disorders (except alcohol use disorders, where by definition the attributable fraction is 100%; i.e., 100% of alcohol use disorders would disappear, if there was no alcohol in a society). For other disorders, we are left with associations without being able to disentangle and quantify causality. Consider the case of alcohol, alcohol use disorders and depression: clearly, alcohol or alcohol use disorders can cause depression, but depression can also cause heavier use of alcohol or alcohol use disorders. Finally, there may be third variables such as genetic variability which can cause both

alcohol and depression. Similar arguments can be made for almost all other mental disorders, and thus quantification of alcohol-attributable mental disorders has been rarely tried, and if, only with very crude methods (for further reasoning and an example see Graham et al., 2004).

Table 1. Alcohol-attributable premature deaths in the EU 2004 by sex and main causes

Detrimental effects	Men #s	Women #s	Men %	Women %
Cancer	17,358	8,668	15.9%	30.7%
Cardiovascular disease (other than Ischemic heart disease)	7,914	3,127	7.2%	11.1%
Mental and neurological disorders	10,868	2,330	9.9%	8.3%
Liver cirrhosis	28,449	10,508	26.0%	37.2%
Unintentional injury	24,912	1,795	22.8%	6.4%
Intentional injury	16,562	1,167	15.1%	4.1%
Other detrimental	3,455	637	3.2%	2.3%
Total detrimental	109,517	28,232	100.0%	100.0%
Beneficial effects				
Ischemic heart disease	14,736	1,800	97.8%	61.1%
Other beneficial	330	1,147	2.2%	38.9%
Total beneficial	15,065	2,947	100.0%	100.0%

With respect to the impact of alcohol on burden of disease in the EU, a similar picture emerges. Burden of disease is usually measured in Disability-Adjusted Life Years (DALYs), which are a summary measure of health combining years of life lost due to premature mortality and years of life lost due to living with disability. DALYs have become the most-used indicator for comparing health across different jurisdictions, used by the WHO, by the World Bank, and by scientific studies such as the GBD.

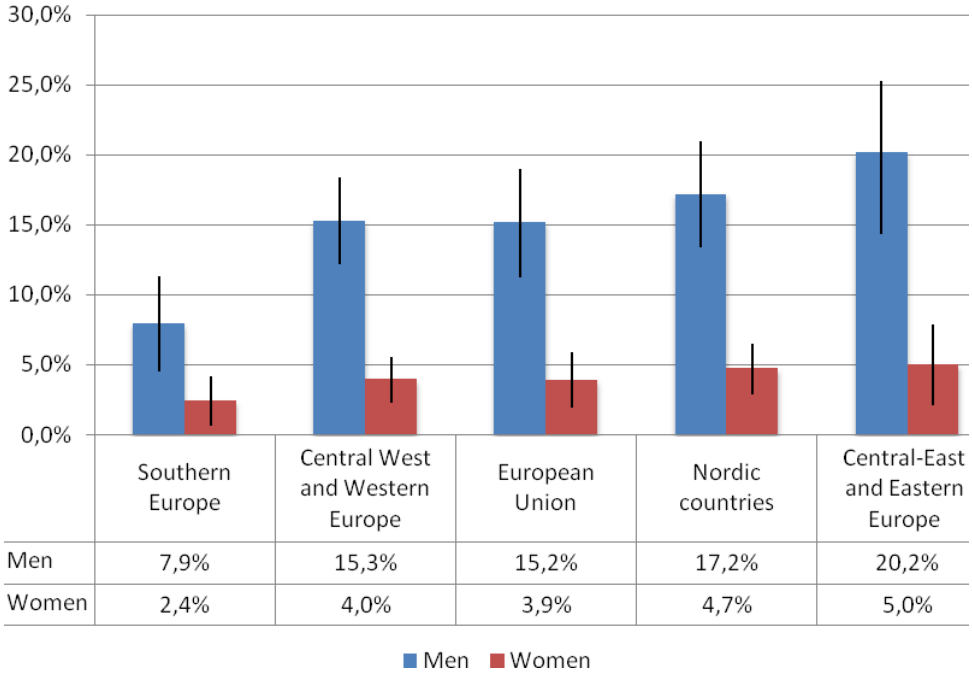
We estimated that in 2004 in the EU, 3,359,000 (95% CI: 2,477,000 to 4,191,000) DALYs in men and 684,000 (95% CI: 330,000 to 1,030,000) DALYs in women were lost due to alcohol-attributable causes (total 4,043,000 (95% CI: 2,807,000 to 5,221,000)). This corresponded to 15.2% (95% CI: 11.2% to 19.0%) of all DALYs in men, 3.9% (95% CI: 1.9% to 5.9%) of all DALYs in women and 10.2% (95% CI: 7.1% to 13.2%) of all DALYs. In other words, the proportional impact of alcohol on burden of disease in the EU is slightly smaller than on mortality; it is slightly higher in men, but markedly lower in women.

In terms of main underlying causes, the same causes as for mortality emerge with one notable exception: alcohol use disorders comprise a sizable portion of all alcohol-attributable burden of disease. As a result, the category mental and neurological disorders, which constituted less than 10% of all the direct causes of death for both sexes (see Table 1), accounted for more than 40% of all alcohol-attributable DALYs in both sexes.

Alcohol use disorders constitute an especially large proportionof all DALYs in the Nordic countries. This leads to an overall higher proportion of alcohol-attributable DALYs in these

countries relative to their consumption, or relative to alcohol-attributable mortality (see Figures 2 and 3).

Figure 2. Proportion of all DALYs (in people 15-64 years of age) in the EU caused by alcohol consumption by sex and region



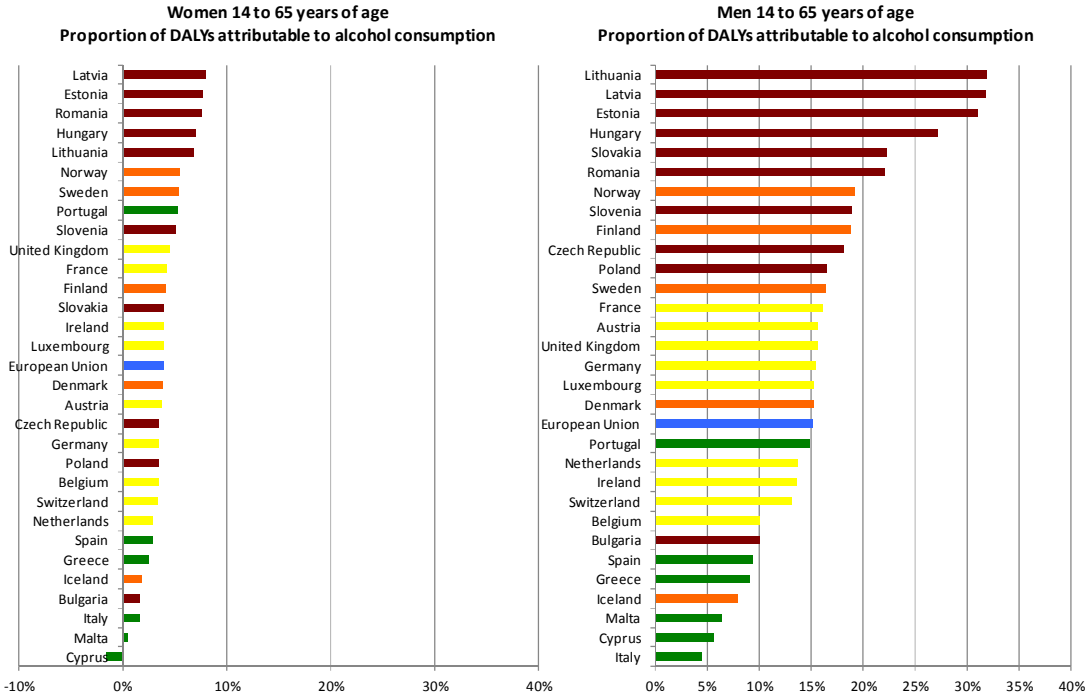
	Southern Europe	Central West and Western Europe	European Union	Nordic countries	Central-East and Eastern Europe
Men	7,9%	15,3%	15,2%	17,2%	20,2%
Women	2,4%	4,0%	3,9%	4,7%	5,0%

Since alcohol use disorders make up such a large portion of burden of disease, it is worth questioning whether the underlying data are comparable. Clearly, the variation in rates of alcohol use disorders or alcohol dependence is much larger than the variation in rates of heavy drinking (Rehm et al., 2005, Rehm et al., 2012b). In the EU, prevalence for alcohol dependence varies between countries in the South, such as Italy, with rates well below 1% for both sexes (de Girolamo et al., 2006) and countries like Latvia with rates of 21% for men and 4% for women (Snikere et al., 2011). While we certainly would expect a lower prevalence of alcohol dependence in Italy compared to Latvia, a more than 20-fold higher prevalence in Latvia almost certainly seems unrealistic given other indicators such as adult per capita consumption or treatment rates.

There are several reasons for this. First, a number of prevalence estimates for different European countries including the estimate for Italy stems from the earlier iterations of the World Mental Health Survey, which used an errorenous procedure of only asking the criteria for alcohol dependence when at least one criterion for abuse was endorsed, thus systematically underestimating alcohol dependence prevalence (Grant et al., 2007). This was only corrected in later surveys, but most of the national World Mental Health Surveys in the EU have this error (Rehm et al., 2012b). Secondly, in countries located in Southern Europe (primarily Mediterranean countries with wine drinking habits), while alcohol (most often wine) is deeply culturally embedded, alcohol problems and dependence are deeply taboo. This means that residents of these particular countries, more than others, may tend not to report symptoms of alcohol dependence (AD), for reasons of social stigma. (For a wider context and additional explanations, see (Room and Mäkelä, 2000)). Other indirect indicators traditionally used for estimating AD rates (such as liver cirrhosis rates) suggest a potential underestimation

for Italy and Spain, in particular (for liver cirrhosis rates in the EU see (Zatonski et al., 2010); however, such estimation methods have problems of their own (Lipscomb, 1966).

Figure 3. Standardised rates for alcohol-attributable DALYs (in people 15-64 years of age) in the EU by sex and country



The role of heavy drinking

Most of the mortality or burden of disease attributable to alcohol was caused by heavy drinking. Almost 80% of all male net deaths attributable to alcohol, and about 67% of all female alcohol-attributable net deaths, were due to heavy drinking—defined as consuming at least 60g of pure alcohol per day for men, and at least 40g for women (Rehm et al., 2012b). With respect to the burden of disease, heavy drinking accounted for an even higher proportion of alcohol-attributable net DALYs with almost 90% of the burden caused by this form of consumption. Heavy drinking, both regular and irregular, thus causes the overwhelming majority of the alcohol-attributable health burden. This has important implications for prevention and alcohol policy: any measure which wants to successfully reduce alcohol-attributable harm has to cut down regular and irregular heavy drinking occasions.

Alcohol-attributable harm to others

Thus far we have discussed the effects of alcohol consumption in terms of disease and mortality affecting the drinkers themselves. However, drinkers not only endanger their own health, but also the health of others. This section will describe the major harms to others due to alcohol consumption. The victims of these damages are people who may or may not drink themselves, but are affected by other people's drinking.

Harm to others, as calculated in comparable fashion for EU countries, includes three major items, with different prevalence (Shield et al., 2012). The most prevalent category is transport injuries: passengers or other drivers who are injured or killed by drunk drivers. This is the main estimated cause of harms to others in EU countries, with the next item coming a distant second: physical violence or homicide engaged in by individuals under the influence of alcohol.

These calculations focus solely on the drinking of the persons responsible for assault. Although it is true that people who drink do increase their own probability of being assaulted, there were not enough data to take into consideration this aspect. Finally, babies born with low birth weight due to the mother's drinking account for a small but significant proportion of harms to others.

One way in which this section differs from the sections above is that it includes all age groups. The category of "harms to others" affects people of all ages, and so this particular analysis is not restricted to people 15–64 years of age.

In the EU in 2004, for men of all ages, the harms to others caused by alcohol consumption included 5,564 deaths, 139,824 potential years of life lost due to premature mortality (PYLL), 18,987 years of life lost due to disability (YLD), and 158,811 DALYs—all estimated to be attributable to drinking. For women of all ages, the analogous figures were 2,146 deaths, 51,326 PYLL, 8,423 YLD and 59,749 DALYs. For both sexes, the totals were 7,710 deaths, 191,151 PYLL, 27,410 YLD, and 218,560 DALYs. Overall, even though the above numbers are clear underestimates, as they are only based on three categories, it is clear that harm to others is an important factor in alcohol-attributable harm.

These numbers are clearly only very rough estimates, as they are based on a number of assumptions stemming from the Australian "harm to others" study (Laslett et al., 2011), and there is no good evidence whether these assumptions hold true or not for European countries. It is thus recommended that EU countries engage in building their own evidence base for harm to others, not only with respect to health indicators but also with respect to alcohol-attributable social harm.

Monitoring and surveillance for alcohol-attributable harm

In an ideal world, alcohol-attributable DALYs should and would be suggested as the best summary measure to capture all alcohol-attributable burden of disease. Clearly, a measure like DALYs is able to integrate non-fatal outcomes and by doing so reflects the values of modern societies, where life expectancy is no longer the major goal, but healthy life expectancy or health adjusted life-expectancy (Wolfson, 1996, Mathers et al., 2004) (i.e., years of life without disability) is the predominant measure by which a healthy society is measured. The problem with an indicator such as DALYs is that data are limited; currently, the last data for all EU countries are for the year 2004, and these are rough estimates, mainly derived by making the assumption that proportionally regional patterns can be transferred to the country level (World Health Organization, 2008).

For the beginning of the year 2013, we expected country level data for the years 2005 and 2010 from the ongoing GBD and study with the new Comparative Risk Analysis (Lim et al., 2012). However, at the time of writing, it is not clear, to what degree these country level data are truly country specific as opposed to just broken down from the regional data. In any case, the next availability of country-specific DALYs will not be for another 5 years, probably longer.

Given this lack of regularly updated data on country-specific DALYs, Rehm and Scafato, as result of the AMPHORA project, (Rehm and Scafato, 2011) suggested using alcohol-attributable years of life lost as an indicator for monitoring and surveillance systems. This indicator requires, in addition to a functioning vital registration system present in all EU countries, that there are regular studies on alcohol exposure indicators (adult per capita consumption and prevalence of drinking, former drinking and lifetime abstention), as population standardised rates that enable better comparability should be used in the monitoring system. This led the WHO European Regional Office to start a monitoring, using the 2010 exposure and mortality data (Shield et al., 2013). The result can be seen in Figure 4.

Figure 4: Alcohol-attributable standardized death rates per 100,000 people in Europe

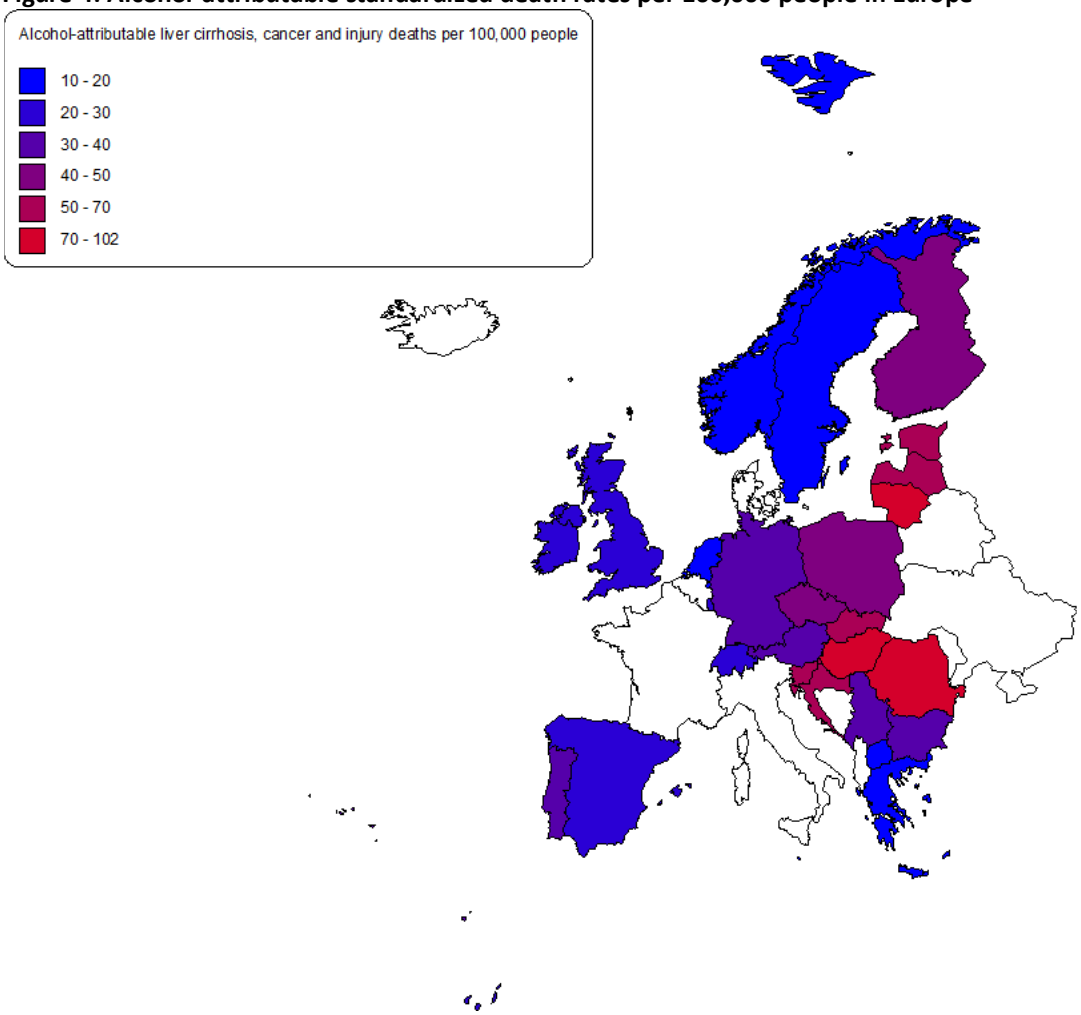


Figure 4 illustrates a clear West-East gradient. Alcohol-attributable mortality is highest in Central East and Eastern Europe regions, with Standardized Death Rates (SDRs) of more than 75 per 1,000 in Hungary, Romania and the Baltic countries. A simple regression analysis indicates that the correlation between adult *per capita* consumption of alcohol and alcohol-attributable mortality is strong ($R^2 = 0.70$), and that the number of alcohol-attributable deaths increases exponentially as adult *per capita* consumption increases. From a point of view of monitoring, such data seem to be relevant and could be updated on a yearly basis, based on standard data collection of WHO European Region. It is hoped, that regular monitoring would also lead to filling in the blanks in the Figure, which belong to countries, who did not deliver their data to WHO.

In addition, on a country level, the authors propose to use more direct indicators such as liver cirrhosis, alcoholic liver cirrhosis and alcohol poisoning (alcohol poisoning is a medical emergency that results from high blood alcohol levels that suppress the central nervous system and can cause loss of consciousness, low blood pressure and body temperature, coma, respiratory depression, or death (Sanap and Chapman, 2003); for the chronic respective acute disease consequences attributable to alcohol see Rehm and Scafato, 2011), wherever valid and reliable information is available. Again, it would be important to measure fatal and non-fatal outcomes (e.g., hospitalisations or emergency visits for acute consequences; see e.g. Verelst et al., 2012), especially for alcohol poisoning in young people.

If there are good data on other disease outcomes related more closely to alcohol in a certain country or region, while fulfilling criteria for good monitoring indicators (Rehm and Room, 2009, Rehm and Scafato, 2011), these outcomes should be used as long as they are justified with empirical findings. In all cases, at least one chronic and one acute indicator should be used, and standardized YLLs rates due to the indicator should be calculated.

What does this mean?

There is a good and internationally accepted framework for measuring the impact of alcohol on mortality and burden of disease. The data show a very high impact of alcohol consumption, especially heavy consumption, on mortality in countries of the EU, where 1 in 7 premature deaths in men and 1 in 13 premature deaths in women were caused by alcohol. In principle all of these deaths are avoidable (Rehm et al., 2006a). In practice, given that alcohol consumption has long been engrained in the European culture (Anderson and Baumberg, 2006), policy will have to focus on which measures can make the biggest impact and are still acceptable to societies (Babor et al., 2010).

We have shown (Rehm et al., 2011b) that epidemiology can help guide alcohol policy. However, what is necessary are relevant and timely data on a regular basis, i.e., a comprehensive monitoring and surveillance system, which can serve multiple purposes: as an early warning system, as a resource to monitor change and to evaluate the impact of policy, and as a comparator to benchmark against other countries. While in principle the elements to create such a monitoring system are in place, in practice meaningful monitoring and surveillance for alcohol-attributable harm is hindered by the data situation.

Consider the following situation: at the media launch of the WHO European Region on alcohol, harm and policy in March 2012 (Anderson et al., 2012), data from 2004 were launched as the most recent data on alcohol-attributable burden of disease. Such a time lag is inacceptable if monitoring and surveillance are to have real impact on policy making. The reason for this time lag is clear: conceptually, public health wants to move away from mortality as the main indicator and incorporate disability and quality of life into a summary measure of health (Murray et al., 2000).

This goal is laudable as it reflects preferences of modern societies and individuals not only to increase life expectancy but also to maximize disability-free life expectancy. However, while the goal is laudable, the implementation does not follow suit, and studies measuring burden of disease or other summary measures of health are rare. Thus, after the publication of the last Global Burden of Disease 2000 Study (World Health Organization, 2002), there has de facto been a 10 year gap before new data on burden of disease were presented (in December 2012), with one non-empirical based update for the year 2004 in-between (World Health Organization, 2008). During this time, few countries have conducted their own burden of disease study, so monitoring of alcohol-attributable burden of disease on a continuous basis has been absent.

In consequence, in order to make monitoring relevant, measures will have to be developed which are based on routinely collected statistics (e.g. hospitalization which could be comparable for a region like the EU – for the use of hospitalizations as a tool to quantify alcohol-attributable harm see e.g., (Rehm et al., 2006b, Rehm et al., 2011a)) and which can be reported within one or two years after the event. Only if we achieve monitoring and surveillance to give timely updates, can these data be really used as policy tools. Otherwise, the recent developments in alcohol epidemiology will remain academic successes without any impact on policy making. This has been acknowledged by most participants of the last

AMPHORA meeting in Stockholm (see 'events' at http://www.amphoraproject.net), where there was a clear plea by scientists and decision makers to develop new summary measures for alcohol-attributable harm for Europe, which could be used routinely with a short time lag. We hope that this plea will result in some action, so we will be able to present a comprehensive and politically relevant monitoring system for alcohol-attributable harm for the EU in the near future.

Take home messages

1. The countries of the European Union have a high level of alcohol consumption, more than twice the global average.

2. Consequently, alcohol-attributable harm is also at high levels, with almost 12% of all premature deaths and more than 10% of all premature burden of disease as measured in DALYs being caused by alcohol. In other words, 1 in every 7 premature deaths before age 65 in men, and 1 in every 13 premature deaths in women is estimated to be caused by alcohol.

3. Given the high level of alcohol-attributable health harm, new forms of alcohol policy, including monitoring and surveillance systems to evaluate effectiveness, should be implemented.

4. While all the elements of such monitoring and surveillance systems have been developed, the underlying data currently limit them to indicators based solely on mortality. This does not correspond to the focus in most societies on increasing healthy life expectancy rather than just prolonging life. There is an urgent need for developing a monitoring and surveillance system for alcohol, which includes non-fatal health outcomes.

5. With respect to social harm, some progress has been made, but further developments to derive comparable and comprehensive indicators are still necessary.

Acknowledgements and Conflicts of Interest Statement

The underlying calculations for this chapter were not only supported by AMPHORA, but in part also by the Global Burden of Disease Study, the WHO European Region and by an unrestricted grant from Lundbeck A/S. Lundbeck is a pharmaceutical company which is currently launching new medication for alcohol dependence. None of the funders had any access to the data or calculations, nor did they have any impact of the design of the study or see this manuscript before publication.

References

Anderson P, & Baumberg B (2006) *Alcohol in Europe: a public health perspective. A report of the European Commission*. London, Institute of Alcohol Studies.

Anderson P, Møller L & Galea G (2012) *Alcohol in the European Union: consumption, harm and policy approaches*. Copenhagen, Denmark, World Health Organization.

Babor T, Caetano R, Casswell S, et al. (2010) *Alcohol: No ordinary commodity. Research and public policy. 2nd edition.,*Oxford and London, Oxford University Press.

de Girolamo G, Polidori G, Morosini P, et al. (2006) Prevalence of common mental disorders in Italy: results from the European Study of the Epidemiology of Mental Disorders (ESEMeD). *Social Psychiatry and Psychiatric Epidemiology,* 41, (11), 853-861.

Gmel G, & Rehm J (2003) Harmful alcohol use. *Alcohol Research & Health,* 27, (1), 52-62.

Graham K, Demers A, Rehm J, et al. (2004) Problems with the graduated frequency approach to measuring alcohol consuption: results from a pilot study in Toronto, Canada *Alcohol and Alcoholism,* 39, (5), 455-462.

Grant BF, Compton WM, Crowley TJ, et al. (2007) Errors in assessing DSM-IV substance use disorders. *Archives of General Psychiatry,* 64, (3), 379-380.

Ipsos MRBI (2012) *Alcohol: public knowledge, attitudes and behaviors* Dublin, Ireland, Health Research Board.

Kehoe T, Gmel GJ, Shield K, et al. (2012) Modelling alcohol consumption as a distribution and determining the impact of the distribution on estimated alcohol-attributable harms. *Population Health Metrics,* 10, (1), 6.

Laslett AM, Room R, Ferris J, et al. (2011) Surveying the range and magnitude of alcohol's harm to others in Australia. *Addiction,* 106, (9), 1603-1611.

Lim, S. S., Vos, T., Flaxman, A. D., et al. 2012. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010 *Lancet* 380, 2224-2260.

Lipscomb WR (1966) Survey measurements of the prevalence of alcoholism. A review of five surveys. *Archives of General Psychiatry,* 15, (5), 455-461.

Mathers CD, Iburg KM, Salomon JA, et al. (2004) Global patterns of healthy life expectancy in the year 2002. *BMC Public Health,* 24, (4), 66.

Murray CJL, Salomon J & Mathers C (2000) A critical examination of summary measures for population health *Bulletin of the WHO,* 78, (8), 981-994.

O'Dowd A (2011) Minister admits government has not convinced public of the harms of excessive drinking. *British Medical Journal,* 343, D6999.

Popova S, Rehm J, Patra J, et al. (2007) Comparing alcohol consumption in central and eastern Europe to other European countries. *Alcohol and Alcoholism,* 42, (5), 465-473.

Rehm J, Anderson P, Kanteres F, et al. (2009a) *Alcohol, social development and infectious disease*. *http://www.eurocare.org/library/eurocare_updates/alcohol_social_development_and_infectious_disease_new_report* [Online].

Rehm J, Baliunas D, Borges GLG. et al. (2010a) The relation between different dimensions of alcohol consumption and burden of disease - An overview. *Addiction,* 105, (5), 817-843.

Rehm J, Fischer B, Krausz M, et al. (2006a) Heroin prescription for opioid addicts *Lancet,* 359, 890.

Rehm J, Giesbrecht N, Patra J, et al. (2006b) Estimating chronic-disease deaths and hospitalizations due to alcohol use in Canada in 2002. Implications for policy and prevention strategies. *Preventing Chronic Disease,* 3, (4).

Rehm J, Kehoe T, Gmel G, et al. (2010b) Statistical modeling of volume of alcohol exposure for epidemiological studies of population health: the example of the US. *Population Health Metrics,* 8, 3.

Rehm J, Mathers C, Popova S, et al. (2009b) Global burden of disease and injury and economic cost attributable to alcohol use and alcohol use disorders. *Lancet,* 373, (9682), 2223-2233.

Rehm J, Patra J, Gnam W, et al. (2011a) Avoidable cost of alcohol abuse in Canada. *European Addiction Research,* 17, 72-79.

Rehm J, & Room R (2009) Monitoring of alcohol use and attributable harm from an international perspective. *Contemporary Drug Problems,* 36, (3-4), 575-588.

Rehm J, Room R, Van den Brink W et al. (2005) Alcohol use disorders in EU countries and Norway: an overview of the epidemiology *European Neuropsychopharmacology,* 15, (4), 377-388.

Rehm J & Scafato E, (2011) Indicators of alcohol consumption and attributable harm for monitoring and surveillance in European Union countries. *Addiction,* 106, (Suppl.1), 4-10.

Rehm, J., Shield, K. D., Rehm, M. X., et al. (2012a) Modelling the impact of alcohol dependence on mortality burden and the effect of available treatment interventions in the European Union *European Neuropsychopharmacology*.

Rehm J, Shield K, Rehm M et al. (2012b) *Alcohol consumption, alcohol dependence, and attributable burden of disease in Europe: potential gains from effective interventions for alcohol dependence*. Toronto, ON: Centre for Addiction and Mental Health.

Rehm J, Zatonski W, Taylor B et al. (2011b) Epidemiology and alcohol policy in Europe. *Addiction,* 106, (Suppl.1), 11-19.

Room R & Mäkelä K (2000) Typologies of the cultural position of drinking. *Journal of Studies on Alcohol,* 61, 475-483.

Samokhvalov AV, Popova S, Room R et al. (2010) Disability associated with alcohol abuse and dependence. *Alcohol Clin Exp Res,* 34, (11), 1871-1878.

Sanap M & Chapman MJ (2003) Severe poisoning: a case report and brief review. *Critical Care & Resuscitation,* 5, (2), 106-108.

Shield, K.D., Rylett, M.J., Gmel, G., & Rehm, J. (2013). Part 1. Trends in alcohol consumption and alcohol-attributable mortality in the EU in 2010. *In*: World Health Organization Regional Office for Europe (eds.), *Status report on alcohol and health in 35 European countries 2013* (pp. 3-14). Copenhagen: WHO Regional Office for Europe. ISBN 978 92 890 0008 6.

Shield KD, Kehoe T, Gmel GJ et al. (2012) Societal burden of alcohol. *In:* Anderson P, Møller L & Galea G (eds.) *Alcohol in the European Union. Consumption, harm and policy approaches.* Copenhagen, Denmark: World Health Organization Regional Office for Europe, 10-28.

Snikere S, Trapencieris M, Koroleva I et al. (2011) *Atkarabu izraisošo vielu lietošana iedzivotaju vidu 2011. Analitisks parskats*. [Substance use among population in 2011. Analytic report]. Riga, Centrs, S. P. U. K.

Verelst S, Moonen PJ, Desruelles D. et al. (2012) Emergency department visits due to alcohol intoxication: characteristics of patients and impact on the emergency room. *Alcohol Alcohol,* 47, (4), 433-438.

Wolfson MC (1996) Health-adjusted life expectancy. *Health Reports,* 8, 41-46.

World Health Organization (2002) *The world health report 2002: Reducing risks, promoting healthy life* Geneva, Switzerland, World Health Organization.

World Health Organization (2008) *The global burden of disease: 2004 update Geneva*, Switzerland, World Health Organization.

World Health Organization (2009) *Global Health Risks. Mortality and burden of disease attributable to selected major risks* Geneva, Switzerland, World Health Organization.

World Health Organization (2010) *Global strategy to reduce the harmful use of alcohol* Geneva, Switzerland, World Health Organization.

Zatonski W, Sulkowska U, Manczuk M et al. (2010) Liver cirrhosis mortality in Europe, with special attention to central and eastern Europe. *European Addiction Research,* 16, 193-201