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Indicators of alcohol consumption and attributable harm for monitoring and surveillance in European Union countries

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ABSTRACT

Aims Alcohol is a major risk factor for burden of disease and injury in Europe, and contributes markedly to between region differences in life expectancy. Monitoring and surveillance systems have shown to be a key factor in implementing effective policies. The aim of this paper is to propose a system of indicators for alcohol consumption and attributable harm which can be used as an over-time monitoring tool at the country level as well as for comparisons between countries. **Design** A systematic research in electronic data bases was conducted but most of the information was derived from ongoing international efforts to establish alcohol monitoring and surveillance systems. **Setting** European Union. **Participants** Countries. **Measurements** Exposure to alcohol, mortality, burden of disease. **Findings** Adult per capita alcohol consumption, prevalence of abstention, and frequency of drinking more than 60g pure alcohol in one occasion are proposed as a minimal set of alcohol exposure indicators, which can quickly be implemented in all EU countries. With respect to health harm indicators, the best minimal choice which can be implemented quickly in all countries of the EU would be alcohol-attributable years of life lost due to premature death. In addition, country specific indicators could be added, when alcohol places specific burden on specific diseases. **Conclusions** National and European Union-wide monitoring systems for alcohol exposure and attributable harm to inform public health-related policy decisions could be implemented easily. The establishement of such monitoring systems would follow the recent World Assembly resolution for a global strategy to reduce alcohol-related harm.

Keywords Alcohol, burden of disease, consumption, European Union, monitoring, World Health Organization (WHO).

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INTRODUCTION

Europe is a region where traditionally more alcohol is consumed than in the rest of the world [1], and the European Union (EU) countries make no exception [2], resulting in considerable alcohol-attributable harm [1,3]. Alcohol consumption also contributes markedly to differences in mortality, burden of disease and life expectancy between and within EU countries and regions ([2,4]; see also [5], for a general overview).

This situation has led to repeated calls to monitor alcohol exposure and related harm, as well as to implement alcohol policy interventions to reduce alcohol-attributable harm in Europe. These calls have been strengthened considerably by the recent adoption of a global strategy to reduce the harmful use of alcohol by the World Health Assembly in May 2010. One of the key elements of the global strategy, and of public health interventions in general, are monitoring and surveillance systems [6]. Such systems allow:

- quantification of the burden comparatively to identify time trends;
- identification of disease categories and specific populations where interventions are most needed; and

- provision of the necessary background data for evaluation of interventions with respect to effectiveness and cost-effectiveness.

Specifically, for alcohol, given the variability in drinking and harm not only in Europe, it would be important to have cross-cultural comparability of key indicators, embedded in a global strategy to reduce alcohol-attributable harm ([7,8] and http://apps.who.int/gb/ebwha/pdf_files/WHA63/A63_13-en.pdf). The experiences in tobacco control have clearly underlined the value of such systems [9].

It is the aim of this contribution to describe key indicators for alcohol consumption and attributable harm, which could be used for a monitoring and surveillance system with a specific emphasis on the countries of the European Union. These indicators will not only be used for the EU Alcohol Measures for Public Health Research Alliance (AMPHORA) research project (see the introduction to this supplement by A. Gual), but also for a sustainable monitoring effort of the EU in line of the World Health Organization (WHO) global strategy.

METHODS

Although we conducted a systematic review of electronic databases, the main data for this paper were collected by examining current efforts to establish such monitoring systems, in particular the Comparative Risk Assessment for alcohol within the Global Burden of Disease Studies [10–14], the efforts of the WHO to establish global indicators [15], including the Global Information System for Alcohol and Health (GISAH; http://www.who.int/substance_abuse/activities/gad/en/) and the Committee on (Alcohol) Data Collection, Indicators and Definitions, organized by the European Commission, Health and Consumers Directorate General (DG SANCO; http://ec.europa.eu/health/ph_determinants/life_style/alcohol/alcohol_data_en.htm). In addition, a much groundwork has also been conducted by the European Community Health Indicator Monitoring (ECHIM) Project (http://www.healthindicators.org/healthindicators/object_document/o4958n28314.html), and earlier by the European Comparative Alcohol Study (ECAS) study [16].

RESULTS

Alcohol exposure

For exposure, at least three dimensions of alcohol consumption impacting on harm can be identified [10,12,17], although only the first two are more important for harm in Europe:

- overall volume of alcohol consumption;
- patterns of drinking, especially heavy drinking occasions;
- quality of alcohol, especially in countries where there are indications of additional risk based on type (e.g. surrogate alcohol, moonshine) and associated quality (e.g. [18]; for a general overview: [19]). Quality of alcohol has been rarely measured, however [20]. Instead, unrecorded alcohol has been used as if it all denotes alcohol of lower quality, i.e. alcohol, where there is risk over and above the risk of ethanol.

Adult per capita alcohol consumption, as defined as total alcohol consumption in litres of pure alcohol divided by the population 15 years and older, is usually considered to be the most reliable overall indicator on the country level [20], as most of it can be derived from reliable statistics concerning sales, taxation, import and export ([10]; see also http://www.healthindicators.org/healthindicators/object_document/o5793n29137.html). The restriction in the denominator to adults is preferable to the usage of per capita consumption as indicator, the latter derived by dividing consumption by the whole population, as the overwhelming majority of alcohol is consumed by people aged 15 years and older. Using the whole population as reference would introduce problems in interpretation and comparability, as the proportion of people under age 15 varies markedly between countries (and varies even more if countries outside of Europe are included in the comparison). Adult per capita alcohol consumption includes unrecorded consumption, and this part is measured less reliably than the recorded part [19,21]. However, in recent years, many improvements have been made to assess unrecorded consumption in European countries, including the recent WHO survey to all countries to collect alcohol-related data. The current data on unrecorded consumption, based most often on surveys, of course incorporate all the random and systematic errors associated with this method (see below). However, they are the most valid estimates to date. Adult per capita alcohol consumption is an indicator for exposure available in all European countries (see websites for WHO headquarters: http://www.who.int/substance_abuse/activities/gad/en/ and for WHO Euro). As mentioned earlier, it only measures overall volume and, on a between-country level, it is not necessarily highly correlated or correlated at all with the other two dimensions, so important aspects of risky alcohol exposure may be missed. Adult per capita alcohol consumption also has the disadvantage that it does not disaggregate without further information, so that differential trends for population subgroups cannot be identified without additional information derived from surveys. As a result, adult per capita alcohol consumption is often combined with survey data to derive indicators such as alcohol consumption per adult drinker, alcohol consumption per adult male drinker or alcohol consumption for specific age groups. Clearly, surveys to estimate the

prevalence of different types of drinkers and abstainers are necessary to calculate such indicators, and considerable random and systematic error may be introduced whenever survey estimates are used [22].

Despite its problems, adult per capita alcohol consumption is, overall, the most valid and important indicator for alcohol exposure in a country [20]. However, if the aim is to have a proxy measure of alcohol-attributable harm, alcohol consumption per adult drinker is the better choice.

Not only volume, but heavy drinking occasions determine alcohol-attributable health. Frequency of heavy drinking occasions (such as drinking more than 60 g pure alcohol in one occasion) has been identified as a good indicator for this dimension as it integrates both volume and heavy drinking occasions (see [23] for specific details on type of drinking culture). If people drink continuously heavily, this corresponds to the volume effect of alcohol. However, there is also a detrimental effect of heavy drinking occasions when overall drinking is light to moderate, particularly for injury and cardiovascular events [11,24–26].

In addition, episodes of very heavy drinking occasions (such as drinking more than 108 g pure alcohol in one occasion) seem to have detrimental effects over and above the volume effect, e.g. for liver cirrhosis [27], but the evidence here is less clear. Thus, assessing the dimension of heavy drinking occasions in addition to volume is important.

When using survey-based measures for monitoring, it is important to determine that the respective surveys are truly both reliable and comparable. For instance, comparing surveys with widely different coverage rates of adult per capita consumption is methodologically wrong, as differences may have resulted simply from differential response rates in certain parts of the population [11,21]. Nevertheless, it may still be possible to make comparisons in some instances based on assumptions about the distribution of consumption [21,28].

Currently there is not enough information available on quality of data. Unrecorded consumption is composed of different components, with as the main categories [29]. Many of the beverages subsumed under unrecorded do not represent a health impact over and above the health impact of recorded consumption. It seems important to identify the types of beverage which constitute such an impact, and to include them into monitoring and surveillance.

Minimal indicators recommended to be included in a monitoring and surveillance system for alcohol exposure in Europe

- Adult per capita alcohol consumption (currently available in all EU countries);
- level of abstention (separated in life-time abstention and ex-drinker; currently available in most EU countries, but not necessarily on regular basis)—the combination of adult per capita alcohol consumption and abstention can be used to calculate alcohol consumption per adult drinkers;
- frequency of drinking 60 g pure alcohol or more in one occasion (currently available in most EU countries, but not necessarily on regular basis); and
- adult per capita consumption of low-quality alcohol (currently not available in most EU countries).

ALCOHOL-ATTRIBUTABLE HEALTH HARM

Compared with many other risk factors, mortality and morbidity attributable to alcohol occur relatively early in life [30,31]. Therefore, time-based outcome measures [such as years of life lost (YLL) or disability-adjusted life-years (DALYs)] should be preferred to event-based outcome measures (such as numbers/rates of deaths or hospitalizations) to capture the public health relevance of alcohol-attributable outcomes. Of course, if the indicators are to be compared between countries, standardized rates of YLLs have to be used [32].

However, which categories should the time-based measure comprise? We suggest using the overall sum of alcohol-attributable causes of death, using the Global Burden of Disease (GBD) study 2005 categories [16], with the alcohol-attributable fractions being derived via the usual formula [33]:

$$AAF = \frac{P_{abs} + P_{form}RR_{form} + \int_0^{150} P(x)RR(x)dx - 1}{P_{abs} + P_{form}RR_{form} + \int_0^{150} P(x)RR(x)dx}$$

where P_{abs} represents the proportion of abstainers, P_{form} the proportion of former drinkers and P(x) the probability distribution function of drinkers. RR_{form} represents the relative risk for former drinkers, and RR(x) the relative risk function for a given alcohol consumption in g/day. A cap at exposure of 150 g pure alcohol was used as a conservative measure, as very few people consume more than 12 standard drinks on a daily basis for an extended period of time. These people here are modelled as drinking 150 g. This basic formula has to be adapted to include the impact of heavy drinking occasions [11].

Alcohol has causal impacts on chronic disease, infectious disease and injury [5,16,34]. The distribution of causes of death varies markedly in the European Union, and consequently the biggest impact of alcohol on mortality varies by country dependent on the country-specific cause of death distribution [2]. Thus, for comparative reasons, the sum of all alcohol-attributable YLLs is best suited to capture this diversity. To select GBD cat-

egories will exclude some of the smaller disease categories related to alcohol, but ensure that the categories are comparable, as measurement error is smaller for wider categories [35].

In addition, even though there are many disease categories where some portion of burden of disease (BOD) is attributable to alcohol (for a list see Table 1), for various reasons most of these categories cannot serve as an indicator for health-related outcomes. A suitable indicator should have the following characteristics (see Table 1 for a matrix of these criteria for other potential comparatively available alcohol-related diagnoses [15]:

- short latency period (i.e. as evidenced by natural experiments such as strikes, political change) to be able to detect changes in alcohol-attributable harm relatively quickly and thus to react to changes relatively quickly;
- reliability in diagnosis—a relatively low error in outcome measurement;
- relation to different dimensions of alcohol;
- occurrence across the life-span;
- importance for both fatal and non-fatal outcomes; and
- availability on a global level with the possibility for comparison, if the proposed indicator is to be used on a global level.

Table 1 gives an overview of the present state of knowledge concerning the performance of different disease categories on these dimensions, from the perspective of their usefulness as indicators of trends in alcohol-attributable harm.

Some of these diseases may be good indicators on a country level, such as liver cirrhosis, alcoholic liver cirrhosis or alcohol poisoning, if the reporting for the latter category is valid (see [36] for a demonstration that this is often not the case). However, there are problems with comparability between countries. First, heavy drinking and alcohol use disorders carry a stigma in many countries, with the consequence that causes of death related directly to 'alcoholic' or 'alcohol-induced' are often avoided in death certificates and different categories, often unspecific larger categories, are used [16,36]; but even the larger categories are problematic, as there are huge differences in mortality rates. Consider liver cirrhosis as an example: the standardized rates for Hungary are a factor of more than 10-fold higher than for Greece, and overall the standardized variability of liver cirrhosis mortality rates is many-fold the standardized variability of drinking indicators in the EU [37]. Neither volume of alcohol consumption nor patterns of drinking can explain such a difference between Hungary and Greece [2]. Quality of alcoholic beverage may contribute additionally to the variability in liver cirrhosis rates ([2,38], but see [29]), but overall it may be problematic to rely heavily on liver cirrhosis as the sole indicator for alcohol-attributable deaths.

Thus, we believe the summary indicator proposed above has distinct advantages over single indicators, or a simple addition of disease categories which are related highly to alcohol such the one from ECHIM (http://www.healthindicators.org/healthindicators/object_document/o5764n29136.html).

Recommendations for monitoring alcohol-attributable harm

- It is suggested to use alcohol-attributable YLLs as indicator. This indicator requires, in addition to a functioning vital registration system which is present in all EU countries, that there are regular studies on alcohol exposure indicators (see above). For better comparability population standardized rates should be used [32].
- On a country level, wherever valid and reliable information is available, we propose to use the more direct indicators such as liver cirrhosis, alcoholic liver cirrhosis and alcohol poisoning for the chronic respective acute disease consequences attributable to alcohol. If there are good data on other disease outcomes being related more closely to alcohol in a certain country or region with fulfilling the above criteria for good monitoring indicators, these outcomes should be used. In all cases, at least one chronic and one acute indicator should be used, and standardized YLLs rates due to the indicator should be used [32].

DISCUSSION

Given the wealth of national statistics already collected routinely, it should be easy to implement national and EU-wide monitoring systems for alcohol exposure and attributable harm to inform public health-related policy decisions. What is needed in addition to a valid vital registration system, which is present in all European countries [39], are valid, regularly collected data for alcohol exposure.

In addition, the quality control of the underlying vital registration data should be improved and harmonized between EU countries. Currently, there are clear regional differences in coding for cause of death, and there is extensive use of unspecific categories for causes of death (the 'not otherwise specified' category). While research studies such as GBD try to reallocate these categories ex-post [40], it would be better to start harmonizing coding practices in the EU (see the efforts of ECHIM and WHO).

Regarding the exposure data, there will be a standardized European Health Interview Survey (EHIS), where member countries will participate in 2013 or 2014 on a legal basis. EHIS is part of the European Core Health Interview Surveys, a comprehensive and coordinated set of surveys performed within the European Statistical

Table 1 Major categories of disease attributable to alcohol and potential for being used as indicator in monitoring system.

Alcohol-attributable cause of death or disease category	*Latency on population level*	*Strength of relationship to alcohol*	*Reliability of outcome*	*Relation to*			*Relation-ship over whole lifespan*	*Relation to morbidity and mortality*	*Main confounding*
				Volume	*Patterns*	*Quality*			
Tuberculosis and other alcohol-attributable infectious diseases	Not clear	Low to medium	High	+ Only for heavy drinking and alcohol use disorders	–	–	+	++	Poverty, nutrition, smoking
Alcohol attributable cancer sites[a]	Long	Low to medium	High	++	–	+/–	+	++	Smoking
Alcohol use disorders	Problematic, not clear	High	Low	++	+	–	++	Mortality problematic	None
Unipolar major depression	Problematic	Low	Low	+	+	–	++	Mortality problematic	Unclear causality
Epilepsy	Problematic	Medium	Low, hard to distinguish from withdrawal seizures	+	?	–	+	+	
Diabetes	Long	Low and problematic as harm indicator (in part beneficial effect)	High	+	+	–	+/–	Mortality problematic	Overweight, smoking
Hypertensive diseases	Medium	Low to medium	Medium	+	+ (meals)	–	+/–	+	Salt intake
Coronary heart disease	Short to medium	Low and problematic as harm indicator (mainly beneficial effect)	Medium	+	+	?	–	+	Smoking
Stroke	Medium	Problematic, different relationships of alcohol to different stroke types	Low to medium	+	+/–	–	–	+	Smoking
Liver cirrhosis	Short	Medium to high	Medium to high	++	+	+	–	+	Socio-economic status, BMI
Pancreatitis	Short	Medium	Medium to high	++	?	–	–	+/–	Gallbladder disease
Alcoholic liver cirrhosis	Short	High	Often low	++	+	+	–	+	Socio-economic status
Low birth weight	Short	Low	Low	+	++	?	–	+	Socio-economic status
Traffic injury	Short	Medium and culture dependent	High	+	++	–	++	+	Highway conditions, driving
Other unintentional injuries: drownings, falls, poisonings, other unintentional injuries	Short	Medium	High	+	++	–	+	+/–	Environmental conditions
Alcohol poisoning	Short	High	Often low	+	++	+	+	++	None, except for coding practices
Intentional injury: self-inflicted injuries, homicide and violence, other intentional injuries	Short	Medium and culture dependent	Medium	+	++	–	+	+	Environmental conditions

++,+,+/–,–: symbols denoting the strength of the relationship from 'very strong', 'strong', 'weak' to 'no relationship'; ?: form and strength of the relationship not clear. [a]Mouth and oropharyngeal cancer, laryngeal cancer, oesophageal cancer, liver cancer, female breast cancer, colorectal cancer.

System under the responsibility of Eurostat. However, to make data comparable, survey data still will have to be triangulated with adult per capita consumption data [19]. As previous efforts with standardized surveys have shown [16], use of the same survey questions may lead to widely differing coverage rates in European countries, which will result in incomparability between survey-based indicators [21]. Given the multiple other threats to survey validity and reliability, e.g. constantly declining response rates or use of cellphones, work on improving the assessment of alcohol exposure is needed urgently. In order to improve further on the triangulation between surveys and adult per capita consumption data, unrecorded consumption should be assessed routinely with comparative measures. This may be included in surveys, but other methods should also be explored.

Clearly, monitoring and surveillance of alcohol consumption and attributable harm in the EU is challenging. However, these problems are small compared to problems related to monitoring exposure and alcohol-attributable harm in other regions of the world. Thus, there should be no excuses in delaying the implementation of national and EU-wide monitoring and surveillance systems for alcohol exposure and attributable harm as a first step for effective and cost-effective interventions to reduce alcohol-attributable harm [41].

Declarations of interest

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