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The high harm score of alcohol. Time for drug policy to be revisited?

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Abstract

The aim of this paper is to create awareness of the negative health impact and economic burden and benefits associated to alcohol consumption. Worldwide about two billion people consume alcohol. Low intake of alcohol has a minor protective cardiovascular effect. On the other hand, even moderate alcohol consumption appears to be weakly, but significantly, associated to a limited number of chronic diseases. Alcohol causes a considerable economic burden to society due to the high absolute number of alcohol consumers. As such, alcohol abuse is more harmful for public health and society than illicit drug use. Some 3.7% of alcohol consumers (worldwide 76 million people) have an alcohol use disorder leading to 60–70% of the societal costs related to alcohol. Therefore, policy measures should, in addition to regulatory measures to reduce alcohol use, aim at closing the treatment gap and improving treatment effectiveness of people with an alcohol use disorder. The key message is that policy-makers unjustifiably focus on the harm of illicit drugs, whereas they underestimate the harm of alcohol use. Policy makers should therefore consider alcohol to be at least as harmful as illicit drugs and invest more in prevention and harm reduction strategies for alcohol abuse and dependence.

Keywords

Alcohol, illicit drugs, drug policy, harm reduction, alcohol use disorder

Introduction

Recent evaluation of the harms of a variety of drugs, alcohol and tobacco showed the relatively high harm of alcohol consumption as compared with the recreational use of drugs. According to estimates of the World Health Organization (WHO) (WHO, 2010b, 2011b), the global burden of disease attributed to alcohol and illicit drugs amounts to 5.4% of the total burden of disease, and approximately 76 million people (WHO, 2004) are affected by alcohol-use disorders worldwide, compared with ‘only’ 27 million people with problematic drug use (UNODC, 2012) (see Figure 1). Annually, alcohol kills 35 people per every 100,000, whereas for illicit drugs this number is nine times smaller. In 2004, 7.6% of all global burdens of disease and injuries among men and 1.4% among women were linked to alcohol use. As compared with alcohol, the contribution of illicit drug use to global burden of disease is substantially lower (Degenhardt and Hall, 2012). These figures emphasize that prevention of excessive alcohol use and the treatment of people with an alcohol use disorder should be a public health priority. Concerning tobacco as a public health priority, various smoking prevention measures, including smoke-free legislation, has led to a firm decline in the prevalence of smoking in the last decades, but its burden of disease remains high due to the long lag time between exposure and disease.

However, worldwide policy makers are primarily concerned about public health effects of illicit drug use and the prohibition of illicit drugs, whereas there is little political interest in the reduction of societal costs due to alcohol use. Even in the Netherlands, the national budget of drug-related law enforcement is three times the national expenditure on health interventions to reduce the public health effects of alcohol and illicit drugs, including treatment (Rigter, 2006). In Europe, drug policies gradually shift to a more prohibitive approach in the enforcement of drugs, whereas the harm reduction approach is primarily aimed at the reduction of

illicit drug exposure to young children. The efforts to control the sales and consumption of the legal drug alcohol are limited to legislative measures, such as age limits to purchase alcohol, reduced advertisement and import (smuggling) control.

Obvious advantages of the legal status of alcohol are controlled quality and sales, tax income and other economic revenues and employment in the production and leisure time industry. However, as outlined below, the costs of alcohol for society (i.e. the societal harm) are at least comparable to those of illicit drugs. To provide a transparent basis for drug policy measures and comparison with the harm of illicit drugs, the damage to public health and the economical benefits of alcohol use are reviewed.

Direct comparisons of harm related to alcohol and illicit drugs

To provide realistic science-based information for policy makers, the overall harm of alcohol, tobacco and 17 recreational drugs was

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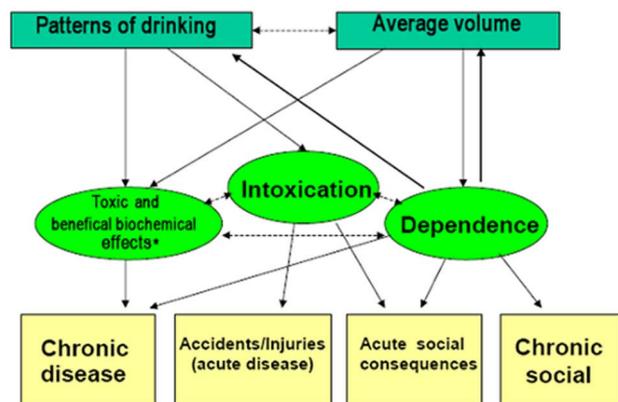


Figure 1. Model of alcohol consumption, mediating variables, and short-term and long-term consequences. Reproduced from Rehm J, Room R, Graham K, et al. (2003) The relationship of average volume of alcohol consumption and patterns of drinking to burden of disease: an overview. *Addiction* 98: 1209–1228 with permission from John Wiley and Sons.

recently assessed and ranked by a Dutch expert panel (van Amsterdam et al., 2010). The results of this ranking study are consistent with similar attempts in the United Kingdom (Nutt et al., 2007, 2010). In the Dutch ranking study the overall harm of each of the 19 substances was obtained by adding the score given for the following domains of potential harm: acute and chronic toxicity, dependence liability, harm for society and criminal involvement. Two separate scores were given for the societal harm domain: one for the societal harm of the drug at an individual level and one for the societal harm at the population level with the latter assessment taking into account differences in the prevalence of drug use and drug-related problems. The expert panel consisted of a wide array of disciplines, including toxicologists, psychiatrists, police, criminologists, social scientists, policy makers and epidemiologists, all working in the field of alcohol, tobacco and (illicit) drugs. For details on the assessment procedure the reader is referred to van Amsterdam et al. (2010). The most striking outcome of the study was the top position of alcohol on the ranking scale, that is, alcohol as drug with a harm rating similar to heroin and cocaine. Furthermore, the total harm score for alcohol at the population level was higher than the total harm score at an individual level, which was mainly due to the high prevalence of alcohol use (problems) and the societal harm score for alcohol at the population level (see Table 1). This is in contrast with most illicit drugs scoring much lower on societal harm at population level than at individual level (see Table 1) due to their relatively low prevalence of use of 4% or lower (WHO, 2010b).

The outcome of the ranking studies, showing alcohol and tobacco in the top of the ranking scale, is highly relevant for policy-makers whose aim is harm reduction. Therefore, national harm reduction policies, especially in Europe where – as compared with the rest of the world – alcohol consumption is very high, should be directed at alcohol (and tobacco) rather than at illicit drugs. The Expert Advisory Committee on Drugs of New Zealand (EACD) scheduled GHB as a Class B1 drug, that is, as a prohibited drug with a high risk to the public health. Using the same criteria as the EACD, Sellman et al. (Sellman et al., 2009) concluded that alcohol was at least as hazardous as GHB, which endorses the view that alcohol is one of the most harmful drugs.

The WHO has initiated various actions to reduce alcohol-related harm (e.g. the Framework for Alcohol Policy in the

Table 1. Mean scores given by 19 experts to assess the societal harm of 19 substances at individual and population level. Substances have been ranked according to difference of the two scores. Difference is (societal harm at individual level) – (societal harm at population level) (source: van Amsterdam et al., 2010).

	Societal harm score ^a		
	Population level	Individual level	Difference
Alcohol	2.8	2.2	+0.6
Tobacco	2.3	2.1	+0.2
Cannabis	1.5	1.3	+0.2
Benzodiazepines	1.3	1.2	+0.1
Ecstasy	1.1	1.2	-0.1
Magic mushrooms	0.4	0.7	-0.3
Anabolic steroids	0.5	0.8	-0.3
Cocaine	1.7	2.1	-0.4
Khat	0.1	0.6	-0.5
Methylphenidate	0.3	0.8	-0.5
Amphetamine	1.2	1.8	-0.6
LSD	0.3	0.8	-0.5
GHB	0.9	1.5	-0.6
Crack cocaine	1.9	2.6	-0.7
Heroin	1.8	2.5	-0.7
Methadone	0.7	1.4	-0.7
Ketamine	0.4	1.1	-0.7
Buprenorphine	0.3	1.2	-0.9
Metamphetamine	0.6	1.8	-1.2

^aSocietal harm comprises loss of a job, worker absenteeism, inferior job performance, decreased productivity, violence, crime, relationship problems and social exclusion and marginalization.

European Region), and the European Union (EU) takes an active and growing role in the prevention and reduction of alcohol-related harm in Europe (WHO, 2006), which is also reflected by the 2010 series of health reports about alcohol under the EU Public Health Programme (WHO, 2010b). However, policy measures by the European Commission or individual EU member states should not violate the EU principle of open market. As no exceptions on health grounds to this principle are allowed, the measures of member states to reduce the harm of alcohol abuse are limited (WHO, 2010b).

Reducing the harm of alcohol use remains an imperative public health priority, and various measures to reduce alcohol-related harm, in particular those aimed at pricing, taxation and availability of alcoholic beverages, have shown to be feasible and effective (Anderson et al., 2009; Chrisholm et al., 2004, 2009). Other effective legislative measures to reduce drinking are age limits and the lowering of blood-alcohol concentration (BAC) levels allowed when driving. Community or school-based education programmes seem to be less effective in reducing alcohol-related harm, although they increase the public awareness of the potential risks. The harm of alcohol can be further reduced by offering better access to more treatment facilities, as currently only 8–25% of people with an alcohol use disorder are treated (Alonso et al., 2004; Cohen et al., 2007; Hasin et al., 2007). Also, the efficacy of the various treatments can be increased using novel therapeutic approaches (van den Brink, 2012) and the acceptance of reduced drinking as a viable treatment outcome (Ambrogne, 2012;

Gastfriend et al., 2007). Finally, stigma should be reduced by public campaigns and education because discriminatory behaviour towards persons with an alcohol disorder is associated with feelings of rejection, loss of status and with a lower probability that people with alcohol problems seek treatment (Keyes et al., 2010; Pescosolido et al., 2010).

Prevalence of alcohol use

As previously indicated, the total societal harm of a drug is closely related with its prevalence of use. The United Nations Office on Drugs and Crime estimated that about 230 million people, or 5% of the world's adult population, have used at least once in 2010 an illicit drug, including cannabis. About half that number are estimated to have been current drug users, that is, having used illicit drugs at least once during the past month prior to the date of assessment (UNODC, 2012).

Impressive as the numbers may be, they are still much lower than the worldwide number of alcohol consuming subjects, which is about two billion people (WHO, 2004). Notably, with a yearly consumption of 9.5 litres of pure alcohol per capita (WHO, 2010c) and a last year prevalence of 75% (WHO, 2010a) the EU has the highest consumption rate in the world. Especially, young people of the EU show a very high weekly alcohol consumption: 5% among 11 year olds, 12% among 13 year olds and 29% among 15 year olds (Hibbell et al., 2004). Around 23% of 15–16 year old boys in the EU reported binge drinking at least three times in the previous month (Hibbell et al., 2004). Over 90% of 15–16 year old Europeans have ever drunk alcohol in their life with 14 years as the average age for 'getting drunk for the first time', and of 15 year olds, who usually drink out of doors (and not at home), 82%, that is, half a million children across England, said they had been drunk in the last four weeks (Donaldson, 2009).

Acute adverse effects

The consumption of large volumes of alcohol (blood alcohol >400 mg/dL; >4‰) on one occasion produces loss of consciousness, respiratory depression and coma. Moreover, due to the diminished reaction time and impaired locomotor activity, alcohol intoxicated subjects are more liable to (fatal) traffic accidents, drowning, chronic disability and HIV-infection in the case of unprotected sexual activity (WHO, 2006). In 2009, 10,839 people were killed in the United States in crashes caused by alcohol-impaired driving, accounting for 32% of all traffic-related deaths (NHTSA, 2010), and the annual cost of alcohol-related crashes totals more than 51 billion dollars (Blincoe et al., 2002). The violent behavior induced by alcohol and alcohol-related traffic accidents imposes a high burden on society.

Consumption of 12 or more alcoholic drinks on one occasion gives a three-fold higher risk to become violent towards others. Of all violent crime offenders in the UK, 44% were under the influence of alcohol (Walker et al., 2006) and 10–18% of injury patients attending emergency rooms were alcohol-related cases (Cherpitel, 2007). The frequency of violent acts, for example, sexual assault, child abuse, domestic violence and homicide, is clearly correlated with the quantity of alcohol consumed (Room and Rossow, 2001; Room et al., 2005). However, other subjects consuming similar quantities of alcohol show no increased

aggression, which indicates that a variety of other factors, such as personality traits and circumstantial factors, are involved in the occurrence of alcohol-related violence (Gustafson, 1993; Lipsey, 1997). As a consequence, a meta-analysis of the relation between alcohol abuse and violent recidivism showed a mean effect size of only 0.12 (Dowden and Brown, 2012). Furthermore, alcohol is often used in combination with other drugs. It is likely – solid evidence is not available – that stimulants like cocaine and ecstasy promote the aggression and violence eliciting effect of alcohol in a synergistic manner. This form of polydrug use, frequently experienced by adolescents, leads to aggression in society that is, hooliganism and unsafe areas.

The risk of death by suicide, homicide, fire or drowning is roughly doubled in alcohol addicts. Alcohol abusers in Norway were 6.9 times as likely to commit suicide as the general population (WHO, 1999). The high suicide risk is also illustrated by the observation in Hungary where 52% of suicide victims had a fatty liver (in the general population this is only 3%) (Encyclopædia Britannica, 2010). In Europe, alcohol is a factor in four in 10 murders and manslaughters and in one in six suicides (Anderson and Baumberg, 2006), which are often the result of impulsive violent outbursts typical for alcohol overdosing.

Chronic adverse effects due to chronic (excessive) alcohol use

After hypertension and smoking, alcohol use is the strongest risk factor for ill-health and premature death in the EU (Anderson and Baumberg, 2006). On the other hand, moderate alcohol consumption has a protective effect on cardiovascular disease, with regular consumption of small amounts of alcohol being more protective than the same amount of alcohol taken less frequently but in larger doses (Gronbaek, 2009). Light to moderate drinking is associated with 14–25% reduction in the risk of cardiovascular outcomes compared with abstaining from alcohol (Ronksley et al., 2011). Various cohort studies conducted among women all confirm the protective cardiovascular effects of alcohol below a rather high (see below) cut-off level of 48 g per day (Fuchs et al., 1995; Klatsky et al., 1997; Rehm et al., 1997; Thun et al., 1997). These findings are consistent with the UK Interdepartmental Working Group on Sensible Drinking conclusion that modest alcohol consumption reduces cardiovascular morbidity and cardiovascular mortality in men aged over 40 and postmenopausal women at a maximum daily intake of 24 g and 32 g of alcohol for women and men, respectively (UKDH, 1995). Finally, a recent meta-analysis on cardiovascular mortality showed a J-shaped pooled curve with a significant maximal protection (average 22%) of alcohol at approximately 26 g per day (Costanzo et al., 2010).

Others, however, have suggested that prospective mortality studies overestimate the cardiac protection of alcohol, because of contamination of the abstainer category with occasional or former drinkers (Filmore et al., 2006). The WHO acknowledges the evidence of a protective effect at levels of drinking as low as one drink (8–12 g) per day, but advised that health benefits should be sought by other means, because of the many adverse effects of alcohol (WHO, 2001).

Indeed, the adverse effects of alcohol consumption are many times higher than its protective cardiovascular effects, considering that consumption of alcohol is related to more than 60 medical

Table 2. Proportions attributable to alcohol use for major alcohol-related diseases and injuries (source: Room et al., 2005) and, in parentheses, the relative risks (RRs) of alcohol consumption (10–30 g per day; 2–3 drinks per day) in men (60+ years) and women (40+ years) (source: Dutch Health Council, 2006).

	Men	Women	Both
Mouth and oropharynx cancers	22% (5.4)	9% (5.4)	19%
Oesophageal cancer	37% (4.4)	15% (4.4)	29%
Liver cancer	30% (3.6)	13% (3.6)	25%
Breast cancer	–	7% (1.6)	7%
Unipolar depressive disorders	3%	1%	2%
Epilepsy	23% (7.5)	12% (6.8)	18%
Ischaemic heart disease	4%	–1%	2%
Haemorrhagic stroke	18% (2.4)	1% (8.0)	10%
Ischaemic stroke	3% (1.7)	–6% (1.1)	–1%
Liver cirrhosis	39% (13.0)	18% (13.0)	32%
Traffic accidents	25%	8%	20%
Drownings	12%	6%	10%
Homocide	26%	16%	24%

conditions (Table 2). For instance, chronic alcohol use is associated with cardiovascular diseases (Patra et al., 2010; Rehm et al., 2009, 2010) like hypertension (Taylor et al., 2009), haemorrhagic stroke (Patra et al., 2010) and atrial fibrillation (Samokhvalov et al., 2010). Regular alcohol consumption elevates blood pressure by approximately 1–2 mmHg for each 10 g alcohol consumed, but this seems largely reversible within 2–4 weeks after a substantial reduction in alcohol intake (Puddey and Beilin, 2006). In addition, binge drinking is an independent risk factor for (ischaemic) stroke (Sundell et al., 2008).

Furthermore, high alcohol consumption is associated to gastritis, gastric ulcers, severe stomach bleeding and lesions in oesophagus and duodenum and is an aetiological factor in acute and chronic pancreatitis (Rall, 1992). However, the most dominant non-carcinogenic effect induced by harmful drinking is liver cirrhosis. Liver cirrhosis caused by excessive drinking is increasing rapidly, with a 10-fold increase in the UK in the last 30 years (Anderson and Baumberg, 2006). More than half of all patients with hepatitis C have a past history of high alcohol consumption (Jamal et al., 2005).

Alcohol consumption is causally and significantly related to cancer of oral cavity, oropharynx, oesophagus and liver (Baan et al., 2007; Rehm et al., 2010) with RRs > 3.6 (Table 2). Much weaker, but significant, associations have been found for renal cell cancer, colon cancer, breast cancer and non-Hodgkin's lymphoma (Baan et al., 2007; Corrao et al., 1999; Doll, 1998; Hamajima et al., 2002; Longnecker, 1995; Rehm et al., 2010).

Furthermore, daily consumption of 10 g of alcohol (one alcoholic drink) decreases male and female fertility (Dutch Health Council, 2005), increases the incidence of spontaneous abortion, foetal death and preterm delivery and decreases length of gestation (Hassan and Killick, 2004). In contrast, the full spectrum of physical and mental handicaps of Foetal Alcohol Syndrome (FAS) is only seen in offspring of female heavy drinkers, that is, after long-term daily consumption of 90 g (or more) of alcohol (Dutch Health Council, 2005). Fortunately, in the last decade the number of pregnant women consuming alcohol declined, but not throughout the EU (see e.g. Gracia-Algar et al., 2008).

Essential nutritional deficiencies due to poor food intake or impaired gastrointestinal and hepatic function are probably responsible for psychiatric syndromes commonly seen in heavy alcohol users, such as Wernicke's encephalopathy, Korsakoff's psychosis, polyneuritis and encephalopathy, of which Wernicke–Korsakoff syndrome is most prominent (Rall, 1992).

Alcohol may impair the development of the brain or selectively retard cognitive maturation (Mattson et al., 2011) (although no conclusive evidence for the causal nature of these findings is available). As such, binge drinking by adolescents is believed to affect decision making, mood, motivation, memory, learning and attention, and school performance (Howland et al., 2010; Schweinsburg et al., 2010).

Mortality

Globally, 6.2% of all male deaths are attributable to alcohol, compared with 1.1% of female deaths (WHO, 2011a), and the worldwide total number of deaths attributable to alcohol consumption was estimated to be 2.25 million in 2004 (WHO, 2009). In the US, alcohol consumption accounts for 85,000 deaths per year, whereas all illegal drugs together account for 'only' 17,000 deaths. In the EU, alcohol consumption at harmful levels leads to 195,000 deaths each year due to cancer, liver cirrhosis, fatal accidents, homicides, suicides and neuropsychiatric conditions (Anderson and Baumberg, 2006; EUPHIX, 2007; Rehm et al., 2006). High alcohol consumption is the third main cause of early death and illness in the EU with 4.5 million disability adjusted life years (DALYs) lost and only more DALYs lost due to tobacco use (7.5 million) and hypertension (6 million) (Anderson and Baumberg, 2006). Alcohol-related mortality in Europe is highest in the lowest age group: in 15–29 year old subjects over 10% and 25% of mortality in males and females, respectively. In the UK, alcohol is the leading cause of death in males 18–50 years old (Jones et al., 2008).

Alcohol dependence

The WHO estimated that worldwide 76 million people were diagnosed with alcohol use disorders (WHO, 2004). It was further estimated that currently 6.1% of adult men and 1.1% of adult women are alcohol dependent in Europe (Rehm et al., 2005). More recent data showed that an alcohol use disorder was present in 14.6 million European citizens, representing 3.4% of the adult population (Wittchen et al., 2011). Importantly, this relatively small percentage with an alcohol use disorder is responsible for 60–70% of the alcohol-related societal costs (Mohapatra et al., 2010; Rehm, personal communication).

Young subjects are especially vulnerable to become addicted to alcohol. If children start drinking before the age of 13, they have a 40% higher risk to become addicted to alcohol than when they start later (Grant and Dawson, 1997). Moreover, being regularly drunk increases the risk for an alcohol disorder. Of Dutch students (average age 15.7 years), 46% had been drunk in the last year and 7% had been drunk three times or more in the last month (Hibbell et al., 2004). In German and English speaking countries and in Eastern Europe these figures were, however, 4–5-fold higher. In the EU, it is estimated that 55 million adults (14%) drink alcohol in harmful amounts, half of them being considered to meet criteria for alcohol abuse or dependence. Fortunately, a

large part (80–90%) of the alcohol abusers in the general population recover spontaneously within three years, whereas the recovery in alcohol dependent subjects was somewhat lower (67–74%) (Dawson et al., 2008; de Bruijn et al., 2006).

Societal harm related to alcohol consumption

The total costs and burden of societal harm may outweigh the health costs related to excessive alcohol consumption. Societal harm related to excessive alcohol use includes job loss, worker absenteeism, 'blue Monday' (lower productivity), violence, crime, criminal justice, relational conflicts, ambulant and specialized health care, and social exclusion and marginalization (Anderson and Baumberg, 2006; ICAP, 2006). Excessive alcohol use may affect not only the drinker, but also others in the private as well as the public environment (Laslett et al., 2011; Room et al., 2010). For instance, between five and nine million children in the EU live in families with alcohol problems (Anderson and Baumberg, 2006). The total health impact attributed to alcohol consumption (due to alcohol disorder and the secondary health effects linked to alcohol consumption) in the EU is estimated to be 6.1% of all deaths and 10.7% of all DALYs. Of total disease burden in the western EU member states (Eastern Europe and former Soviet states excluded), 11.9% of all DALYs in men and 1.4% in women can be attributed to alcohol (Rehm et al., 2006). Jones et al. (2008) reviewed the alcohol-attributable mortality and hospital admissions in the UK.

Although no direct comparisons are available, the societal harm of alcohol exceeds that of illicit drugs, mainly because the number of subjects with an alcohol use disorder is some three-fold higher than the number of people with a drug use disorder (cf. sections *Direct comparisons of harm related to alcohol and illicit drugs* above and *Reflection and balance* below).

Economic costs and benefits of alcohol use

It is difficult to make a solid cost–benefit analysis of alcohol use and abuse based on the data available in the literature. One of the best models (and analysis done) is the Sheffield Alcohol Policy Model (Purshouse et al., 2009, 2010) in England. Furthermore, an analytical framework report, including a cost–benefit analysis, was prepared for the New Zealand Law Commission (Marsden et al., 2009).

The total verifiable costs of alcohol to EU society in 2003 were estimated to amount to 125 billion euros, equivalent to 1.3% of the Gross Domestic Product (GDP) (Anderson and Baumberg, 2006; ICAP, 2006). The non-verifiable costs related to mental harm caused by crime and social disruption were estimated to be 270 billion euros or 2.8% of the GDP (Anderson and Baumberg, 2006; ICAP, 2006). Other costs – in addition to medical treatment – related to excessive alcohol consumption result from drunk-driving, unemployment, absenteeism, reduced productivity, premature mortality, and harms to others than the drinker.

On the other hand, the alcohol industry plays a considerable economic role in many EU member states. According to a report by RAND Europe (Horlings and Scoggings, 2006), the trade in alcohol contributes around 9 billion euros to the EU overall balance of trade, generates 600,000 jobs in production of alcoholic beverages, another 600,000 jobs supplying the goods and 2.6 million

jobs in retail of beer alone. According to the same report, alcohol excise duties in 15 of the older-member countries of the EU (EU-15) amounted to 25 billion euros in 2001, excluding sales taxes and other taxes paid within the supply chain (Anderson and Baumberg, 2006; ICAP, 2006). The total value added attributable to the production and sale of beer in Europe is estimated to amount to 59 billion euros (Berkhout et al., 2009). In addition, it has been estimated that for each job offered in the brewing sector, one job is generated in retail, two in the supplying sectors and more than 12 in the hospitality sector (Berkhout et al., 2009; ICAP, 2006). As such, the European spirits industry directly employs about 50,000 people and indirectly 250,000 people (ICAP, 2006). Furthermore, about 2.2 million people work in the EU in alcohol distribution and trade, while the hotel–restaurant–catering sector employs 17 million people. In the UK alone, approximately one million jobs are generated by the alcohol industry (Cabinet Office, 2003).

However, the figures of these reports should be interpreted with caution and the estimates may be inflated, because they come either directly from the alcohol industry or via commissioned research. Unfortunately, objective figures about the economic benefits of alcohol have not been described in publicly available literature. In addition, it should be emphasized that the alcohol industry has (most of) the economic merits, whereas solely the public society has to bear the financial burden of the adverse effects of alcohol overconsumption.

Finally, it is virtually impossible to evaluate the pleasure of drinking alcohol. Dodgson et al. (2003) made an attempt by estimating the consumer surplus, that is, how much more people would have been willing to pay for the good than the actual price they paid. Consumer surplus takes into account the happiness that moderate alcohol consumption brings, including the escape from mental stress and sorrow encountered in society, thereby improving mental health and well-being. Obviously, this approach is simplistic, has many methodological challenges (WHO, 2009) and it will provide only a proxy of this value.

Reflection and balance

In addition to highlighting the adverse health effects of excessive alcohol consumption, the aim of this paper is to create awareness of both the health and economic burden and the personal and social benefits associated to alcohol consumption. Clearly, the economic benefits of the alcohol industry pose a dilemma to policy makers on how to achieve a balance with the public health burden elicited by alcohol consumption.

Worldwide about two billion people consume alcohol and about 76 million people (only 3.7% of total users) are diagnosed with alcohol use disorders (WHO, 2004). It should be noted, however, that those with an alcohol use disorder (3.7%) are responsible for 60–70% of the damage and the costs (Mohapatra et al., 2010; Rehm et al., personal communication). Policy measures aiming at the reduction of alcohol use (e.g. regulation of sales, taxation) are complex and diminish the economic benefits, but closing the treatment gap and improving treatment effectiveness can reduce alcohol-related harm in a cost-effective way.

These figures imply that most people consume alcohol at a level that has a low impact on both individual health and society. Still, the high number of subjects with an alcohol use disorder puts a high economic burden on society. Indeed, low to moderate

alcohol consumption creates a benefit for the individual and society as a whole because it generates a pleasant feeling, promotes social interactions, gives some relief from daily stress and hassles and produces economic benefits. However, excessive alcohol use is very harmful both for the individual and society and should be prevented. Even when used at moderate levels, the contributing risk of alcohol for a limited number of chronic diseases and for social adversities (e.g. aggression, crime, job performance) is significant.

In summary, the estimated worldwide number of problematic users of alcohol is considerably higher than the number of problematic users of opioids, cocaine and amphetamines (1.2% vs. 0.3–0.9%) (Degenhardt and Hall, 2012). Based on the estimate of UNODC of 27 million problematic users of illicit drugs (including cannabis) (UNODC, 2012), the number of subjects with an alcohol use disorder (76 million) (WHO, 2010b, 2011b) is some three times higher. In addition, the estimated number of attributable deaths and DALYs is much higher for alcohol use disorders than for problem illicit drug use (3.8% vs. 0.4% and 4.5% vs. 0.9%, respectively) (Degenhardt and Hall, 2012). Together, these data suggest that excessive alcohol consumption is more harmful for public health and for society than the use of illicit drugs. Therefore, the key message remains upheld that policy-makers unjustifiably emphasize the harm of illicit drugs, whereas they often underestimate and neglect the harm of alcohol use. Policy makers should therefore consider alcohol to be at least as harmful as illicit drugs and invest in prevention and harm reduction strategies for harmful drinking. To establish a more balanced drug policy, either alcohol abuse should be more discouraged and/or the use of illicit drugs should be liberalized. Reduced illicit drug enforcement (see e.g. Reuter, 2009) and controlled liberalization (MacCoun, 2011; van den Brink, 2008; Wodak and Cooney, 2004) is advocated, because prohibition and criminalization of illicit drug use is hardly effective to decrease the prevalence of use and it has a negative impact on public health and increases acquisitive crime. At all times, national drug policy should be science-based and aimed at harm reduction.

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Conflict of interest statement

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References

- Alonso J, Angermeyer MC, Bernert S, et al. (2004) Use of mental health services in Europe: Results from the European Study of the Epidemiology of Mental Disorders (ESEMeD) project. *Acta Psychiatr Scand Suppl* 240: 47–54.
- Ambrogne JA (2012) Reduced-risk drinking as a treatment goal: What clinicians need to know. *J Subst Abuse Treat* 22: 45–53.
- Anderson P and Baumberg B (2006) *Alcohol in Europe. A Public Health Perspective. A report for the European Commission*. London: Institute of Alcohol Studies. Available at: <http://dse.univr.it/addiction/documents/External/alcoholineu.pdf> (accessed 27 December 2012). Report summary, p. 6. *Drugs Education Prev Policy* 13: 483–488.
- Anderson P, Christolm D and Fuhr D (2009) Effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol. *Lancet* 373: 2234–2246.
- Baan R, Straif K, Grosse Y, et al. (2007) Carcinogenicity of alcoholic beverages. WHO International Agency for Research on Cancer Monograph Working Group. *Lancet Oncol* 8: 292–293.
- Berkhout B, Boersma N, Kruis G, et al. (2009) The contribution made by beer to European economy. *Ernst & Young Tax Advisors and Regioplan Policy Research*. Brussels: Brewers of Europe.
- Blincoe L, Sealy A, Zaloshnja E, et al. (2002) *The Economic Impact of Motor Vehicle Crashes 2000*. Washington, DC: Dept of Transportation (US), National Highway Traffic Safety Administration (NHTSA).
- Cabinet Office (2003) Strategy Unit Alcohol Harm Reduction project. Interim Analytical Report. Available at: http://www.cabinetoffice.gov.uk/strategy/downloads/files/SU%20interim_report2.pdf (accessed 27 December 2012).
- Cherpitel CHJ (2007) Alcohol and injuries: A review of international emergency room studies since 1995. *Drug Alcohol Rev* 26: 201–214.
- Christolm D, Rehm J, Frick U, et al. (2009) Alcohol policy cost effectiveness briefing notes for 22 European countries. Available at: <http://www.ias.org.uk/buildingcapacity/resources/briefing-notes/cp-all-countries.pdf> (accessed 27 December 2012).
- Christolm D, Rehm J, van Ommeren M, et al. (2004) Reducing the global burden of hazardous alcohol use: A comparative cost-effectiveness analysis. *J Stud Alcohol* 65: 782–793.
- Cohen E, Feinn R, Arias A, et al. (2007) Alcohol treatment utilization: Findings from the National Epidemiologic Survey on Alcohol and Related Conditions. *Drug Alcohol Depend* 86: 214–221.
- Corrao G, Bagnardi V, Zambon A, et al. (1999) Exploring the dose-response relationship between alcohol consumption and the risk of several alcohol-related conditions: A meta-analysis. *Addiction* 94: 1551–1573.
- Costanzo S, Di Castelnuovo A, Donati MB, et al. (2010) Alcohol consumption and mortality in patients with cardiovascular disease: A meta-analysis. *J Am Coll Cardiol* 30: 1339–1347.
- Dawson DA, Stinson FS, Chou SP, et al. (2008) Three-year changes in adult risk drinking behavior in relation to the course of alcohol-use disorders. *J Stud Alcohol Drugs* 69: 866–877.
- de Bruijn C, van den Brink W, de Graaf R, et al. (2006) The three year course of alcohol use disorders in the general population: DSM-IV, ICD-10 and the Craving Withdrawal Model. *Addiction* 101: 385–392.
- Degenhardt L and Hall W. (2012) Extent of illicit drug use and dependence, and their contribution to the global burden of disease. *Lancet* 379: 55–70.
- Dodgson J, Bramley-Harker E, Spackman M, et al. (2003) *Alcohol in London: A cost-benefit analysis – a final report for the Greater London Authority*. Prepared by NERA Economic Consulting. Available at: http://www.nera.com/67_4845.htm (accessed 27 December 2012).
- Doll R (1998) Epidemiological evidence of the effects of behaviour and the environment on the risk of human cancer. *Recent Results Cancer Res* 154: 3–21.
- Donaldson L (2009) *Guidance on the consumption of alcohol by children and young people. A report by the Chief Medical Officer*. 101 pp. Available at: <http://www.drugsandalcohol.ie/12725/> (accessed 27 December 2012).
- Dowden C and Brown SL (2012) The role of substance abuse factors in predicting recidivism: A meta-analysis. *Psychol Crime Law* 8: 243–264.
- Dutch Health Council [Gezondheidsraad] (2005) *Risico's van Alcoholgebruik bij Conceptie, Zwangerschap en Borstvoeding*. The Hague, the Netherlands: Gezondheidsraad.
- Dutch Health Council [Gezondheidsraad] (2006) *Ethanol (ethyl alcohol); evaluation of the health effects from occupational exposure*. Publication no. 2006/06OSH. The Hague, the Netherlands: Gezondheidsraad.

- Encyclopædia Britannica (2010) Ultimate Reference Suite. *Chicago*. Available at: <http://www.britannica.com> (accessed 27 December 2012).
- EUPHIX (2007) Medical conditions and social harms related to alcohol consumption. In: *EUPHIX, EUphact*. Bilthoven, The Netherlands: RIVM. Available at : http://www.euphix.org/object_class/euph_health_behaviours_alcohol_use.html (accessed 12 January 2012).
- Filmore KM, Kerr WC, Stockwell T, et al. (2006) Moderate alcohol use and reduced mortality risk: Systematic error in prospective studies. *Addict Res Theory* 14: 101–132.
- Fuchs CS, Stampfer MJ, Colditz GA, et al. (1995) Alcohol consumption and mortality among women. *N Engl J Med* 332: 1245–1250.
- Gastfriend DR, Garbutt JC, Pettinati HM, et al. (2007) Reduction in heavy drinking as a treatment outcome in alcohol dependence. *J Subst Abuse Treat* 33: 71–80.
- Gracia-Algar O, Kulaga V, Gareri J, et al. (2008) Alarming prevalence of fetal alcohol exposure in a Mediterranean city. *Ther Drug Monit* 30: 249–254.
- Grant BF and Dawson DA (1997) Age at onset of alcohol use and its association with DSM-IV alcohol abuse and dependence: Results from the National Longitudinal Alcohol Epidemiologic Survey. *J Subst Abuse* 9: 103–110.
- Gronbaek M (2009) The positive and negative health effects of alcohol and the public health implications. *J Intern Med* 265: 407–420.
- Gustafson R (1993) What do experimental paradigms tell us about alcohol-related aggressive responding? *J Stud Alcohol Suppl* 11: 20–29.
- Hamajima N, Hirose K, Tajima K, et al. (2002) Alcohol, tobacco and breast cancer – collaborative reanalysis of individual data from 53 epidemiological studies, including 58,515 women with breast cancer and 95,067 women without the disease. *Br J Cancer* 87: 1234–1245.
- Hasin DS, Stinson FS, Ogburn E, et al. (2007) Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Arch Gen Psychiatry* 64: 830–842.
- Hassan MAM and Killick SR (2004) Negative lifestyle is associated with a significant reduction in fecundity. *Fertil Steril* 81: 384–392.
- Hibbell B, Anderson B, Bjarnason T, et al. (2004) *The ESPAD Report 2003: Alcohol and Other Drug use Among Students in 35 European countries*. Stockholm: CAN.
- Horlings E and Scoggings A (2006) *An ex ante assessment of the economic impacts of EU alcohol policies*. RAND Technical Report TR-412-EC. Leiden, The Netherlands: RAND Europe for the European Commission. http://www.rand.org/pubs/technical_reports/TR412/.
- Howland J, Rohsenow DJ, Greece JA, et al. (2010) The effects of binge drinking on college students' next-day academic test-taking performance and mood state. *Addiction* 105: 655–665.
- ICAP (2006) International Center for Alcohol Policies (ICAP) Reports 17. *The structure of the beverage alcohol industry*. March 2006. Available at: <http://www.icap.org/Publications/ICAPReports/tabid/75/Default.aspx>. (accessed 27 December 2012).
- Jamal M, Saadi Z and Morgan TR. (2005) Alcohol and hepatitis C. *Dig Dis* 23: 285–296.
- Jones L, Bellis MA, Dedman D, et al. (2008) *Alcohol-attributable Fractions for England. Alcohol-attributable Mortality and Hospital Admissions*. Centre for Public Health Faculty of Health and Applied Social Sciences. Liverpool John Moores University. North West Public Health Observatory. Available at: <http://www.nwpho.net/nwpho/publications/alcoholattributablefractions.pdf>. (accessed 27 December 2012).
- Keyes KM, Hatzenbuehler ML, McLaughlin KA, et al. (2010) Stigma and treatment for alcohol disorders in the United States. *Am J Epidemiol* 172: 1364–1372.
- Klatsky AL, Armstrong MA and Friedman GD. (1997) Red wine, white wine, liquor, beer, and risk for coronary artery disease hospitalization. *Am J Cardiol* 80: 416–420.
- Laslett AM, Room R, Ferris J, et al. (2011) Surveying the range and magnitude of alcohol's harm to others in Australia. *Addiction* 106: 1603–1611.
- Lipsey MW (1997) Is there a causal relationship between alcohol use and violence? A synthesis of evidence. In: Galanter M (ed.) *Recent Developments in Alcoholism, Vol. 13: Alcoholism & Violence*. New York: Plenum Press.
- Longnecker MP. (1995) Alcohol consumption and risk of cancer in humans: An overview. *Alcohol* 12: 87–96.
- MacCoun RJ (2011) What can we learn from the Dutch cannabis coffee-shop system? *Addiction* 106: 1899–1910.
- Marsden J, Tunny G and Jones PH (2009) *The benefits, costs and taxation of alcohol: Towards an analytical framework* (A report prepared for the New Zealand Law Commission, Marsden Jacob Associates). http://www.marsdenjacob.com.au/cms/index.php?option=com_content&task=view&id=100&Itemid=81
- Mattson SN, Crocker N and Nguyen TT (2011) Fetal alcohol spectrum disorders: neuropsychological and behavioral features. *Neuropsychol Rev* 21: 81–101.
- Mohapatra S, Patra J, Popova S, et al. (2010) Social cost of heavy drinking and alcohol dependence in high-income countries. *Int J Public Health* 55: 149–157.
- NHTSA (2010) Traffic Safety Facts. 2009 Data: Alcohol-Impaired Driving. Washington (DC): Dept of Transportation (US), National Highway Traffic Safety Administration (NHTSA). Available at: <http://www.nrd.nhtsa.dot.gov/Pubs/811385.pdf> (accessed 27 December 2012).
- Nutt DJ, King LA and Phillips LD. (2010) Drug harms in the UK: A multicriteria decision analysis. *Lancet* 376: 1558–1565.
- Nutt D, King LA, Saulsbury W, et al. (2007) Development of a rational scale to assess the harm of drugs of potential misuse. *Lancet* 369: 1047–1053.
- Patra J, Taylor B, Irving H, et al. (2010) Alcohol consumption and the risk of morbidity and mortality for different stroke types, a systematic review and meta-analysis. *BMC Public Health* 10: 258.
- Pescosolido BA, Martin JK, Long JS, et al. (2010) 'A disease like any other'? A decade of change in public reactions to schizophrenia, depression, and alcohol dependence. *Am J Psychiatry* 167: 1321–1330.
- Puddey IB and Beilin LJ. (2006) Alcohol is bad for blood pressure. *Clin Exp Pharmacol Physiol* 33: 847–852.
- Purshouse R, Brennan A, Latimer N, et al. (2009) *Modelling to assess the effectiveness and cost-effectiveness of public health related strategies and interventions to reduce alcohol attributable harm in England using the Sheffield Alcohol Policy Model version 2.0*. Report to the NICE Public Health Programme Development Group. NICE Public Health Collaborating Centre at the University of Sheffield, Sheffield, UK.
- Purshouse RC, Meier PS, Brennan A, et al. (2010) Estimated effect of alcohol pricing policies on health and health economic outcomes in England: An epidemiological model. *Lancet* 375: 1355–1364.
- Rall TW (1992) Hypnotics and sedatives: Ethanol. In: *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. New York: McGraw-Hill, Ch. 17.
- Rehm J, Baliunas D, Borges GLG, et al. (2010) The relation between different dimensions of alcohol consumption and burden of disease: An overview. *Addiction* 105: 817–843.
- Rehm JT, Bondy SJ, Sempos CT, et al. (1997) Alcohol consumption and coronary heart disease morbidity and mortality. *Am J Epidemiol* 146: 495–501.
- Rehm J, Mathers C, Popova S, et al. (2009) Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *Lancet* 373: 2223–2233.
- Rehm J, Room R, van den Brink W, et al. (2005) Alcohol use disorders in EU countries and Norway: An overview of the epidemiology. *Eur Neuropsychopharmacol* 15: 377–388.
- Rehm J, Taylor B and Patra J (2006) Volume of alcohol consumption, patterns of drinking and burden of disease in the European region 2002. *Addiction* 101: 1086–1095.
- Rehm J, Room R, Graham K, et al. (2003) The relationship of average volume of alcohol consumption and patterns of drinking to burden of disease: an overview. *Addiction* 98: 1209–1228.

- Reuter P (2009) Ten years after the United Nations General Assembly Special Session (UNGASS): Assessing drug problems, policies and reform proposals. *Addiction* 104: 510–517.
- Rigter H (2006) What drug policies cost. Drug policy spending in the Netherlands in 2003. *Addiction* 101: 323–329.
- Ronksley PE, Brien SE, Turner BJ, et al. (2011) Association of alcohol consumption with selected cardiovascular disease outcomes: A systematic review and meta-analysis. *BMJ* 342: d671.
- Room R and Rossow I (2001) The share of violence attributable to drinking. *J Subst Use* 6: 218–228.
- Room R, Babor T and Rehm J. (2005) Alcohol and public health. *Lancet* 365: 519–530.
- Room R, Ferris J, Laslett AM, et al. (2010) The drinker's effect on the social environment: A conceptual framework for studying alcohol's harm to others. *Int J Environ Res Public Health* 7: 1855–1871.
- Samokhvalov AV, Irving HM and Rehm J. (2010) Alcohol consumption as a risk factor for atrial fibrillation: A systematic review and meta-analysis. *Eur J Cardiovasc Prev Rehabil* 17: 706–712.
- Schweinsburg AD, McQueeney T, Nagel BJ, et al. (2010) A preliminary study of functional magnetic resonance imaging response during verbal encoding among adolescent binge drinkers. *Alcohol* 44: 111–117.
- Sellman JD, Robinson GM and Beasley R (2009) Should ethanol be scheduled as a drug of high risk to public health? *J Psychopharmacology* 23: 94–100.
- Sundell L, Salomaa V, Vartiainen E, et al. (2008) Increased stroke risk is related to a binge-drinking habit. *Stroke* 39: 3179–3184.
- Taylor B, Irving HM, Baliunas D, et al. (2009) Alcohol and hypertension: Gender differences in dose–response relationships determined through systematic review and meta-analysis. *Addiction* 104: 1981–1990.
- Thun MJ, Peto R, Lopez AD, et al. (1997) Alcohol consumption and mortality among middle-aged and elderly U.S. adults. *N Engl J Med* 337: 1705–1714.
- UKDH (1995) *Sensible drinking. The report of an inter-departmental working group*. Wetherby, UK: UK Department of Health.
- UNODC (2012) World drug report 2012. Vienna: United Nations Office on Drugs and Crime (UNODC). Available at: www.unodc.org/unodc/en/data-and-analysis/WDR-2012.html (accessed 27 December 2012).
- van Amsterdam JGC, Opperhuizen A, Koeter M, et al. (2010) Ranking the harm of alcohol, tobacco and illicit drugs for the individual and the population. *Eur Addict Res* 16: 202–207.
- van den Brink W (2008) Forum: Decriminalization of cannabis. *Curr Opin Psychiatry* 21: 122–126.
- van den Brink W (2012) Evidence-based pharmacological treatment of substance use disorders and pathological gambling. *Curr Drug Abuse Res* 5: 3–21.
- Walker A, Kershaw C and Nicolas S (2006) British Crime Survey. *Crime in England and Wales*. Available at: <http://www.homeoffice.gov.uk/rds/pdfs06/hosb1206.pdf>
- WHO (1999) *Global status report on alcohol 1999*. Geneva: World Health Organization (WHO), 45 pp. Available at: http://whqlibdoc.who.int/hq/1999/WHO_HSC_SAB_99.11_pp1-112.pdf (accessed 27 December 2012).
- WHO (2001) *Global status report on alcohol (summary)*. Geneva: World Health Organization (WHO). Available at: http://www.who.int/substance_abuse/publications/en/globalstatussummary.pdf (accessed 27 December 2012).
- WHO (2004) *Global status report: Alcohol policy*. Geneva: World Health Organization (WHO).
- WHO (2006) *WHO Expert Committee on Problems Related to Alcohol Consumption*. 2nd report 2006. WHO Technical Report Series, no. 944. Geneva: World Health Organization (WHO). Available at: http://www.who.int/substance_abuse/expert_committee_alcohol_trs944.pdf (accessed 27 December 2012).
- WHO (2009) Global health risks. Mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization (WHO). Available at: http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf (accessed 27 December 2012).
- WHO (2010a) Alcohol in Europe. Available at: http://ec.europa.eu/health-eu/doc/alcoholineu_chap4_en.pdf (accessed 27 December 2012).
- WHO (2010b) Atlas on substance abuse: Resources for the prevention and treatment of substance use disorders. *World Health Organization (WHO)*. Available at: http://www.who.int/substance_abuse/publications/Media/en/ (accessed 27 December 2012).
- WHO (2010c) *World Health Statistics 2010. WHO Statistical Information System (WHOSIS)*. World Health Organization (WHO). Available at: <http://www.who.int/whosis/whostat/2010/en/index.html> (accessed 27 December 2012).
- WHO (2011a) *Global status report on alcohol and health*. World Health Organization (WHO). Available at: http://www.who.int/substance_abuse/publications/global_alcohol_report/msbgsruprofiles.pdf (accessed 27 December 2012).
- WHO (2011b) mhGAP newsletter – Mental Health Gap Action Programme. World Health Organization (WHO), January 2011. Available at: http://www.who.int/mental_health/mhGAP_nl_June_2012.pdf (accessed 27 December 2012).
- Wittchen HU, Jacobi F, Rehm J, et al. (2011) The size and burden of mental disorders and other disorders of the brain in Europe 2010. *Eur Neuropsychopharmacol* 21: 655–679.
- Wodak A and Cooney A (2004) Should cannabis be taxed and regulated? *Drug Alcohol Rev* 23: 139–141.