

Alcohol Consumption and the Burden of Disease

The Issue in Brief

The Global Burden of Disease (GBD) study assesses the relative contribution of major diseases and injuries—and the risk factors that cause them—to premature death and disability.

The debate around alcohol's involvement in GBD assessment relates, in particular, to whether all drinking or only alcohol abuse should be included, and to implications for policy.

The evidence:

Calculating the burden of disease

- Many diseases, injuries, or deaths are related to exposure to certain risk factors or hazards. Their contribution to the burden of disease is calculated in terms of so-called Disability Adjusted Life Years (DALYs).
- DALYs allow different risk factors and different diseases to be compared in terms of their public health impact.

Alcohol as a risk factor

- The GBD study lists alcohol among the 10 leading risk factors.
- Although alcohol may be a risk factor for certain diseases, it does not necessarily cause them.
- Certain diseases to which alcohol contributes occur and develop without the involvement of alcohol.

The distribution of alcohol-attributable disease burden

- The alcohol-attributable burden of disease varies by age and gender, with a higher burden for males and younger age groups.
- The proportion of alcohol-attributable deaths varies between regions, as does the burden of disease.
- It has been estimated that the burden of disease attributable to alcohol is higher in low-income countries than in high-income countries.

ICAP Issues Briefings address specific topics relevant to alcohol policy, providing a succinct overview of key evidence. Where appropriate, they include an analysis of intended and unintended outcomes, country-level case studies, and main positions around a particular debate.

Limitations:

- Alcohol is inherently different from other risk factors in the GBD study: Its outcomes include benefits as well as harms and are strongly related to drinking patterns.
- To account for drinking patterns, it has been proposed that GBD estimates should include alcohol abuse—not simply “alcohol”—as a risk factor.
- Calculations of GBD depend largely on aggregate measures of volume, which do not account for different drinking behaviors or for unrecorded alcohol consumption.
- The quality of survey data used to estimate alcohol consumption, as well as disease and death rates, is variable across countries.
- Confounding factors cannot always be accounted and controlled for when determining the effect of a particular risk factor.
- Most conditions involving alcohol can also be caused by other risk factors, and many diseases involve multiple factors and have different etiologies.
- The involvement of alcohol as a causal factor is particularly difficult to estimate in regard to social harms.
- Attribution of risk is not always objective, which may further confound the issue.

Relevant ICAP publications:

Ellison, R. C. (Ed.). (2007, May). Health risks and benefits of moderate alcohol consumption: Proceedings of an international symposium. *Annals of Epidemiology*, 17(Suppl.), S1–S116.

Grant, M., & Litvak, J. (Eds.). (1998). *Drinking patterns and their consequences*. Washington, DC: Taylor & Francis.

Stimson, G. V., Grant, M., Choquet, M., & Garrison, P. (Eds.). (2007). *Drinking in context: Patterns, interventions, and partnerships*. New York: Routledge.

What Is the Issue?

The Global Burden of Disease (GBD) study assesses the relative contribution of major diseases and injuries—and the risk factors that cause them—to premature death and disability.

The study was first conducted in 1990 by the World Bank, the World Health Organization (WHO) (1, 2), and a number of collaborating academic institutions.

- The analysis relies on the use of a single measure for comparing the public health impact of the most common risk factors for health.
- It provides a framework for examining the comparative importance of diseases and injuries across populations by age and sex at country, regional, and global levels.

A health risk is defined as a “factor that raises the probability of adverse health outcomes” (50, p. v).

Alcohol is identified as one of the 10 leading risk factors worldwide.

- According to estimates based on 2004 data, the burden attributable to alcohol worldwide was 3.6% of deaths and 4.4%¹ of Disability Adjusted Life Years (DALYs) (50).

What Is the Debate?

The debate around alcohol’s involvement in GBD assessment relates, in particular, to whether all drinking or only alcohol abuse should be included.

However, other issues have also been raised, including:

- reliability of available data;
- relative contributions of recorded and unrecorded alcohol;
- different outcomes for different drinking patterns;
- accounting for the beneficial effects of drinking, somatic health, and social and mental wellbeing;
- alcohol as a causal factor for many diseases.

These issues are relevant not only to the assessment of alcohol’s contribution to the disease burden but also to policy recommendations:

“Because there are no bounds on the sum of attributable fractions, there is also no limiting factor to temper the claims of advocates or analysts. For this reason one must interpret the estimates of attributable burden of any given exposure with great caution.” (2, p. 598)

What Is the Evidence?

Calculating the burden of disease

Data used for the assessment of GBD are collected at country level, using a standardized coding system for causes of mortality and morbidity.

This system, the International Classification of Diseases (ICD), is used by health professionals in countries worldwide (4), who assign a code to each diagnosis that is made.

Data on mortality, disease, and injury are pooled to obtain epidemiological information, including:

- *prevalence* – the proportion of a population with a particular disease at a given point in time;
- *incidence* – the number of new cases of a disease occurring during a given period of time.

Many diseases, injuries, or deaths are related to exposure to certain risk factors or hazards.

These risk factors may directly cause a particular disease (or death) or may be associated with it. In some cases, they may be involved in its progression.

The contribution of deaths, injuries, and diseases to the burden of disease is calculated in terms of Disability Adjusted Life Years (5).

Table 1. Estimated Attributable Burden from Leading Risk Factors

<i>Risk Factor</i>	<i>DALYs (millions)</i>	<i>Percent of Total</i>
Childhood underweight	91	5.9
Unsafe sex	70	4.6
Alcohol use	69	4.5
Unsafe water, sanitation, and hygiene	64	4.2
High blood pressure	57	3.7
Tobacco use	57	3.7
Suboptimal breastfeeding	44	2.9
High blood glucose	41	2.7
Indoor smoke from solid fuels	41	2.7
Overweight and obesity	36	2.3

Source: World Health Organization, 2009 (50)

¹ The 2009 report on global health risks (50) uses both 4.4% and 4.5% (see Table 1 on this page) as the percentage of DALYs attributable to alcohol worldwide.

DALYs include two measures:

- life years lost to premature death;
- life years lost to combined death and disability.

These are derived from the ideal projected life expectancy of an individual at the time of death or hospitalization in the absence of the disease.

In simple terms:

$$\text{Number of years lost to disability} = (\text{Number of new cases in a year}) \times (\text{Disability weight}) \times (\text{Average length and duration of a disability})$$

- For nonfatal diseases, the number of years lost is estimated by multiplying the time an “average” patient is sick by a disability factor, ranging between 0 and 1, specific to each disease.
- The more disabling a disease, the closer to 1 is the disability factor.

Similarly, for deaths and disabilities together:

$$\text{DALYs} = (\text{Years lost to premature death}) + (\text{Years lost to disability})$$

DALYs are also used to assess the contribution of various risk factors to the burden of disease.

This contribution is assessed in terms of “attributable fractions,” which represent the proportion of a disease that would be eliminated if the risk factor were absent (6).

Table 1 shows the relative impact of the top 10 risk factors in terms of DALYs.

It is important to note that risk factors are not the same as causes of disease and injury.

Causes refer to the specific diseases or injuries that account for mortality and morbidity.

Some of the leading causes of disease and injury include (8):

- lower respiratory infection;
- diarrheal diseases;
- unipolar depressive disorders;
- ischemic heart disease;
- HIV/AIDS;
- cerebrovascular disease;
- prematurity and low birth weight;
- birth asphyxia and birth trauma;
- road traffic accidents;
- neonatal infections and other noninfectious causes in the perinatal period.

DALYs allow comparisons of the public health impact of different risk factors, as well as of different diseases and injuries.

DALYs have also been used for other purposes (7):

- providing a performance indicator for progress in reducing diseases and disabilities;
- helping to identify national priorities for disease control;
- allocating time of clinical and public health practitioners;
- allocating research and development resources;
- allocating resources to health interventions.

DALYs and estimates of the disease burden are used to set the policy agenda around health issues.

Alcohol as a risk factor

The GBD Study lists alcohol among the 10 leading risk factors by attributable burden (see Table 1).

The degree to which alcohol is involved in causes of death and in disease diagnoses is complicated and varied.

Alcohol is involved, by definition, in the so-called alcohol use disorders. For these diseases, alcohol consumption is a necessary cause.

In addition, alcohol is a risk factor for various other conditions (3; see Table 2), without necessarily causing them. For example:

- Cirrhosis of the liver may be caused by hepatitis B or C, as well as by other factors, without the involvement of alcohol.
- Although alcohol may be present in some homicides or motor vehicle accidents, many of these incidents do not involve alcohol.

Disease conditions related to alcohol have been grouped into three broad categories, defined by the nature of the disease and the involvement of alcohol in their etiology (9):

- wholly attributable to alcohol (by definition) – e.g., alcohol use disorders, alcoholic fatty liver and cirrhosis, ethanol toxicity;
- chronic conditions where a significant relationship with alcohol as a contributing cause has been found – e.g., cancers of the mouth and throat, breast cancer, ischemic stroke;
- acute conditions where alcohol is a contributing cause – e.g., road traffic crashes, drowning.

Table 2. Diseases and Injuries Involving Alcohol as a Risk Factor

Conditions Involving Alcohol as a Risk Factor
● Cirrhosis of the liver
● Drowning
● Epilepsy
● Falls
● Hemorrhagic stroke
● Homicide
● Ischemic heart disease
● Unipolar depressive disorders
● Liver cancer
● Mouth and oropharynx cancer
● Esophageal cancer
● Other cancers
● Self-inflicted injuries
● Poisoning
● Other intentional injuries
● Motor vehicle accidents
● Other unintentional injuries

Source: World Health Organization, 2002 (3)

The relationship between alcohol and long-term health and social outcomes has been described through three mechanisms (9, 10):

- direct biological effects of ethanol –which may influence chronic diseases;
- intoxication – involved mainly in acute outcomes, such as accidents;
- dependence – impact on both chronic and acute physiological and social outcomes (11).

Increasing attention is being paid to the relationship between alcohol and communicable diseases (12).

Currently, alcohol-attributable diseases do not include any communicable diseases.

- However, it has been argued that some infectious diseases, notably tuberculosis and HIV/AIDS, should be included, as they may be associated with (mostly heavy) alcohol consumption (13-17).

The distribution of alcohol-attributable disease burden

The alcohol-attributable burden of disease varies by age and gender.

In general, the contribution of alcohol to GBD is higher for men than for women (18).

- According to 2004 data, 7.6% of DALYs for men and 1.4% for women were attributed to alcohol.
- Based on the same data, 6% of deaths among men and 1.1% of deaths among women globally were attributed to alcohol (50).

Estimates show a significant burden of alcohol for younger age groups (18):

- 33.6% of all alcohol-attributable DALYs are for those in the age groups between 15 and 29 years.

The proportion of alcohol-attributable deaths varies between regions, as does the burden of disease.

- In low-income countries, “traditional” risks—those associated with poverty (e.g., under-nutrition) and communicable diseases—are most salient (50).
- In middle- and high-income countries, on the other hand, the major risks are associated with chronic and non-communicable diseases (50).

Alcohol consumption is generally higher for developed than for developing countries (18, 50).

However, it has been estimated that the burden of disease attributable to alcohol is higher in lower income than in higher income countries (19).

- The highest proportion of deaths attributable to alcohol has been calculated for Eastern Europe and Latin America (50).
- Poorer populations in low-income countries are thought to shoulder a disproportionate burden per liter of alcohol consumed as compared to populations in higher-income countries (18).

Table 3 shows the alcohol-attributable burden of disease (in DALYs) for chronic disease and injury, by region.

Table 3. Alcohol-attributable DALYs for Chronic Disease and Injury by World Bank Region (in thousands of DALYs)

<i>Disease Category</i>	<i>Europe and Central Asia</i>	<i>Latin America and the Caribbean</i>	<i>Sub-Saharan Africa</i>	<i>Middle East and North Africa</i>	<i>East Asia and the Pacific</i>	<i>South Asia</i>	<i>High-income countries</i>	<i>World</i>
<i>Chronic Disease</i>	6,511	5,283	2,769	182	10,296	3,167	4,526	33,634
<i>Injury</i>	5,949	3,856	3,382	144	4,540	2,789	2,324	22,374
<i>Total DALYs Attributable to Alcohol</i>	12,460	9,139	6,151	326	14,836	5,956	6,850	56,008
<i>Proportion of DALYs Attributable to Alcohol (%)</i>	10.7	8.8	1.8	0.5	4.3	1.5	4.6	3.6

Source: Rehm, Chisholm, Room, & Lopez, 2006 (19)

What Are the Limitations?

Several confounding factors have been raised with regard to the contribution of alcohol to GBD, both in relation to the methodology used and the interpretation of results.

Data collection and analysis are not standardized across different assessments of GBD, making comparison difficult and possibly affecting the interpretation of results.

Risk factors included in the 2009 assessment of GBD (based on 2004 data; see 50) are different from those used in earlier assessments. For example:

- The 2002 assessment of GBD includes “underweight” as a leading risk factor (3); in the 2009 assessment (50), leading risk factors include “childhood underweight,” changing the attributable percentage of total DALYs from 9.5% to 5.9%.
- Whereas high cholesterol and iron deficiency are included in the 2002 data (3), the 2009 assessment includes suboptimal breastfeeding and high blood glucose (50). The selection of risk factors included affects the standing of each relative to the others.
- The 2009 report on global health risks (50) includes analysis of low-, middle-, and high-income countries. In the 2002 World Health Report (3), on the other hand, countries are grouped by child mortality strata by region and as developing or developed countries, while a third report, published in 2006 by the World Bank Group (19) divides countries by geographic region.

Relationship with drinking patterns

Alcohol is inherently different from other risk factors in the GBD study in that its outcomes are strongly related to drinking pattern.

One of the main shortcomings of the GBD methodology is its inability to adequately differentiate between low, moderate, and heavy and abusive drinking patterns, all of which are associated with different outcomes.

- Harms are generally associated with heavy drinking patterns (20), while benefits are associated with low to moderate consumption (21, 22).
- Chronic harms are related to sustained drinking, while acute harms may result from a single episode.

These differences are not captured in GBD assessments.

To account for drinking patterns, it has been proposed that GBD estimates should include alcohol abuse—not simply “alcohol”—as a risk factor (23).

Although efforts have been made to construct a scale that groups countries by drinking pattern (24), this attempt also has several shortcomings.

- It presupposes that patterns remain constant over time.
- It does not account for variations in patterns within the population of a country—some individuals are abstainers, others moderate or heavy drinkers, so variation is inevitable.

While exposure to other risk factors has a largely linear relationship with harm, alcohol's relationship is J-shaped and includes benefits as well as harms (21, 23).

More recent calculations of GBD have attempted to take the beneficial contribution of alcohol consumption into account, notably for cardiovascular diseases, stroke, and diabetes mellitus.

Cardiovascular and certain other health benefits of moderate drinking are particularly associated with older populations (25). An aging population in many industrialized countries in regions like Europe and North America suggest that offsetting harms with benefits is an important consideration.

While some of the somatic benefits of alcohol consumption have been taken into consideration, the social and mental health benefits are not accounted for.

This is, in part, due to the absence of an adequate methodology for quantifying these benefits (23, 26, 27).

However, there is strong evidence to suggest that moderate alcohol consumption affects cognitive function, subjective wellbeing, and quality of life (28-30). These, in turn, have a demonstrated effect on physical health status (31).

Data collection

Calculations of GBD depend largely on aggregate measures of volume for a country, or its per capita alcohol consumption.

They do not take into consideration drinking patterns in terms of the distribution of consumption across populations—whereas some individuals are heavy drinkers, others are moderate drinkers or abstainers.

These differences are likely to influence outcomes and involvement in disease or injury.

Aggregate volume measures, largely derived from sales data, do not account for drinking patterns among men and women, different age groups, and other population groupings.

These data have to be extrapolated from additional population surveys, which are not consistent or of uniform quality across countries (32).

- Only 52% of countries included in the GBD analysis for which per capita consumption data were available also had available survey data.

- For the remaining 48%, estimates were made on the basis of survey data from neighboring countries, matched according to cultural and geographic similarities.

More recent assessments of GBD have attempted to address drinking patterns for individual countries, but data are still lacking for many parts of the world.

Aggregate sales data also do not include figures for unrecorded alcohol consumption.

Although estimates vary, unrecorded alcohol may account for around 30% of total global alcohol consumption and is estimated to be significantly higher in some regions (33).

- The quality of unrecorded beverages (be they illicit or legally home-produced) is likely to be a contributing factor to harmful outcomes and thereby to the disease burden (34-36).

Estimates used for disease and death rates are equally inconsistent, as data collection in many countries is unreliable (2).

As a result, the risks studies have been applied and extrapolated across different populations when burden is calculated.

However, most such studies have been undertaken in a few industrialized countries.

It is unlikely that the exposure–risk relations can be simply transferred from industrialized countries to the developing world (37).

Methodological issues

Prospective studies used to calculate risk relating to GBD have certain methodological shortcomings.

Many studies assume that an individual's drinking patterns do not change over time.

There is solid evidence to show shifts in drinking patterns across a lifetime (also called drinking trajectories) (38-43), with a general decrease in drinking in young adulthood and further decline in consumption as individuals age.

Confounding factors cannot always be accounted and controlled for when determining the effect of a particular risk factor.

While many studies attempt to match subjects studied (e.g., controlling for age and gender among subjects who drink compared with those who do not drink), certain lifestyle or health factors cannot always be controlled for.

These confounders may influence the results of a particular study or may introduce alternative or competing explanations that may not be considered.

Much of the evidence relies on meta-analyses of individual studies, and may introduce confounders.

Meta-analyses are only as strong as the studies they consider:

- The inclusion of poorly executed studies, for example, lacking proper controls, will affect the findings of the meta-analysis.

Determining causation

Most conditions involving alcohol (see Table 3 above) can also be caused by other risk factors.

Therefore, the same disease or disability can be attributed to both alcohol and another risk factor or even to multiple risk factors.

In fact, the attributable fractions for death or disability for a particular “condition” can be greater than 100%.

The GBD assessment does not account for the involvement of a common genetic basis as a risk factor in certain diseases or disorders.

- For example, risk for certain alcohol use disorders (alcohol dependence) and major depressive disorder may be increased by the presence of a common gene (or genes) (49).
- In this case, the principal risk factor for depression would be the genetic component, not alcohol consumption per se.

GBD estimates rely on the assumption that single risk factors are involved, with all others held constant.

However, this is not always the case, as two (or more) risk factors may interact to cause a disease:

- For example, heavy smoking and heavy alcohol consumption have a synergistic effect for the development of certain oral cancers (45-47).

It is, therefore, debatable how the contribution of each risk factor should be reflected in calculations of attributable fractions.

The involvement of alcohol as a causal factor is particularly difficult to estimate with regard to social harms.

Whereas child abuse, public disorder, or vandalism, for example, may occur where heavy drinking is prevalent, they also occur in the absence of alcohol consumption.

- A causal link between alcohol and these outcomes has not been established in the research literature and cannot be assumed.

The involvement of a number of complex factors in the etiology of some diseases makes it difficult to single out alcohol consumption as a cause and may involve a subjective assessment.

- Many diseases are closely related to social exclusion and the lack of adequate access to prevention and healthcare.

Attribution of causality is not always objective, which may further confound the issue.

Several requirements need to be met for a causal relationship to be established (3):

- temporality – cause must precede effect;
- strength – strong associations are more likely to be causal than weak ones;
- consistency – repeated observation of an association in different populations and under different conditions;
- biological gradient – dose-response curve;
- plausibility – biological plausibility is relevant but can be “subjective and is based on current level of knowledge and beliefs” (3, p. 21);
- experimental evidence.

The possible “subjective” nature of plausibility is a strong potential source of bias in attributing causation.

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