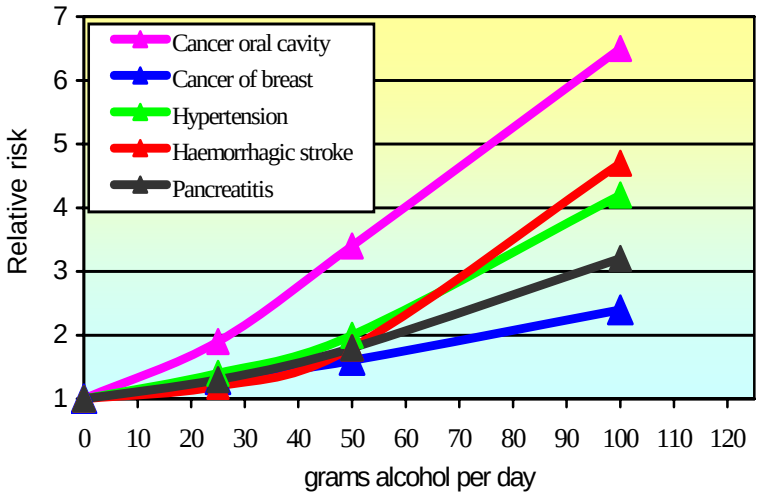
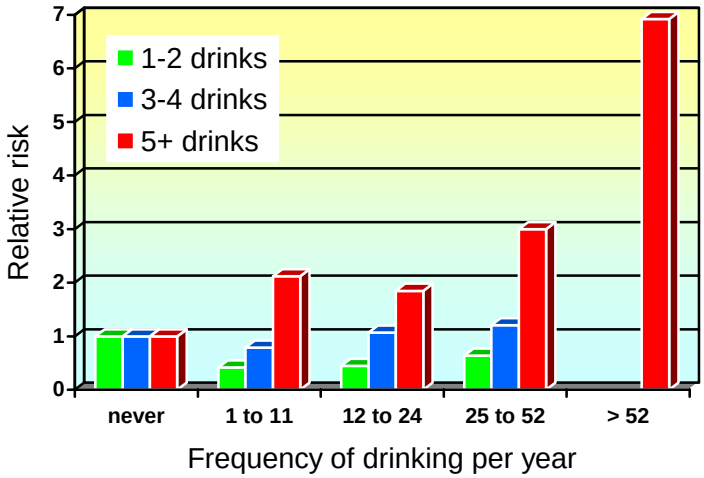
Alcohol is a toxic substance

Alcohol is a toxic substance that can harm almost any system or organ of the body, and is related to more than 60 different disorders with short and long term consequences[1]. For many conditions there is an increasing risk with increasing levels of alcohol consumption, with no evidence of a threshold effect below which it can be regarded as entirely risk free. Alcohol can exacerbate pre-existing mental and physical disorders and can adversely interact with other prescribed and illicit drugs in the body.



Relative risk of a range of conditions in relation to average alcohol consumption (g/day, where 10g is approximately one drink)[2]

Injury is mainly linked to acute drinking and intoxication. Causal relationships between alcohol and almost all kinds of unintentional as well as intentional injuries have been established. There is a clear dose-response relationship: the higher the level of blood alcohol in the body, the higher the risk for injury. Both the frequency of drinking, and the amount drunk per occasion increase the risk of fatal injury.



Relative risk of a fatal injury amongst Finnish men by frequency of drinking per year, and number of drinks per drinking occasion[3]

Many **neuropsychiatric disorders** are associated with alcohol consumption as well as with alcohol use disorders, (alcohol dependence and harmful use of alcohol). Alcohol may cause or exacerbate disorders such as depression, anxiety disorders, panic disorders or other substance use disorders, but on the other hand, such disorders may also lead to increased drinking. Also, other factors such as genetic disposition may be related to both alcohol use

disorders and related mental disorders. Alcohol consumption has both immediate and long-term effects on the brain and neuropsychological functioning. Brain development is a highly regulated process under tight temporal and spatial constraints, with each brain region having its own unique timetable for development. Alcohol selectively exerts its effects at the cellular and molecular levels on all of these developmental processes. Adolescents and young people are particularly vulnerable to the adverse effects of alcohol. During adolescence, alcohol can lead to structural changes in the hippocampus (a part of the brain involved in the learning process) and at high levels can permanently impair brain development. There is a relationship between lifetime alcohol use and the volume of brain grey matter (regions of the brain involved in muscle control, sensory perceptions, such as seeing and hearing, memory, emotions and speech), with increasing alcohol consumption related to decreasing volume of grey matter in a dose dependent manner.

Alcohol increases the risk of **liver cirrhosis**. The relationship between alcohol consumption and liver cirrhosis follows an exponential curve, with relatively less risk increases for smaller amounts of consumption, and huge increases for larger average amounts of consumption. Repeated alcohol use exposes the liver to hypoxia, harmful products of alcohol metabolism, reactive oxygen chemicals, and protein adducts, all of which lead to liver damage and an increased risk of cirrhosis of the liver.

Alcohol increases the risk of a wide range of **cancers**. There are significantly elevated risks even for drinking on average 25 g pure alcohol per day for cancers of the oral cavity and pharynx, oesophagus, stomach, colon and rectum, liver, larynx, and female breast. Overall, the relationship between volume and relative risk of cancer is linear, meaning the increases of volume of drinking are associated with steady increases of relative risk in comparison to abstention. Several mechanisms have been identified for alcohol-associated carcinogenesis, including acetaldehyde formation, induction of CYP2E1 leading to formation of reactive oxygen species and enhanced pro-carcinogen activation, and modulation of cellular regeneration.

Alcohol has a variety of causal relations to **cardiovascular disease**. Both average volume of consumption and patterns of drinking determine the extent of these relationships, as well as whether alcohol has a protective or detrimental impact. For hemorrhagic stroke and blood pressure, the relationships are detrimental, with clear dose response relationships. For ischaemic stroke and ischaemic heart disease, a pattern of low and regular consumption has been associated with protective effects, where as heavy consumption has a detrimental impact. Alcohol consumption raises levels of high density lipoprotein cholesterol (HDL), which removes fatty deposits in blood vessels and thus is associated with a lower risk of coronary heart disease deaths. Alcohol also favourably affects blood clotting profiles, reducing the risk of heart disease. However, alcohol also has adverse effects, with consumption, and episodic heavy drinking, increasing the risk of calcification of the coronary arteries in young adults in a dose dependent manner. In addition, alcohol can cause cardiac arrhythmia and muscle damage leading to cardiomyopathy and ultimately, heart failure.

Alcohol can increase the risk of **communicable diseases** in two ways: first, alcohol leads to a weakening of the immune system and thus may increase the risk for communicable diseases such as Tuberculosis, HIV/AIDS or different forms of hepatitis. Second, there is another indirect link via alcohol leading to a higher risk of unsafe sex thereby increasing the risk of sexually transmittable infectious diseases.

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[1] Rehm J, Room R, Monteiro M, Gmel G, Graham K, Rehn T, Sempos CT, Frick U, Jernigan D. Alcohol. (2004) In: WHO (ed), *Comparative quantification of health risks: Global and regional burden of disease due to selected major risk factors*. Geneva: WHO.

[2] Corrao, G., Bagnardi, V., Zambon, A. and La Vecchia C. (2004) A meta-analysis of alcohol consumption and the risk of 15 diseases. *Preventive Medicine* 38 613-619.

[3] Paljärvi, T., Mäkelä, P. and Poikolainen, K. (2005). Pattern of drinking and fatal injury: a population-based follow-up study of Finnish men. Addiction 100 1851-1859.