

Drinking and Cancer

The Issue in Brief

Ethanol has been classified as a Group 1 human carcinogen by the International Agency for Research on Cancer (IARC).

Various lifestyle, environmental, and genetic factors affect the relationship between alcohol consumption and cancer.

Drinking patterns play an important role in modulating any association between alcohol and cancer risk.

Risks vary according to cancer type:

- The strongest relationship has been found for heavy drinking and cancers of the oral cavity, larynx, pharynx, and esophagus.
- Risk for breast cancer increases linearly with rising levels of consumption.
- Epidemiological evidence for an association between drinking and colorectal cancer is inconsistent but suggests increased risk with heavy drinking.
- A link has been postulated between heavier drinking levels and liver cancer.
- No clear association has been established between drinking and gallbladder cancer, ovarian cancer, or prostate cancer.
- Studies on the relationship between drinking and lung cancer have yielded inconsistent results.
- Research indicates that alcohol may lower the risk for certain cancers such as renal (kidney) cancer and non-Hodgkins Lymphoma.

Genetic factors play a significant role in modulating the association between drinking and risk for cancer.

Risk also varies with lifestyle, hormonal, and dietary factors.

An association between drinking and cancer does not mean that alcohol causes cancer.

ICAP's Health Briefings cover the effects of alcohol consumption on health. They offer an overview of the relationship between drinking patterns and health outcomes, compile the key literature, and provide the reader with an extensive bibliography that refers to original research on each topic. The Briefings attempt to present the balance of the available evidence. They have been peer reviewed by external experts and do not necessarily reflect the views of ICAP or its sponsoring companies.

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. Available: <http://www.annalsofepidemiology.org/issues>

What Is the Evidence?

Is alcohol a carcinogen?

Ethanol has been classified as a Group 1 human carcinogen by the International Agency for Research on Cancer (IARC) (1–2, 52, 56).

Criteria for defining agents as Group 1 “carcinogenic to humans” include:

- sufficient evidence of carcinogenicity in humans;
- less than sufficient evidence of carcinogenicity in humans, but sufficient evidence in experimental animals *and* strong evidence in exposed humans;
- action through a relevant mechanism of carcinogenicity.

Various confounders make interpretation difficult.

- Some of the metabolic products of alcohol are also classified as carcinogens, including acetaldehyde (3–4) and urethane (ethyl carbamate) (1).
- Ethyl carbamate has been found in fermented beverages such as wine or beer, but higher levels have been observed in spirits, especially those made with stone fruits (55).
- Ethyl carbamate is considered “probably carcinogenic to humans” because of research conducted on animals (56).
- Some beverages, including noncommercial beverages, may pose an added risk for cancer due to the presence of methanol or other contaminants.

Drinking and cancer risk

The relationship between cancer risk and a range of genetic, environmental, and lifestyle factors has been studied extensively.

The impact of alcohol consumption on cancer risk is one of the most studied.

- Some studies have shown a positive association between drinking and certain cancers; other studies have found no such relationship; still others suggest a possible negative or protective relationship (1, 56).

It has been suggested that about 5% of all cancers are linked to drinking (5).

This association may be positive or negative, depending on the type of cancer, the particular research study, and various confounding factors. For example:

- There is evidence of a positive association between heavy drinking patterns and an increased risk for cancers of the upper digestive tract (6–9).

- In the case of lung cancer, while some studies have found a correlation, others have found none, particularly when additional confounding factors were taken into account (3).
- Studies have suggested that moderate drinking may be associated with a reduced risk for renal (kidney) cancer.

Risks associated with drinking vary according to the type of cancer.

Drinking patterns play an important role in modulating the relationship between alcohol and cancer risk.

Most associations are for heavy drinking, particularly regular heavy drinking.

There is little evidence that moderate drinking increases the risk of most cancers for which an association has been shown (10).

The association with alcohol consumption has been studied for various types of cancers.

TABLE 1. Increases in Cancer Risk for Different Organs with Consumption of 50 grams (g) of Ethanol per Day (Compared with Abstainers)

Organ site	Increase in relative risk* (for consumption of 50g/day)
Oral cavity and pharynx	3 X
Larynx and esophagus	2 X
Breast	2 X
Colorectum	1.4 X
Prostate	1.2 X

Source: IARC, 2010 (56).

* **Note:** See section *What Do Risk Levels Mean?* at the end of this ICAP Health Briefing for information on how the relative risk of developing a disease is determined.

Upper digestive tract cancers

The strongest relationship has been found for heavy drinking and cancers of the oral cavity, larynx, pharynx, and esophagus.

These account for 25 to 39% of all cancers in which drinking is thought to play a role (6–9).

- Risk is associated with heavy alcohol consumption (6–9, 29–30).
- Risk is higher for individuals who are both heavy drinkers and smokers (31).
- Heavy drinking and smoking have a multiplicative effect on the risk for upper digestive tract cancers (31).

- Drinking alone has a less significant independent effect than smoking (18, 32).

One of the breakdown products of ethanol—acetaldehyde—has been shown to increase risk of head and neck cancers.

- Acetaldehyde is classified as a Class 1 carcinogen (52, 56).
- Those individuals who have a decreased ability to break down acetaldehyde may be at heightened risk (52, 54). This includes persons of East Asian descent with a genetic variant of the enzymes that metabolize ethanol.

Changes in drinking pattern can change risk for upper digestive cancers (29, 30).

For example:

- Increasing consumption to more than 14 drinks a week can significantly increase risk.
- For heavier drinkers, decreasing consumption to fewer than 7 drinks a week can significantly lower risk.
- Research suggests that former drinkers may have a lower risk for oral, pharyngeal (57–59), and esophageal cancers (60–62) than current drinkers.

Breast cancer

Alcohol consumption is associated with an increased risk of breast cancer: Risk increases linearly with rising levels of consumption (56).

- Drinking 18g of alcohol a day is associated with a relative risk of 1.13. An average consumption of 50g is associated with a much higher relative risk of 1.5 (63).
- Whereas the risk is minor at moderate drinking levels, it is estimated to increase by 2% with each additional drink consumed.
- The risk is similar for all beverage types (1).

The link between drinking and breast cancer is modified by other factors.

- Research has shown that family history and hormonal and reproductive factors do not affect the association between alcohol consumption and the risk of breast cancer, but risks are additive (63).
- Dietary factors also modulate risk. Intake of folic acid (folate/Vitamin B9) may reduce the risk for breast cancer associated with moderate or high alcohol consumption (17).

Stomach Cancer

The evidence on the association between alcohol and stomach cancer is mixed.

- Although some studies report a positive and dose-response relationship, results are confounded by dietary and lifestyle factors, as well as by infection with *Helicobacter pylori* (56).

Colorectal cancer

According to IARC, there is a “significant positive association” between alcohol consumption and the risk for colon, rectal, and colorectal cancers (56).

However, a strong dose-response relationship between alcohol intake and colorectal cancer has not been confirmed (56).

Colorectal cancer appears to be more strongly associated with heavy than moderate drinking.

- Risk has been shown to increase at consumption levels over 30g of alcohol a day (19), although there is also some evidence of an increase at weekly consumption levels of more than 7 drinks (20).
- Heavy drinkers, consuming over 45g of alcohol per day, have a relative risk of 1.4 (56).
- The association between drinking and increased risk is stronger in men than in women (21).
- The risk is similar for all beverage types (64–69).

It is unclear whether or not the association between alcohol consumption and colorectal cancer is modulated by lifestyle.

Dietary habits may influence the association between drinking and colorectal cancer.

- A more “Western” way of life and diet may be associated with increased risk of colorectal tumors (22, 23).
- The absence of a significant association with alcohol consumption seen in some Asian studies may be attributable in part to diet (24, 25).
- Colorectal cancer may be associated with a diet low in folate—however, research has provided mixed results on this issue (56).

Smoking history appears to affect the relationship between alcohol consumption and colorectal cancer.

- Moderate drinking among long-term smokers may decrease risk of adenomas as compared to abstainers (20).

Liver cancer

A link has been postulated between heavier drinking levels and liver cancer (56).

- Liver cirrhosis is strongly correlated with heavy chronic drinking and is a risk factor for liver cancer (4, 27).

No association has been found between liver cancer and moderate drinking (26).

Alcohol and tobacco are independent risk factors for liver cancer (28).

However, the impact of alcohol on liver cancer is difficult to measure because of potential confounding factors, such as hepatitis B and C (56).

Lung cancer

Research into the relationship between drinking and lung cancer has yielded inconsistent results.

While some studies have failed to find an association between drinking and lung cancer (34), others have found a possible link (35).

- There is evidence that susceptibility for lung cancer may be related to genetic variation for the enzymes that metabolize alcohol (36).
- Where a relationship has been found, it is often confounded by the effects of smoking (3).
- The association may also be modulated by other lifestyle and nutritional factors (37).

Ovarian, urinary bladder, cervical, and endometrial cancers

No association has been found between alcohol consumption and ovarian or urinary bladder cancer (38–40).

Findings on the association between alcohol consumption and endometrial cancer have been inconsistent.

- There is no strong evidence of risk associated with varying drinking levels (70), beverage types (70–71), or menopausal state.

Research on the association between alcohol and cervical cancer has been inconclusive.

Pancreatic cancer

Most studies conducted on light or moderate drinkers have shown no association of risk for pancreatic cancer.

In heavy drinkers (those consuming over 15 drinks a week), results have been inconclusive:

- Some studies have shown an increased risk (72–76), while others have shown a decreased risk (77–79) of pancreatic cancer.

It has been suggested that alcohol consumption is involved in the development of pancreatitis (inflammation of the pancreas), which may lead to the development of pancreatic cancer (2).

Prostate cancer

A weak dose-response relationship has been found between alcohol consumption and prostate cancer (56).

- According to IARC, alcohol consumption of four drinks a day is associated with a relative risk of 1.21 for prostate cancer (56).

Renal cancer

There is evidence that alcohol consumption may be a protective factor against kidney cancer.

Although the relationship is still unclear, it appears to hold for all three beverage types (beer, spirits, and wine).

- Risk continues to decrease even above 8 drinks (i.e., over 100g of alcohol) per day (28).

Lymphatic cancer and cancers of the hematopoietic system

Data on alcohol consumption and lymphatic cancer and cancers of the hematopoietic system are sparse and inconsistent.

- However, a weak inverse (protective) relationship has been seen with non-Hodgkin (80–81) and some Hodgkin lymphoma (53, 82–84); this does not vary by factors such as age or gender.
- No association has been observed with leukemia or with multiple myeloma.

Confounding factors

Genetic factors play a significant role in modulating the association between drinking and risk for cancer.

Family history has been strongly correlated with risk for certain types of cancer.

Variation in genes encoding enzymes involved in alcohol metabolism (alcohol dehydrogenase, aldehyde

dehydrogenase) may affect individual risk for certain cancers (21).

- Deficiency in these enzymes—for example, among certain East Asian populations—may increase risk.

Risk for developing different types of cancers varies with lifestyle and dietary factors.

- Smoking is a major confounder in the relationship between drinking and several types of cancer. The effects of smoking and drinking are likely multiplicative (1).
- Diet also influences the risk of developing certain cancers—for example, diets poor in fruits and vegetables or rich in red meats.
- Obesity has been implicated in higher risk for certain types of cancer—for example, endometrial and esophageal cancer in postmenopausal women (46).

What Do Risk Levels Mean?

The risk of developing a disease is often expressed as relative risk (also as the risk ratio or odds ratio), the likelihood of developing a disease following exposure to a potential determinant or factor (49).

A relative risk of 1.0 (the “null value”) indicates no association between the exposure and the disease (50).

- A relative risk greater than 1.0 indicates increased risk.
- A relative risk less than 1.0 indicates a protective effect, or decreased risk.

Relative risk also represents the percentage change in probability of developing a disease.

- For example, a relative risk of 1.3 can be interpreted as a 30% increase in the statistical probability of developing a disease, versus the statistical probability of otherwise developing the disease.

Epidemiologists generally consider relative risk of greater than 1.0 but less than 2.0 “weak associations” (51).

The U.S. National Cancer Institute has stated that in epidemiological research, relative risks under 2.0 are “considered small and usually difficult to interpret.”

- These associated risks may be due to chance, bias, confounding factors, or correlative effects (47).

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