DRINKING AND INFECTIOUS DISEASES

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IARD Health Reviews offer a referenced overview of recent peer-reviewed, published research on the relationship between alcohol consumption and health outcomes. The Reviews report the findings of the referenced studies and are not intended to provide advice or recommendations. They are not necessarily intended to be exhaustive representations of all scientific research on a given subject and, as research is constantly evolving, they may not include the most recent findings. These materials do not necessarily reflect the views of IARD or its member companies. The reviews report the findings of the referenced studies and are not intended to advise individuals about their drinking. People with specific questions about their drinking are encouraged to consult a healthcare professional; together, they can determine what is best based on individual risk factors, including family history, genetics, and lifestyle. For some people, the better choice may be to not drink at all. IARD Health Reviews should be read in their entirety and not misrepresented or taken out of context.

There is a glossary of key terms used in this chapter on **page 6**.

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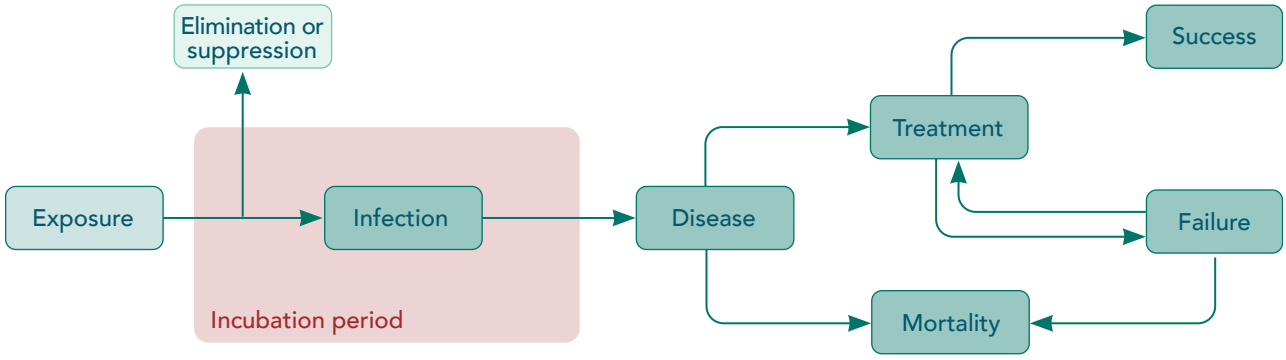
The International Alliance for Responsible Drinking (IARD) *is a not-for-profit organization dedicated to addressing harmful drinking worldwide and promoting understanding of responsible drinking, among those who choose to drink. IARD is supported by its member companies from all sectors of the regulated alcohol industry – beer, wine, and spirits – in their common purpose of being part of the solution to reducing the harmful use of alcohol.*

Background

Infectious diseases are caused by a diverse group of microorganisms such as bacteria, viruses, parasites, and fungi. These can be transmitted through insect bites, contaminated food or water, skin or sexual contact, inhaling airborne particles, or from mother to child during pregnancy or childbirth [1-4].

Exposure to such infectious organisms leads to multiplication or replication of the organism, which can result in mild to severe symptoms and disease affecting an isolated area or spreading throughout the body. The immune system has multiple defenses to ward off infection and prevent progression but, if the infectious organism overwhelms the body's defenses or if the immune system is already compromised, infection can result in prolonged or severe illness and death [5]. See Figure 1 for a depiction of the natural history of an infectious disease.

Figure 1. Natural course of infection and disease progression



Notes.
- Not all persons exposed to TB will incubate the bacteria and become infected
- Individuals with a strong immune system are able to eliminate or suppress the infectious organism

According to the Global Burden of Disease (GBD) 2019 study, five groups of infectious diseases accounted for 14% of all deaths and 65% of all new disease diagnoses worldwide in 2019. These groups are respiratory infections and tuberculosis, enteric infections human immunodeficiency virus and acquired immunodeficiency syndrome (HIV/AIDS) and sexually transmitted infections (STIs), neglected tropical infectious diseases and malaria, and other infections including hepatitis [6].

Table 1 summarizes global statistics for these infectious diseases in 2019 [6] and demonstrates the variability in incidence (new cases diagnosed within a given year) versus mortality rates across diseases. For example, upper respiratory infections are very common with an incidence rate equivalent to 2.26 infections per person but have a low mortality rate, whereas HIV infections are far less common (25 cases per 100,000 people) but have a higher mortality rate.

Table 1: Infectious disease global incidence and mortality rates, 2019

Infectious disease	Number of new cases	*Age-standardized* incidence rate (per 100,000)	Age-standardized mortality rate (per 100,000)
Respiratory infections & TB	18,086,688,912	237,122.3	49.1
TB	8,497,317	106.7	14.6
Lower respiratory infections	488,902,504	6,295.0	34.3
Upper respiratory infections	17,228,885,368	225,505.7	0.13
Enteric infections	6,595,314,435	86,288.7	24.0
HIV/AIDS & STIs	771,841,187	9,560.9	12.1
HIV/AIDS	1,989,282	25.2	10.7
STIs	769,851,905	9,535.7	1.4
Other infections	384,277,652	5,355.1	10.2
Acute hepatitis	263,951,644	3,615.9	1.0
NTDs and malaria	289,730,013	4,006.9	10.3
Malaria	231,357,372	3,247.0	9.0

Source: Institute for Health Metrics and Evaluation, Global Burden of Disease study 2019 [6].

Globally, incidence and mortality rates for each of these diseases vary by World Bank income level and World Health Organization (WHO) region. The highest incidence and mortality rates are in low-income countries and the African Region [6].

Infectious disease risk factors

Some established risk factors for infectious diseases include individual factors (for example, compromised immune system, health-related behaviors, and inadequate hygiene) and external factors (for example, crowding or close-contact with an infected person, inadequate sanitation, and poverty) [3, 5, 7, 8].

- According to a 2021 review on behavioral risk factors and infectious disease risk, alcohol consumption, high body mass index, illegal drug use, and smoking are associated with impaired immune function [7].

- Individuals with an existing chronic disease such as cardiovascular disease or diabetes may share some of the same behavioral risk factors for infectious diseases [7] and may be at higher risk of disease progression due to a weakened immune system [9].

- Similarly, those with an existing immunosuppressive infectious disease, such as HIV/AIDS, are more susceptible to other infectious diseases, which, in combination with chronic heavy alcohol use, can accelerate progression of both diseases [5, 9, 10].

This Health Review focuses on the role of alcohol consumption as a risk factor for infectious diseases: TB and HIV/AIDS.

The main way in which alcohol consumption is associated with infectious diseases is through its potential effects on the immune system.

ALCOHOL CONSUMPTION AND IMMUNE FUNCTION

Different drinking patterns can influence the immune system through multiple mechanisms, altering both *innate* and *adaptive* immune function, and can either suppress or activate *immune* response depending on how much is consumed [5, 11, 12].

- As part of the innate response, alcohol can reduce the normal migration of *white blood cells* to an infection site (or injury) and reduce the normal function of *natural killer cells* and *monocytes/macrophages* and can modify production of *cytokines* [5, 12]. These types of cells are responsible for eliminating *antigens*, recruiting other types of immune cells to assist, and regulating immune cell production [5].

- As part of the adaptive response, alcohol can disrupt the normal function of *B and T lymphocytes* [5, 12]. These types of cells mediate the adaptive immune response by stimulating other cells, identifying and destroying infected cells, and producing antigen-specific *antibodies* [5].

Alcohol may also affect immune function by altering the normal interaction and balance between the immune system and an individual's gut microbiome, or community of microorganisms [5, 13].

Heavy alcohol consumption

Heavy alcohol consumption can reduce the immune system's ability to suppress or eliminate invading pathogens through multiple effects, as described above [14].

- According to recent reviews, much of the research on the effect of alcohol on immune function comes from in vitro and animal studies [11]. Whereas, human studies appear to have been conducted primarily on individuals described by various study authors as those who have alcohol use disorders (AUDs) or who abuse alcohol, or who are chronic heavy drinkers [5, 11].

- Individuals with an AUD have weakened immune systems through functional changes in immune cells, barrier deficits, and deficiencies in nutrients supportive of immune function (for example, Vitamins A, C, E, folate, and thiamine) [11] and thus, are considered "immunocompromised hosts" [11].

- In some individuals, a compromised immune system may be undetected until an individual encounters an infection, injury, or other assault on the host system [14].

- Like chronic heavy drinking, heavy episodic drinking (referred to as "binge drinking" by the authors) may also suppress immune response [14, 15], but studies have shown that this response may be temporary [15, 16].

Light or moderate alcohol consumption

Few studies about the effect of alcohol on immune function have been conducted among light and moderate drinkers. The existing evidence on the effects of alcohol consumption at non-heavy drinking levels includes experimental studies on animals and humans and a small number of epidemiological studies [11, 12, 15, 17-19].

- In contrast to acute or chronic heavy drinking, moderate drinking has been associated with either no risk or decreased risk of respiratory infections according to two reviews conducted in 2007 and 2015 and a 2012 study on the common cold [12, 15, 18].

- Moderate alcohol consumption may stimulate an immune system response to an infection [11, 12], and may enhance immune responses to certain vaccines, as documented in both human and animal experimental studies and summarized in two reviews [11, 15, 17, 19].

To our knowledge, there has been little to no evidence of an increased risk of viral or bacterial infection associated with light or moderate drinking. More research in this area is needed to adequately inform a conclusion [12].

Glossary

- **Age-standardized rates** are hypothetical rates used to make comparisons of populations across different locations or time periods. These rates indicate what could have been observed if the populations being studied had the same age-distribution as the standard or reference population.

- An **antigen** is a part of foreign or harmful substance – sometimes called a pathogen – that triggers the body's immune system to initiate a defense against that substance through the production of **antibodies** (large proteins unique to specific antigens). Antibodies attach to specific antigens and eliminate them from the body.

- **Cytokines** are small proteins produced by several types of cells including white blood cells (macrophages and B and T lymphocytes) and control the growth and activity of blood cells and immune system cells.

- **Immune response** consists of two systems: the adaptive immune response and the innate immune response.

  - The **innate immune response** is the immediate responder part of the immune system and is non-specific to an invading pathogen, whereas the **adaptive immune response** is activated in the presence of a specific pathogen or antigen; it can recognize and immediately defend against a previously encountered antigen, but it can also be activated by the innate immune response [11].

- **White blood cells** are formed within the bone marrow from stem cells and circulate in the blood and lymphatic system. Granulocytes, monocytes, and lymphocytes are all types of white blood cells, with distinct activities in the innate or adaptive immune response to infection or disease. A high white blood cell count can be an indicator of infection or inflammation.

  - **Monocytes** are a type of white blood cell that circulates in the blood stream and recognizes foreign substances and induces inflammation to activate the immune system.

    - **Macrophages** are derived from monocytes after being recruited in tissue cells where there is infection or tissue damage. They engulf and kill microorganisms, remove dead cells, and activate other immune system cells.

  - **Natural killer (NK) cells** are a type of innate lymphocyte that rapidly respond to infection or tumor cells through a wide array of inhibitory and activating functions. These cells have the unique ability to identify and kill harmful cells without their first being marked as "foreign" by another type of immune cell.

  - **T and B lymphocytes** are a type of white blood cell involved in antigen specific immune response. The B cell lymphocytes produce antibodies to destroy bacteria, viruses, and toxins, whereas T cell lymphocytes attack the body's own cells that have become infected or cancerous.

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