



Biological Factors

WHAT IS THIS FACTOR ABOUT?

This factor explains what is known in research regarding biological influences on gambling. It focuses on genetics and biological differences in brain structure and functioning.

WHY IS THIS FACTOR IMPORTANT?

Biology may explain why some people are more vulnerable to developing gambling problems than others. Gambling has a genetic, heritable component, although it is also shaped by environmental factors. There is evidence that people with gambling problems have altered brain structure and functioning as compared to people without gambling problems. It is less clear if the differences in neurobiology make people more vulnerable to harmful gambling or if they occur as a consequence of harmful gambling. This factor discusses what is known in gambling research regarding genetics and neurobiology. It also outlines the limitations of current research.

WHAT TOPICS ARE INCLUDED IN THIS FACTOR?

Genetic Inheritance

Family studies have found that gambling problems are more common among relatives of people with gambling problems. These studies provide some evidence to support the genetic inheritance of harmful gambling. However, family studies cannot answer to what extent gambling is shaped by genetics as compared to the environment.

Twin studies are the gold standard design to understand the influences of genetics versus the environment. These studies compare identical twins and non-identical twins. Identical twins share nearly all of their genetic makeup, whereas non-identical twins share about half of their genetic makeup. Twin studies have revealed that

genetic factors account for about 50% of the chance of developing gambling problems; but, most twin studies have been based on male twin pairs and included participants who might not have been diagnosed by a clinician.

Gambling can be modified by the environment; some twin studies have examined the effects of shared and non-shared environmental factors. Shared environmental factors are features of the environment that are common to both twins, such as their upbringing and the neighbourhood in which the family lives. Non-shared environmental factors are unique to each twin, such as friends that one has. There is typically a strong role of non-shared environmental factors on gambling, with only a minor role of shared environmental factors. Recent studies have considered both genetic and environmental influences. It has been reported that genetic influence on gambling is greater among people living in disadvantaged neighbourhoods.

Recent studies have also attempted to identify specific genes that contribute to harmful gambling. Some studies have tested for variants in genes affecting dopamine release in the brain. Dopamine is a neurotransmitter (i.e., a chemical in the brain) that plays an important role in various functions, including motor control, reward response, and learning. Yet, most studies have been small studies with few participants, and there have been failures to replicate the same results in different studies. Overall, it appears that the development of harmful gambling is shaped by many genes and the environment.

Neurobiology

Studies on neurobiology have compared brain structure and functioning between people with and without gambling problems. These studies reveal changes in brain regions involved in processing reward information, controlling impulses, weighing risks, and making decisions.

But the evidence is at an early stage and inconsistent findings have been reported. It is also not clear if the neurobiological changes reflect a vulnerability to harmful gambling or occur as a consequence of harmful gambling.

Behavioural tasks have been widely used to detect changes in brain functioning. Many studies have found that people with gambling problems are more likely to make impulsive choice and have impaired decision-making. For example, they prefer a smaller reward that is available immediately over a larger reward that is delayed. People with gambling problems often make impulsive choices when experiencing intense moods (e.g., sadness, frustration). This may reflect difficulties in regulating emotions, which can affect gambling behaviour. In more severe cases, there are broader deficits in executive function. Executive function refers to mental skills that enable one to plan, organize, monitor actions, and work toward one's goals.

Functional magnetic resonance imaging (fMRI) has been used to examine brain activity when performing a task. In these studies, participants perform tasks related to reward and decision making while lying in a brain scanner. fMRI studies have found that people with gambling problems show changes in a network of brain regions commonly known as the brain reward system. However, mixed findings have been reported. Some studies have reported stronger activity in people with gambling problems compared to those without gambling problems, while other studies have reported weaker activity.

Activity in the brain reward system may be shaped by the structural characteristics of gambling games. Structural characteristics are specific game features. For example, a near-miss is a game feature where the outcome is very close to a win (e.g., getting two out of the three jackpot symbols). Near-misses can motivate people to gamble longer. It has been reported that near-misses trigger responses in the brain reward system, specifically the striatum and insula. These brain responses are stronger in people with gambling problems when compared to those without gambling problems.

Dopamine is a key neurotransmitter in the brain reward system. Positron emission tomography (PET) imaging has been used to measure dopamine release in the brain. Some studies have found an increase in dopamine release in people with gambling problems during a gambling task or after taking an amphetamine. (Amphetamine is a stimulant drug that increases the release of dopamine, leading to pleasurable effects, and can be addictive.)

To date, the most promising drug therapy for gambling is the opioid receptor antagonist, naltrexone. Naltrexone targets dopamine pathways in the brain. Some clinical trials have supported the benefits of naltrexone in reducing gambling problems. However, the mechanism of how the drug works as a gambling treatment is still unknown.

A few studies have examined the noradrenaline system, which is a hormone system that plays a key role in arousal. People with gambling problems may have increased arousal, such as increased heart rate, due to an abnormal noradrenaline system. Increased arousal during gambling may be a sign of harmful gambling, but the evidence is mixed. Other studies have begun to look at the serotonin system, which is known to contribute to mood and anxiety disorders. The serotonin system may be very relevant as many people with gambling problems also have mood and anxiety disorders.

This is a summary of the Biological Factor, one of eight interrelated factors that comprise the Conceptual Framework of Harmful Gambling. To learn more about this factor, please refer to the [full report](#) or visit the [biological factor webpage](#) on the GREO website.