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Adolescent Gaming and Gambling in Relation to Negative Social Consequences and Health

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Abstract

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The aims of the thesis were to study relationships between the effects of online gaming and gambling and negative social consequences and ill health among adolescents and to determine whether gaming and gambling activities occur together.

The papers in this thesis used epidemiological methods to obtain self-report information from Swedish adolescents aged 13–18 years. Time spent in online gaming was associated with negative social consequences, and this relationship was explained by online gaming motives. Gaming for fun and social motives was associated with a reduced risk of negative social consequences, whereas gaming to escape problems, gain status, or meet demands from others was associated with an increased risk.

Increased online gaming time on weekdays increased the probability of having depressive, musculoskeletal, or psychosomatic symptoms, and was related to online gaming motives. The probability of ill health was low in those who reported gaming for fun or social motives. Adolescents with symptoms of attention deficit hyperactivity disorder (ADHD) were more sensitive to gambling frequency and to developing a gambling problem. However, among those identified as susceptible, adolescents with ADHD were equally affected compared with other susceptible participants in terms of their gambling frequency.

Boys had a higher probability than girls of participating in online gambling in association with online gaming. Having at least one parent born outside Scandinavia was associated with a higher probability of online gambling, especially among girls. The effect of alcohol use as a factor contributing to online gambling was greater among boys than among girls.

The results of this thesis contribute new knowledge about sex differences in online gaming and gambling behaviours and add to the limited research on online gaming and online gambling behaviours among adolescent girls. Gaming motives may be helpful for identifying online gamers needing support to reduce their unhealthy gaming behaviour. Information about factors related to gaming and gambling problems may be of interest to clinicians in psychiatry, psychology and social work, as well as to policymakers, parents and teachers involved in adolescent health and development. Effect preventive strategies should consider the sex differences in gaming and gambling behaviour in adolescents.

Keywords: Adolescents, Depression, Gambling, Gaming, Health, Musculoskeletal symptoms, Negative social consequences, Psychosomatic Symptoms.

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*To Patricia, Adrian
and Mattias*

List of papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.

- I Hellström, C., Nilsson, K.W., Leppert, J., & Åslund, C. (2012) Influences of motives to play and time spent gaming on the negative consequences of adolescent online computer gaming. *Computers in Human Behavior*, 28:1379–1387. DOI: 10.1016/j.chb.2012.02.023
- II Hellström, C., Nilsson, K.W., Leppert, J., & Åslund, C. (2015) Effects of adolescent online gaming time and motives on depressive, musculoskeletal and psychosomatic symptoms. *Upsala Journal of Medical Sciences*, Accepted 5 May 2015. Early Online 1-13. DOI: 10.3109/03009734.2015.1049724
- III Hellström, C., Wagner, P., Vadlin, S., Nilsson, K.W., Leppert, J., & Åslund, C. (2015). Gambling frequency and symptoms of attention-deficit hyperactivity disorder in relation to problem gambling among Swedish adolescents: A population-based study. *Submitted*.
- IV Hellström, C., Vadlin, S., Nilsson, K.W., Leppert, J., & Åslund, C. (2015) Online computer gaming among adolescent girls is associated with higher probability for online gambling. *Submitted*.

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Abbreviations

ADHD	Attention deficit hyperactivity disorder
ASRS	Adult ADHD Self-Report Scale
ASRS-S	Adult ADHD Self-Report Scale Screening version
BMI	Body mass index
CI	Confidence interval
DSM	Diagnostic and Statistical Manual of Mental Disorders
DSRS	Depression Self-Rating Scale
fMRI	Functional magnetic resonance imaging
IGD	Internet gaming disorder
MMOG	Massively multiplayer online game
MMORPG	Massively multiplayer online role-playing game
OR	Odds ratio
PGSI	Problem Gambling Severity Index
SALVe	Survey of Adolescent Life in Vestmanland
SES	Socio-economic status
WoW	World of Warcraft TM

Introduction

This thesis presents information about the different pathways into gaming and gambling, and the consequences of gaming and gambling from a public health perspective. In 2003, I was asked to assist the Public Health Centre in Västerås in developing advice to give to parents and schoolteachers about adolescents' gaming habits and to help them to set limits for adolescents' gaming time. The more knowledge I obtained about the research on gaming, the more I realized that there are too few evidence-based facts on which to base such advice. This made me curious and to want to investigate this further, especially because of the many contradictions in this research field.

On one hand, all the positive aspects of gaming were presented by the research field, and yet on the other hand, a negative perspective on gaming was shown. It seemed to me that these two contradictory perspectives could not be combined—one is either “for” or “against” gaming. Because I could agree with both perspectives, I chose to maintain an open mind in trying to understand both the positive and negative effects of gaming. Early on, I realized that population-based studies of adolescent gaming were limited. I became determined to obtain results based on a large study population that could add new knowledge. In 2003, there were only a few people in Sweden studying adolescent gaming behaviour and its consequences. By joining networks of researchers and others interested in this topic, I became inspired and rapidly learned more about the different perspectives on gaming behaviours. Gaming and gambling behaviours have much in common, and researchers (including me) are studying both behaviours. This thesis adds to the growing body of knowledge about problem gaming and problem gambling among adolescents. My hope is that the results contained in the papers presented here may help to guide the development of prevention programmes to help gamers and gamblers to avoid gaming- and/or gambling-related problems.

Play

“Play” was defined and viewed from a positive perspective in the early 1950s by the Dutch historian Johan Huizinga, who wrote:

*“Play is at the very foundation of culture and society where civilization arises and unfolds in and as play...a free activity standing quite consciously outside ‘ordinary’ life as being ‘not serious’, but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner”*¹ (page 13).

According to Huizinga, play involves energy, creativity, imagination and enjoyment, and influences the development of culture and society. Huizinga stated that gambling is different from play because it includes material interests (e.g., monetary rewards) that should not be considered as part of play activity. About 10 years later, Caillois suggested that, in contrast to Huizinga’s theory, play is essential to culture as a spiritual activity, whereas Huizinga claimed that human civilization was built on play. Another difference between these two theories about play is that Caillois argued that gambling should be included in the definition of play as an activity based on chance². Caillois also considered gambling to include competitive factors and superstitious ideas, which are now understood as factors that are important to gambling behaviour². Social status may be achieved by winning money through gambling facilities, which may lead to a higher position in the social hierarchy. On the other hand, gambling may be a leisure activity that leads the gambler to become preoccupied with gambling, which may cause problems with natural behaviours and self-discipline, such as the ability to maintain the discipline to continue working².

Game

The term “game” is defined as a form of recreation that includes any activity engaged in for diversion or amusement. A game has three components: *gamer*, *rules* and *goals*. The *gamer* participates in the game’s challenge, participation is limited by the *rules*, which also set the *goal* of the game, and the goal motivates the gamer to continue the game³.

Gaming

Early games used interactive electronic devices with various display formats. The earliest example of a computer game is from 1947, which was called a “cathode, ray tube amusement device” that was found while searching for a patent in the USA. This device comprised an analogue device and was inspired by the technology used for radar display. The development of the Internet has provided opportunities for online gaming that have expanded the gaming market to nearly endless limits. In the early 21st century, online gaming became a very popular activity⁴ for both adults and adolescents, with a predominance of male gamers⁵. Digital technology and devices such as stationary computers, laptops, iPads and mobile phones provide never-ending opportunities for online gaming through the Internet⁶. Digital technology has become a natural and important part of people’s daily lives. Gaming, as well as socializing with other gamers during gaming, is an increasingly influential factor in society through the world of digital technology⁶. Gaming has become a common leisure activity, especially among adolescents, because of its social, competitive and challenging components⁷. The prevalence of gaming for two hours or more on weekdays among adolescents in the United Kingdom is estimated at 55% among boys and 20% among girls, and gaming activity increased about 10% between 2006 and 2010⁷. An in-depth understanding of the many different contexts of gaming is needed to explain why some gamers develop problem gaming behaviour and others do not, what motivates gaming behaviour, the socializing aspects and the possible influence of genetics and personality factors on gaming behaviour⁴.

Massively multiplayer online role-playing games

Massively multiplayer online games (MMOGs) comprise games that are played online with other gamers. MMOGs offer different gaming experiences because the chosen gaming paths are decided by the participating gamers. Of all online games, massively multiplayer online role-playing games (MMORPGs) are the most popular, and 46% of gamers report a preference for this type of game⁸. MMORPGs offer a variety of gaming adventures that are shared with other gamers, in which social communication plays an important part of the individual’s personal gaming experience⁹. One of the most successful MMORPGs is World of Warcraft™ (WoW) by Blizzard Entertainment®, which is situated in a fantasy world called Azeroth that is populated by the opposing members of the Alliance and the Horde⁹. The game’s mass appeal to gamers is shown by the eight million players who played the extension of WoW, “Cataclysm”, in 2013⁴. Some online gamers, such as those who participate in WoW, exhibit many of the criteria that are considered part of the definition of addiction and that satisfy various gaming motivational factors¹⁰. Whether excessive online gaming is of concern is widely debated.

MMORPGs require a high degree of commitment and time investment from players to progress through the game, which takes time away from other life activities and social relationships ¹¹.

Motives for playing MMORPGs

According to Yee ¹⁰, MMORPGs offer the possibility of achieving the game's goals by immersing oneself in the game and socializing with other gamers by chatting, making new friends and working together in teams to progress through the game by taking on different tasks ¹⁰. The ability to customize one's online character ("avatar") is compelling for many gamers because it provides the opportunity to identify oneself as someone else (e.g., someone the gamer wishes to be). MMORPG players often prefer to be anonymous by not revealing their real identity ^{5,12-14}. Games also provide a chance to escape from the problems of everyday life. Escapism is often mentioned as a gaming motive, and is often found in people with gaming problems and addictive behaviours ^{11,15}, in which the activity provides a mood modifier that helps the individual to cope with real-life situations ^{16,17}. A qualitative study ⁹ has identified 15 motivational factors for gaming:

- *to earn money*
- *for the excitement*
- *to avoid restlessness or irritable feelings when not playing*
- *to gain status among friends*
- *to gain status among other players*
- *because friends were playing*
- *since there was nothing more fun to do*
- *for fun*
- *due to demands from others to play*
- *for social reasons*
- *to get away from all the problems in everyday life*
- *because everyday life was so boring*
- *to relax*
- *to avoid thinking and worrying about problems*
- *because the gamer had many friends in the game.*

Socializing aspects of gaming activities

Many online games provide social communication with other gamers. Social experiences and contact with other gamers are among the most valued parts of the gaming experience ¹⁸⁻²¹. Some gamers prefer socializing online rather

than offline, and the paradox is that even if a gamer experiences gaming as a social activity, excessive gaming is in fact an antisocial activity from a real-life perspective because the gamer spends so much time alone while gaming²².

Consequences of gaming

For most gamers, gaming is a fun and social leisure activity that causes no harm to the gamer. However, for others, gaming may lead to both ill health and negative social consequences²³. It is important to acknowledge the negative consequences related to gaming, especially when gaming becomes the dominant activity in the gamer's life²⁴⁻²⁶. Gender and differences in personality are moderating factors in relation to the association between gaming and negative consequences^{22,27-31}. Psychiatric distress has been suggested as being both directly and indirectly (via escape and competition motives) associated with problem gaming behaviours²⁷. Escapism has also been suggested to be the strongest predictor of gaming-related problems¹⁰. Excessive online gaming is thought to derive more from the desire to relieve dissatisfaction than from the pursuit of satisfaction, and the relief of dissatisfaction is thought to be more important than the feeling of flow within the gaming experience³².

Gaming addiction

A definition of gaming addiction was developed from the original criteria for pathological gambling addiction given in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM) in 1980, 1994, 2000 and 2013³³⁻³⁵. The criteria were *salience*, *tolerance*, *withdrawal*, *conflicts* and *relapse*. These criteria are the same regardless of whether the addiction involves substance use disorders or behavioural disorders^{36,37}. In early 1993, Browns³⁸ suggested that these criteria were also applicable to addictive gaming behaviour. Since then, the criteria have been modified in 1996 and 2005 by Griffiths^{39,40}. The criteria for gaming and gambling addictions have many similarities but also differ in some aspects³³, most prominently the financial aspect of gambling that is not present in most gaming forms. Internet gaming disorder (IGD) is classified in Section III under the condition for further studies included in the fifth version of the DSM (DSM-5)³³. However, it has also been suggested that more evidence-based research is needed before IGD is included in the DSM system of standard disorders with reliable diagnostic measurements. IGD may be related to and influenced by other mental health disorders³³ and may provide a maladaptive coping strategy for individuals with depressive symptoms or attention deficit hyperactivity disorder (ADHD)^{4,41}. "Gaming addiction" is not a proven diagnosis even though it is often defined in research as though it is proven. The suggestion that IGD might

be included in future versions of the DSM indicate that certain forms of gaming addiction might have a reliable means of diagnosis in the future. However, the terms “gaming disorder” and “gaming addiction” are not thought to fit into the section covering behavioural addictions, but rather within the field of Internet addictions³³.

Reward-triggering ingredients in gaming

Many of the reward-triggering ingredients of MMORPGs include gamer stimulation and arousal while gaming⁴². However, the same reward-triggering components that make the games fun to play also contribute to negative consequences if the gaming activity becomes obsessive⁴³.

King et al.⁴² have suggested several structural aspects inherent in online games that might contribute to the development of both positive and negative effects:

- *Social aspects within the gaming activity such as communication, social competition, friendship, support and feeling part of a group.*
- *To be able to control and manipulate the story of the game provides the feeling of interacting with both the game and other gamers. The gamer can also go back to correct mistakes and to finish uncompleted tasks.*
- *The ability to “be” someone else is appealing to many gamers. Gamers may create a character that is part of and affects the story of the game.*
- *Common reward features in games include additional lives, points, resources, upgrades or levelling up; obtaining bonuses, finding hidden targets or treasures; and achieving or winning.*
- *Negative reinforcement can occur when a gamer’s avatar avoids near misses or situations that weaken the avatar’s position. Receiving feedback from other gamers when losing at a task is another example of negative reinforcement.*
- *The gamer receives a form of punishment that is inherent in the game if he or she has to restart the game or makes a mistake that affects other gamers.*

- *Games also include several forms of presentation features such as music, sound and graphical experiences. These features are important to the gaming experience and help stimulate the brain's reward system during gaming*⁴².

Gambling

Gambling can take place in numerous forms such as poker, lotteries, betting on horse-racing and other sports, roulette, slot-machines and casino games. All of these forms are available 24-7 through online gambling sites. Online gambling and gaming sites⁶ may be accessed through computers, mobile phones and other electronic devices, therefore gambling is available at all times to anyone with a mobile phone⁴⁴. About 8% of the Swedish population gambles online⁴⁴, although the percentage of gamblers among the Swedish population has decreased from 88% in 1997/1998 to 70% in 2009. However, the gambling market has expanded markedly in this time, so that even though gamblers comprise a smaller percentage of the population, those who gamble are gambling more. Most adolescents in Sweden have gambled at least once, and about 4.2% of them develop problems relating to their gambling activities⁴⁵. Boys gamble more than girls, older adolescents gamble more than younger adolescents, and gambling problems are more common among adolescent gamblers than among adult gamblers⁴⁵. Excessive gambling is now seen as a health problem because it may lead to addictive and pathological consumption behaviour. Before the middle of the 20th century, gambling was seen as a sin and as stupid behaviour, and the gambler received the blame for negative outcomes^{44,46,47}. The subsequent acceptance of gambling seems to be associated with changes in society including changes to social, cultural and economic structures. Gambling is more common in societies with large inequalities within the population⁴⁸.

Definition of gambling

For this thesis, gambling is defined as:

“An online or offline activity involving the wagering of money on the outcome of a particular event”

Online gambling

The expansion of online gambling has given people the opportunity to gamble at any time from any place, the only requirement being a device that enables them to connect to the Internet. Online gambling activities involve several of the risk factors⁴⁷ such as high continuum; high frequency with more rounds

provided; multi-gambling on several different games at the same time; the feeling of nearly winning, which activates the need to continue; the illusion that the game is controllable instead of driven by coincidence; a mix of skills and coincidence; the chance for a large win; and easy entry to betting. Gamblers often participate in several forms of gambling, and it is difficult to identify the most popular form and the form that is most likely to lead to problem gambling ^{44,47}.

Gambling as a multidimensional phenomenon

Gambling should be studied from different perspectives because of its multidimensional complexity. The research field of gambling has focused mainly on the psychological aspects and more recently on the neurobiological brain impulses that may explain gambling behaviour. The social and cultural approaches to gambling still need further study. Governmental and business approaches may be important for furthering knowledge about the economics, availability, limitations and laws relating to gambling that may affect gamblers ⁴⁹. However, even though a particular study focuses on a specific area of interest, it is important to discuss other perspectives on gambling and gambling behaviour. Studying gambling from the public health perspective requires a multidimensional perspective to understand gambling activities within the population as a whole as well as the risk factors that lead to problem gambling and the destructive behaviour that follows. The public health approach to gambling also includes the need to identify preventive strategies to help gamblers from ruining their life ⁴⁹. Relatives are often influenced by the gambler's behaviours, and the costs for the individual, family and society are high. The development of preventive measures and evidence-based implementation strategies require understanding of gambling, especially adolescent gambling behaviours, for which there is an acknowledged request ^{25,44,49-53}. According to the Public Health Institute in Sweden, there is a special need for understanding what motivates people to gamble, why certain categories of people are involved in gambling and why some people have problems keeping their gambling activity within reasonable limits ⁴⁹.

Gambling problems

Gambling disorder is estimated to have a prevalence of 0.2–0.3% in the general population in the USA, where the lifetime prevalence is 0.4–1.0%: 0.2% for females and 0.6% for males. Pathological gambling is more common among African-Americans (lifelong prevalence of 0.9%) than among European Americans (0.4%) and Hispanics (0.3%) ³³.

Diagnostic and Statistical Manual of Mental Disorders

In the section called “Non-Substance-Related Disorders” in the fifth edition of the DSM (DSM-5)³³, gambling problems are classified as gambling disorder according to the following nine diagnostic criteria.

“A). Persistent and recurrent problematic gambling behavior leading to clinically significant impairment or distress, as indicated by the exhibiting of four (or more) of the following in a 12-month period. B). The gambling behavior is not better explained by a manic episode” (American Psychiatric Association, 2013, pp. 585–86)³³. Specify current severity; mild: 4–5 criteria met, moderate: 6–7 criteria met, and severe: 8–9 criteria met.

1. *Needs to gamble with increasing amounts of money in order to achieve the desired excitement (tolerance).*
2. *Is restless or irritable when attempting to cut down or stop gambling (abstinence).*
3. *Has made repeated unsuccessful efforts to control, cut back, or stop gambling (control problems and relapse).*
4. *Is often preoccupied with gambling (salience) (e.g., having persistent thoughts of reliving past gambling experiences, handicapping or planning the next venture, thinking of ways to get money with which to gamble).*
5. *Often gambles when feeling distressed (e.g., helpless, guilty, anxious, depressed) (coping strategy).*
6. *After losing money gambling, often returns another day to get even (“chasing one’s losses”).*
7. *Lies to conceal the extent of involvement with gambling (conflict).*
8. *Has jeopardized or lost a significant relationship, job, or educational or career opportunity because of gambling (withdrawal).*
9. *Relies on others to provide money to relieve desperate financial situations caused by gambling.*

Gambling is the only form of non-substance-related addiction included in the DSM-5. This is because there is evidence-based research on gambling and because of the similarities with substance addictions³³.

Involvement of brain stimulation in addiction

Addictions typically involve a feeling of satisfaction and pleasure that is produced by the substance intake or the activity. The brain releases dopamine when the person experiences something that gives a sense of well-being while engaging in natural behaviours such as sleeping, eating, drinking, having sex and performing physical activities, all of which are important for human survival. The common factor in all forms of addiction is that they directly activate the brain's reward system, which is involved in reinforcement of stimuli and may explain some behaviour. Gambling and drug intake actively stimulate the release of neurotransmitters from the brain, such as dopamine and serotonin^{54,55}, and it is thought that the new rewarding situation augments these neurotransmitter pathways. For individuals with an addiction, the drug- or behaviour-related brain stimulation overrides the natural behavioural needs, which can lead to a situation in which the addiction "kidnaps" the individual's brain^{44,54-57}. The cue-induced gaming urge or craving for online gaming is thought to be similar to the cue-induced urge or craving in substance dependence⁵⁸.

The plasticity of the brain allows changes in the reward system to occur during addictive behaviour, in which the most prominent need is to keep the addiction satisfied⁵⁷. Normal activities are often neglected because of the intensity of the reward system activation. Natural needs such as sleeping and eating become less important than feeding the addiction^{56,57}. Studies using functional magnetic resonance imaging (fMRI) cameras to visualize brain activities in pathological gamblers and substance abusers have shown lower activity in the brain reward system during normal basal conditions but an increase in brain activity during gambling or drug intake⁵⁶.

Addicted individuals who have lower levels of self-control may use the addiction as a form of self-medication to cope with other problems or disorders such as depression or loneliness. It is also plausible that these factors may partially predispose certain individuals to developing addiction. Such self-medication involves an increase in the brain's dopamine level, leading to a feeling of well-being that the addict has difficulties obtaining elsewhere through normal means. This suggests that biology and personality issues both play an important role in the mechanisms that influence susceptibility to addictive behaviour³³.

Behavioural addiction and substance addiction

Both gaming disorder and gambling disorder are described in the literature as behaviours with addictive components and are often referred to as gaming addiction and gambling addiction, respectively^{28,59-61}. However, only gambling addiction is included in the DSM-5³³. Internet gaming disorder is currently listed in the DSM-5 but not as an actual diagnosis; the aim is to encourage researchers to investigate the phenomenon further⁶². All addictions share underlying biological and genetic factors that play an important role in the development of addictive behaviours¹⁶. Other shared factors for addictions from the macro perspective are availability and social and environmental factors^{16,56,57}. There are many similarities between substance abuse and behavioural addictions, which have shared criteria regardless of whether the addiction involves a substance or a behaviour. These are presented below and refers to the nine criteria presented earlier:

- *Salience*: the addiction is the dominant factor in the individual's life.
- *Tolerance*: the dose of the drug or the addictive behaviour must be increased to obtain the feeling of satisfaction or the behaviour becomes more intense.
- *Withdrawal*: only the drug or the behaviour provides feelings of well-being.
- *Conflict*: the individual feels guilty about the behaviour and is often questioned by other people.
- *Relapse*: the individual has attempted to quit or has tried to reduce the dose or behaviour but without success.

There are comorbidities associated with gambling addictions and other addictions, and individuals with an alcohol addiction are more likely than others to develop gambling problems^{16,57}. It has been suggested that shared underlying mechanisms explain alcohol abuse, drug abuse, gambling addiction and norm-breaking behaviours. These underlying mechanisms were earlier referred to as "problem behaviour syndrome"⁶³. Consistent with this perspective, preventive programmes should target that promotion of health instead of focusing only on risk factors. Epidemiological studies have identified the genetic, environmental, social and psychological effects on the development of problem gambling. Genetic components influence the development of gambling addiction, and there is a 12% overlap between the genetic risk associated with developing pathological gambling and the genetic risk of developing alcoholism⁵⁶.

Public health perspective on adolescent health

Health determinants

Health is a resource for the individual and public health is a goal for society⁶⁴. Lifestyle, as well as biological and environmental factors, is a determinant of an individual's health. Inequalities in living conditions and lifestyle are related to differences in health between specific population groups. Society is influenced by laws and social constructions, as well as by the economic and political setting (macro perspective).

Because gaming and gambling activities relate to many different aspects, gambling should be understood from several contexts: from the macro level, in which determinants of health are influenced by society; the micro level, in which health determinants such as lifestyle and living conditions play a role; and the influences of biological factors such as genetics, sex and age. Health determinants, either separately or in combination, are all important from the public health perspective^{53,65,66} and may partly explain individual differences in health (Figure 1).

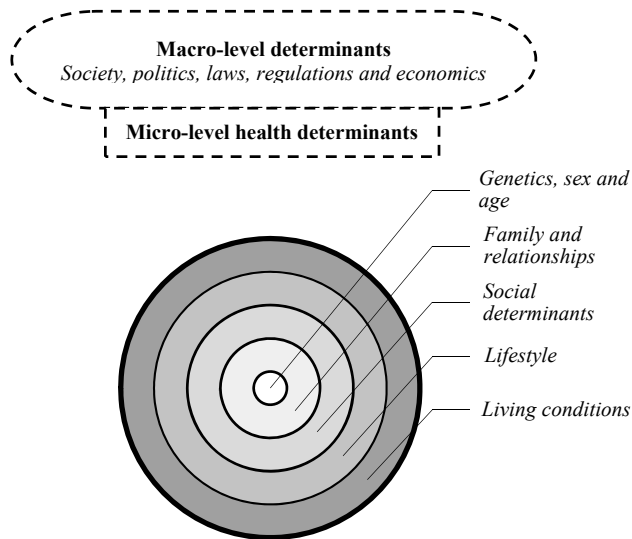


Figure 1. The determinants of health. A freely modified interpretation of the original model of health determinants in Dahlgren & Whitehead (1991)⁶⁵.

Pathways in adolescent health

Adolescents mental and physical health issues are of interest from a public health perspective, especially because the prevalence of ill health among adolescents is growing⁶⁷⁻⁶⁹. Depression is one of the most prominent aspects of mental health, and mental health problems have been described as a global burden with costs for both the individual and society in the form of productivity loss and health-care treatment⁶⁸⁻⁷¹. Many of the major public health problems have their roots in childhood and adolescence⁷²⁻⁷⁴, and it is important to develop strategies for prevention that target adolescents at risk of developing unhealthy behaviours. Lifestyle and living conditions during adolescence may influence health and may cause further health problems such as musculoskeletal pain and psychosomatic symptoms, which often persist into adulthood. Some of these may be related to psychosocial factors⁷²⁻⁷⁴. As illustrated in Figure 1, societal factors are health determinants at the macro level, whereas biological, social and psychological factors are health determinants at the micro level; all of these are factors that can be influenced by living conditions and lifestyle.

Psychosomatic and musculoskeletal symptoms

Pain during childhood and adolescence (experienced pain in the past three months) has an estimated prevalence of 83%⁷⁵. Psychosomatic and musculoskeletal symptoms among Western adolescents are a public health problem because of the significant costs for the individual and society^{76,77}. It has been suggested that frequent computer-related activities such as gaming form a new health risk factor⁶⁷ associated with both physical complaints and psychosomatic symptoms^{41,68,78-81}. Experiencing psychosomatic symptoms during adolescence increases the risk of prolonged ill health in adulthood, with associated consequences such as chronic pain, depression and anxiety^{65,66,72-74}. The short-term consequences during adolescence might appear as poorer academic performance and unhealthy sleeping habits^{82,83}.

Attention deficit hyperactivity disorder

Attention deficit, impulsivity and hyperactivity are characteristics of ADHD^{34,84}. The estimated prevalence of ADHD is 2.2–17.8% in children and adolescents aged 10–20 years⁸⁴ and 2.5% in adults³³. The symptoms of depression or ADHD are among the most common reasons for referral of a child or adolescent to psychiatric care⁸⁵. Impulse control problems and a lower capability of predicting the consequences of one's actions are common factors among adolescents with ADHD⁸⁶. These problems might further increase the risk for other problems and disorders, such as negative social relationships and mental health disorders^{33,86}.

The frequency of ADHD symptoms differ between boys and girls. For example, boys with ADHD are more likely to have externalizing disorders such as hyperactivity and impulsive behaviours, whereas girls with ADHD are more likely to have internalizing disorders including inattention⁸⁷. Internalizing disorders may be more difficult to identify than hyperactivity, and inattention is thought to be the most common ADHD subtype⁸⁸. Because girls with ADHD are more likely to have inattention problems, there is a significant possibility that ADHD remains underdiagnosed among girls⁸⁵.

ADHD is associated with adolescent gambling behaviours, although gambling problems seem to be more related to hyperactivity/impulsivity than to inattention. Young adults who report earlier childhood ADHD symptoms experience more gambling-related problems compared with young adults in the general population⁸⁹. However, other studies have reported contradictory results⁹⁰. Faregh and Derevensky⁸⁸ found no interaction between ADHD symptoms and gambling in relation to gambling pathology, although ADHD subtype and gambling severity varied in relation to depressive affect and emotional problems. Young people are more vulnerable neurobiologically compared with adults and are at higher risk of developing problem gambling, partly because of their underdeveloped ability to predict consequences of actions (e.g., gambling)⁹¹. Hyperactivity, low impulse control and inattention are important issues in research on gambling behaviour among adolescents. Impulsivity is inherent in both problem gambling and ADHD, and the hyperactivity and impulsivity subtypes are more closely related than the inattention subtype to gambling. Individuals with hyperactive behaviour prefer quicker, smaller rewards instead of larger rewards that take longer to achieve. These impulsive “quick-win” preferences are also present among problem gamblers. With the growing interest in adolescents’ gambling habits, there is a need for greater knowledge about ADHD symptoms among adolescent gamblers.

Depression

Depression of long duration influences the long-term mental health prognosis⁹². It has been suggested that the most common duration of a depressive episode is at least one year⁹³. The prevalence of depression has been estimated at 1–3% before adolescence^{94,95}. Adolescent girls are twice as likely as boys to have depression; the one-year prevalence for girls around puberty is 6% and the lifetime prevalence is 12%^{93,96,97}. Comorbidity of child and adolescent psychiatric disorders is common^{98,99} and rates of 45–65% have been found in the clinical setting^{99,100}. Comorbidity of psychiatric disorders increases the severity of illness and complicates the implementation of interventions because treatment is usually given for one diagnosis at a time¹⁰¹⁻¹⁰⁵. Excessive gamers and those experiencing problems because of gaming have lower life satisfaction scores and higher levels of negative symptoms^{106,107}. Somatic

complaints and excessive screen-based activity are both suggested causes of depressive symptoms and indicate generally poor adaptation to stressful conditions⁸¹. Associations between gaming, anxiety and depression have also been found¹⁰⁷.

A multidimensional perspective on gaming and gambling

It is necessary to take a theoretical approach to gaming and gambling in order to retain the multidimensional perspective mentioned above because of the complexity of the nature of both gaming behaviour and gambling behaviour (Figure 2).



Figure 2. Multidimensional theories of gaming and gambling behaviours. (Source: 'Author').

Genetics and psychological perspectives on gaming and gambling

The heritability of both personality and psychiatric disorders is important for understanding the multidimensional causes of human behaviour. One's personality reflects how one experiences one's surroundings and how one looks at oneself in relation to what is happening. Personality is thought to be reflected in lifestyle and is defined as a complex of many factors that determine an individual's characteristic behaviour and thought^{108,109}. Personality is biologically influenced by gene function, activities in the brain related to the chemistry of the neurotransmitter systems and physiological reactivity. Each individual's uniqueness is determined by the multidimensional combination of the interplay between the environment and genes, from which the personality is shaped^{108,109}.

Personality issues have been discussed since 1920, when Allport first described the fundamental conceptual unit of personality. Eysenck argued that personality should be viewed according to three factors: *extraversion*, *neuroticism* and *psychoticism*^{108,109}. Later, McCrae and Costa's "Big Five" factor theory modified these personality factors to *neuroticism*, *extraversion*, *conscientiousness*, *agreeableness* and *openness to experiences*. The Big Five factor theory still dominates the research field¹¹⁰.

Genetic predisposition is important because 30–40% of depression is explained by genetic vulnerability¹¹¹. The type of personality is likely to affect the way people handle gaming and gambling. As noted above, for some individuals, gaming and gambling provide an opportunity to escape from the real world into the world of gaming/gambling as a means of coping with everyday life issues^{12,14}. Conversely, the special features included in gaming or gambling activity may not appeal to individuals with a different personality. The brain's reward system is involved in both gaming and gambling activities. Moreover, the heritability of pathological gambling is estimated at 50–60%⁵⁹, and the genetic contribution seems to be related to the severity of problem gambling¹¹².

Social perspectives on gaming and gambling

The social interactions included in both gaming and gambling play an important role in the gaming/gambling experience. Many gamers and gamblers find pleasure in playing with others who share the same interests. For some, gaming and gambling activities also provide a means of escaping loneliness in their life. Online gaming (and some online gambling activities) includes anonymity^{5,12,14}, which is appealing to some. When playing a game, the individual can pretend to be someone else¹³ in a world where he or she is not

judged. From that perspective, it is easy to understand why some gamers claim to prefer online socializing to offline socializing^{12,14}. Another aspect of socializing within the gaming and gambling environment involves communication and making friends by playing together^{6,9}. However, the paradox is that gaming or gambling can take over a person's life and lead to loneliness and withdrawal issues¹¹³.

Behavioural theories in relation to gaming and gambling

According to early behavioural research, human free will is an illusion because human actions were suggested to result from both external and internal rewards in the brain and the expected consequences of the action taken. According to this line of research, it is unlikely that a person would repeat an action if the outcome was negative, whereas positive effects of an activity would reinforce the repetition of that activity. This was called *The Principle of Reinforcement* and was studied by the early researcher in behaviourism, B.F. Skinner (1904–1990)¹⁰⁸. Reinforcement occurs when “*something in the environment fortifies, or reinforces, a behaviour. A reinforcement is an environmental consequence that occurs after a produced response, and when the response is most likely to recur*”¹⁰⁸. If the behaviour is for pure entertainment or used as a coping strategy, it may develop into an addictive-like behaviour if there is loss of control⁴². Skinner's theories of reinforcement are widely accepted and used, and have contributed to a better understanding of behavioural addictions such as addictive gaming and gambling behaviours¹¹⁴. Gaming provides rapid reward responses¹¹⁵, which enhance the activity. If a gamer does not have to wait long to obtain the results, the quick response becomes a reinforcement. If a near win reduces negative feelings, gambling becomes intermittent. The behaviour is both negatively and positively reinforced, which leads to a feeling of arousal and may also explain the complexity of trying to stop the gaming activity.

Rationale for this thesis

The past decade has seen a rapid change in how children and adolescents spend their leisure time¹¹⁶. Adolescents are now more likely to engage in adult-regulated leisure activities inside the home than to spend time socializing with friends outside the home^{7,117}. The current generation's never-ending access to a virtual playground is markedly distinct from previous generations¹¹⁸. The vast majority of adolescents now engage, to some extent, in gaming in their leisure time¹¹⁹, predominantly those in the early to middle years of adolescence¹¹⁷.

The field of research about online gaming and online gambling by adolescents needs further knowledge from multidimensional perspectives^{44,50,51,114,120}. The exploration of gaming and gambling behaviours and psychiatric symptoms in relation to problem gaming and problem gambling among adolescents can be helpful for developing programmes for prevention and treatment²⁷. New knowledge may help to support and extend non-generalizable results from earlier studies with small study populations. An exploratory design involving a large study sample provides the ability to investigate online gaming and online gambling behaviours from several perspectives, to determine whether online gaming and online gambling are related to and associated with other lifestyles and health determinants¹²¹, and to obtain further knowledge about motivational factors¹⁰ and potential effects. The contradictory research on gaming and gambling behaviours requires generalizable results as these are common leisure activities among adolescents^{25,26} and a dominant activity in some individuals' lives²⁴⁻²⁶. Further understanding may help to identify key characteristics (such as demographic factors) of the online gamers who need to reduce or limit their unhealthy online gaming behaviour or to identify gamers who might be able to play for a long time without experiencing negative consequences.

Others have discussed whether online gaming behaviour is related to ill health^{24-26,67}. From a public health perspective, it is important that preventive programmes for any problem behaviour are founded on evidence-based research and not on myths and ungrounded opinion. Investigating whether the additive effects of online gaming and motives to play are associated with depressive, psychosomatic and musculoskeletal symptoms may help to identify the effects of time spent gaming.

ADHD symptoms in adulthood are thought to be associated with gambling frequency and gambling problems⁸⁹. Investigating these associations in an adolescent population may bring new understanding of the younger gambling population in Sweden. To our knowledge, no one has performed a large population-based Swedish study of the association between adolescent gaming and gambling behaviour in the 15–18-year-old age group. One reason might be that, under Swedish law, gambling activities are illegal for people under 18 years of age, which suggests that gamblers are unlikely to be found within this age group.

According to the Swedish Institute of Public Health⁴⁴, online gaming in one's younger years seems to be related to online gambling in adulthood. Research investigating the relationship between online gaming and online gambling frequency during adolescence, including any sex differences and relationships with suspected confounding factors, should add new knowledge in this emerging field of research¹²².

General and specific aims

The overall aims of this thesis were to examine online gaming and online gambling in relation to negative social consequences and ill health among adolescents, and to determine whether gaming and gambling activities co-occur.

Specific aims

I To examine 1) the amount of time spent playing MMORPGs among boys and girls; 2) the motives for playing MMORPGs among boys and girls; and 3) the relationships between time spent gaming, the motives for playing MMORPGs and the negative consequences experienced by boys and girls.

II To measure the amount of time spent gaming by adolescents and to study whether gaming motives have additive effects on depressive, musculoskeletal and psychosomatic symptoms.

III To investigate the associations between gambling frequency, ADHD symptoms and problem gambling among adolescent boys and girls.

IV To investigate 1) the association between adolescents' online gaming and online chatting in relation to online gambling and 2) whether these relationships are related to alcohol consumption or differences between boys and girls.

Methods

The studies included were part of the Survey of Adolescent Life in Vestmanland (SALVe). Quantitative data were obtained from SALVe 2008 and SALVe 2012, which are part of the population-based cross-sectional studies conducted biennially since 1995 by the County Council of Västmanland in Sweden to monitor the life situation, habits and health of the county's adolescent population. Västmanland is located about 100 km west of Stockholm and is a medium-sized Swedish county of about 260,000 inhabitants. Västmanland is considered representative of Swedish society because of its distribution of educational, income and employment levels as well as urban and rural areas. In SALVe 2008, the target population comprised all students in the 7th grade (13–14-year-olds) and 9th grade (15–16-year-olds) of compulsory school and the 2nd year of upper secondary school (17–18-year-olds), and the response rate was 78.2% (Papers I and II). In SALVe 2012, the target population comprised all students in the 9th grade (15–16-year-olds) of compulsory school and the 2nd year of upper secondary school (17–18-year-olds), and the response rate was 72.3% (Papers III and IV).

Study design

Papers I–IV

Population-based cross-sectional studies based on self-reported data from the 'Survey of Adolescent Life in Vestmanland' in 2008 (SALVe 2008) and 2012 (SALVe 2012).

Participants and data collection

Papers I and II

The target population was all students in the 7th grade (13–14-year-olds) and 9th grade (15–16-year-olds) of compulsory school and the 2nd year of upper secondary school (17–18-year-olds) in Västmanland. The students were asked

to complete a questionnaire during class hours, and a flow chart is shown in Figure 3.

A total of 7906 students (78.2% of those enrolled) participated. After exclusion of 41 participants who did not state their sex and 108 who did not complete the questionnaire, the questionnaires for 7757 participants were available for analysis (Figure 3).

Papers III and IV

The target population was all students in the 9th grade (15–16-year-olds) of compulsory school and the 2nd year of upper secondary school (17–18-year-olds) in Västmanland. The students were asked to complete a questionnaire during class hours, and a flow chart is shown in Figure 4.

Students at special schools and students with insufficient knowledge of the Swedish language were excluded. Students from schools whose principals chose not to participate in the studies are referred to as administrative drop-outs in the flow charts (Figures 3 and 4). In these figures, internal non-respondents were defined as those who did not indicate whether they were male or female and those who did not complete the questionnaire. External non-respondents were those who were absent on the day of data collection and did not return their questionnaire by mail or those who declined to participate.

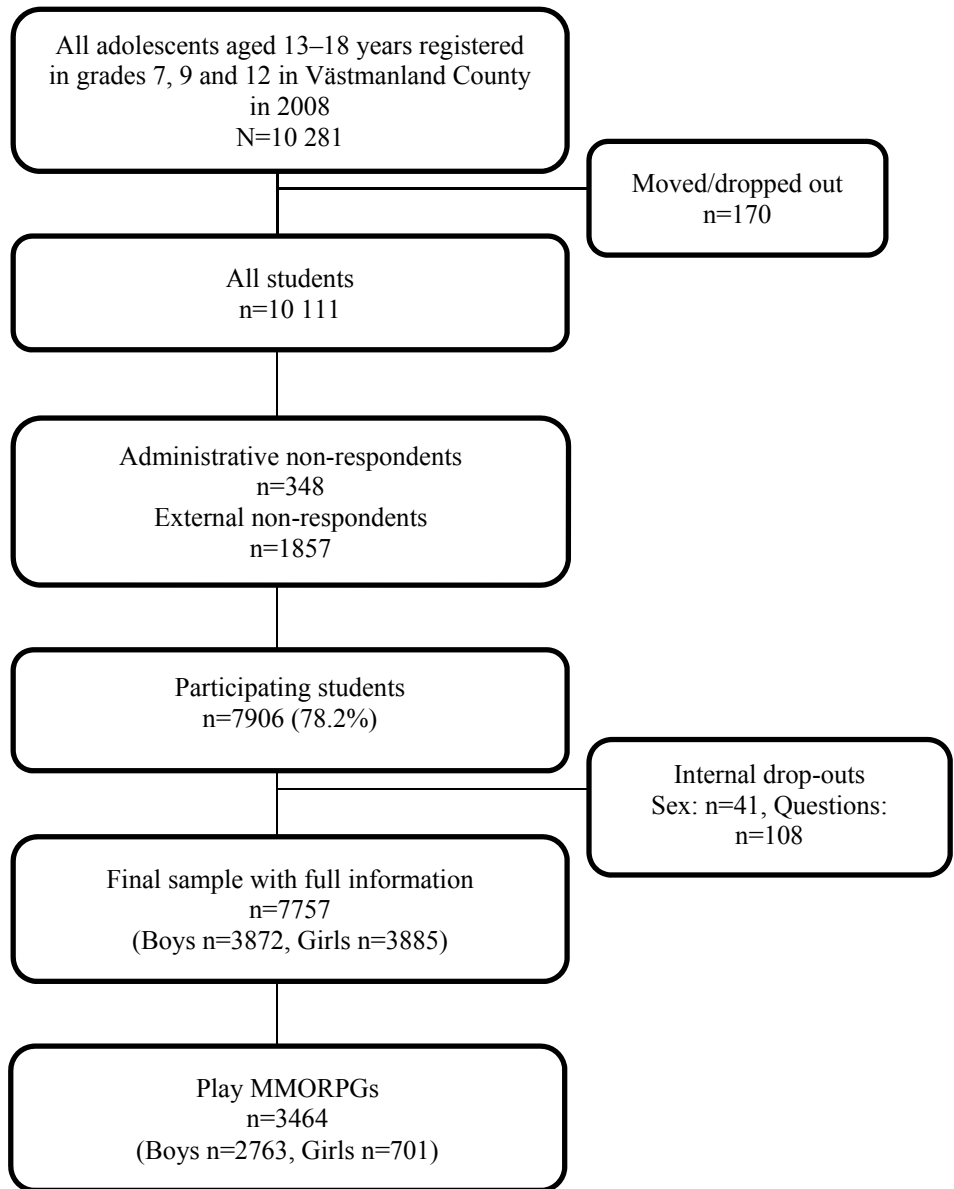


Figure 3. Flow chart of the study population in Papers I and II (SALVe 2008).

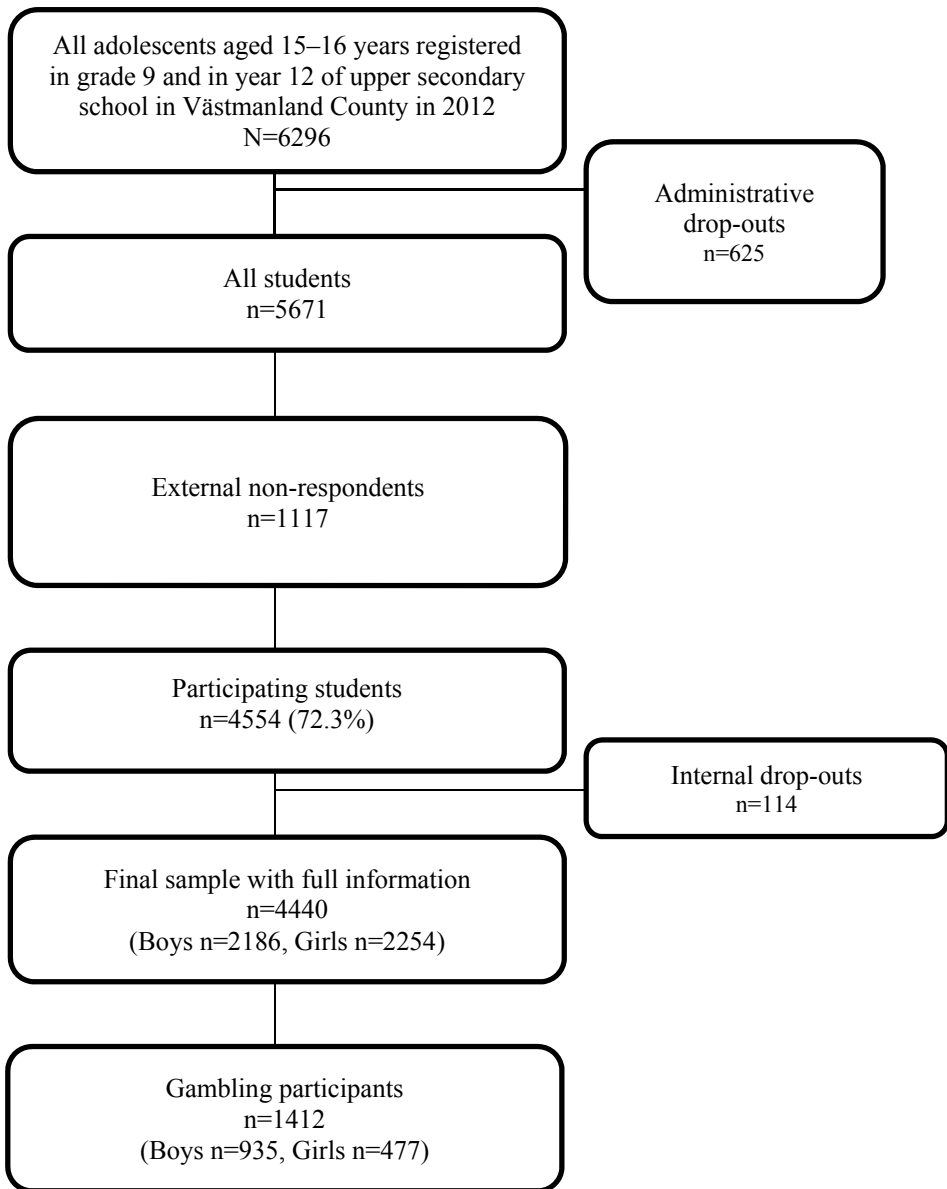


Figure 4. Flow chart of the study population in Papers III and IV (SALVe 2012).

Procedure

The County Council of Västmanland and the Centre for Clinical Research in Västerås were responsible for both planning the study design and constructing the questionnaires in the extensive studies of SALVe 2008 and SALVe 2012. The included schools were informed about the aims of SALVe both orally and in writing by the county council and were instructed on how the survey was to be completed, the importance of the anonymity of the study and that participation was voluntary. Teachers or school nurses then administered the questionnaire in the classroom on a school day, and all students were informed both orally and in writing that participation was voluntary and anonymous, and that they could end their participation at any time. The completed questionnaires were collected in an envelope that was sealed immediately and sent back to the Centre for Clinical Research. Students who were not present on the day of the study were given a second chance to complete the questionnaire when next present at school. The data collected were only analysed by grade and sex on group level.

Measures

Gaming

Computer use

The participating adolescents were asked about how many hours a day they used a computer: “*On average, how many hours a day do you use a computer during your leisure time (not at school)?*” The response options were 1 = do not use a computer, 2 = less than 1 h, 3 = 1–2 h, 4 = 2–5 h and 5 = more than 5 h (Paper I).

Computer gaming habits

To study the participants’ computer gaming habits, the students were asked: “*How often do you play multiplayer online computer games, for example World of Warcraft™, Counter-Strike, Guild Wars, EverQuest, StarCraft, Battlefield or similar?*” The response options were 1 = never, 2 = a few times a year, 3 = occasionally every month, 4 = 2–4 times a month, 5 = 2–3 days a week, 6 = 4–5 days a week and 7 = 6–7 days a week (Papers I and II).

Online gaming time on weekdays and on weekends

We chose to distinguish between online gaming time on weekdays and on weekends. The participants were asked: “*If you play an online computer or other game on the Internet, how long do you play on average on an ordinary*

weekday (Monday to Friday)?” The response options were 1 = do not play, 2 = less than 1 h, 3 = 1–2 h, 4 = 2–5 h and 5 = more than 5 h.

The same question was asked about gaming on weekends (Saturday and Sunday) with the same response options (Papers I, II and IV).

Computer gaming motives

The variables used to describe the motives for playing online computer games were extracted from a qualitative study⁹. The motives described in the included papers (Papers I and II) were adjusted to be asked in questions in a quantitative design. Fifteen affective measurement variables were used to identify the aspects that predicted the participants’ motives for playing computer games. We asked the participants: *“If you play online computer or other multiplayer games on the Internet, what are your reasons for doing so?”* The response options were 1 = “It is fun”, 2 = “It is relaxing”, 3 = “My friends play”, 4 = “Demands from other players that I have to play”, 5 = “It is exciting”, 6 = “It is social”, 7 = “I have many friends in the game”, 8 = “I get away from all the problems in my everyday life”, 9 = “I have nothing more fun to do”, 10 = “To earn money”, 11 = “My everyday life is so boring”, 12 = “I gain status among other players”, 13 = “I gain status among my friends in real life”, 14 = “I become restless and irritated when I’m not playing” and 15 = “I don’t have to think about all the worries in my everyday life”.

Negative consequences of gaming

Seven variables relating to problems were created and used in Paper I in this thesis. These were based on the self-evaluated negative social consequences described by Linderoth and Bennerstedt (2007)⁹. Unconstrained quotes about the self-experienced negative social consequences of gaming were modified to fit a quantitative study design. All self-experienced negative social consequences relating to gaming included in the qualitative study were also included in the quantitative study, but in a modified form. We asked the participants: *“Has your computer gaming/Internet use lead to any problems in your everyday life?”* The response options were 1 = “Do not have time to spend with my friends”, 2 = “Do not have time/forget to eat”, 3 = “Quarrels and troubles with parents or siblings because of gaming, chatting or use of the Internet”, 4 = “Stayed home from school to play/chat/use the Internet”, 5 = “No time to do school assignments”, 6 = “Less sleep because of time spent gaming/on computer late in evening and at night” and 7 = “Other consequences”.

Gambling

Gambling frequency items (Paper III)

We chose to distinguish between different gambling forms and between offline gambling and online gambling. The following questions were asked:

Online poker gambling frequency: “How often do you gamble on poker, a casino or similar on the Internet for real money?”

Offline poker gambling frequency: “How often do you play poker for money (not on the Internet)?”

Gambling frequency on lotteries or other games: “How often do you gamble for money on lotteries or other games (horse-racing, scratch cards, sports, etc., not on the Internet)?”

Gambling frequency on slot-machines: “How often do you gamble on slot-machines (the sort you can win money on, not on the Internet)?”

The response options for these questions were 0 = never, 1 = a few times a year, 2 = once a month, 3 = 2–4 times a month, 4 = 2–3 days a week, 5 = 4–5 days a week and 6 = 6–7 days a week.

Online gambling time on weekdays (Paper IV)

To calculate an average online gambling time per day, we asked the participants how many hours they spent on gambling online on an average weekday (Monday to Friday) and on an average weekend (Saturday or Sunday). The participants answered on a scale ranging from 0 hours to more than 5 hours that included steps for every half hour. We then multiplied the average weekday hours by 5 (*days*) and the average weekend hours by 2 (*days*). These numbers were added and divided by 7 (*days*) to calculate an average online gambling time per day. Online gambling participants were then dichotomized into (0) non-gamblers or (1) those who gambled online (i.e., reported any gambling time during weekdays or weekends), and this was used as the dependent variable in the logistic regression analysis in Paper IV.

Problem gambling (Paper III)

Only participants identified as gamblers completed these questions. The Problem Gambling Severity Index (PGSI) ¹²³ included nine questions about gambling behaviour and was used in Paper III to measure the severity of gambling problems (range 0–27 points). The PGSI provides the opportunity to analyse problem gambling as a continuum and to categorize gambling according to risk as non-problem gambling, low risk for problem gambling, moderate risk

for problem gambling and high risk for problem gambling. For all analyses, the PGSI summation index was treated as a continuous variable, except for the descriptive analyses, which were categorized into three levels: 1 = non-problem gambling and low risk for problem gambling (≤ 2 points), 2 = moderate risk for problem gambling (3–7 points), and 3 = high risk for problem gambling (≥ 8 points).

Depression

In Paper II, we used the Depression Self-Rating Scale (DSRS) of the DSM 4th edition (DSM-IV) ^{35,124} to assess depressive symptoms. The general criterion “A” for major depression is defined as two weeks of dysphoric mood or loss of interest or pleasure in most activities. In children and adolescents, it also includes irritated mood accompanied by at least four other symptoms from sleep disturbance, feelings of worthlessness or guilt, concentration disturbance, weight loss or gain or appetite disturbance, fatigue, loss of energy and suicidal thoughts. We used a summation of the DSRS-reported symptoms as a depression index, with each symptom category counting only once (0–9 points). A dichotomous variable was also created, in which subjects fulfilling the DSM-IV A criterion for depression were classified as depressed. Cronbach’s α for the DSRS was 0.84. The A criterion has a reported sensitivity of 96.1% and a specificity of 59.4% for major depression ^{124,125}.

ADHD (Paper III)

The World Health Organization Adult ADHD Self-Report Scale (ASRS) was used. Of the 18 ASRS questions, the first six are valid for use alone as a short screening tool (ASRS-S) and were used here ^{126,127}. Participants were asked about the frequency of ADHD symptoms within the past six months, and the response options were never = 0, rarely = 1, sometimes = 2, often = 3 and very often = 4 (range 0–24). Cronbach’s α for the items of the ASRS-S was 0.787. The ASRS-S has been validated in an adult non-clinical sample with a sensitivity of 68.7% and a specificity of 99.5% ¹²⁷. To create a dichotomized ADHD symptom variable, the cut-off score of ≥ 4 symptoms on the ASRS-S, as recommended by Kessler ¹²⁷, was used. The presence of 0–3 symptoms was categorized as not having ADHD (0) and the presence of ≥ 4 symptoms was categorized as having symptoms of ADHD (1). The ASRS-S has two latent factors: attention deficit and hyperactivity ¹²⁶, which were investigated using separate summation indices in subgroup analyses. The internal consistency values were 0.79–0.87 for the inattention subscale and 0.68–0.89 for the hyperactivity subscale ¹²⁸. A dichotomous cut-off point was set for each item ¹²⁷.

Musculoskeletal symptoms

For the analyses in Paper II, participants were asked: “How often during the past three months have you had the following symptoms: pain in the shoulders/neck; pain in the back/hips; and pain in the hands/knees/legs/feet?” The response options were 0 = never, 1 = seldom, 2 = occasionally, 3 = often and 4 = always. The internal consistency (Cronbach’s α) of the questions about musculoskeletal pain symptoms was 0.68. The use of this measurement has been previously reported^{82,129}. A summation index was created with a range of 0–12 points. The index was divided based on standard deviations, where -1 *SD* was the cut-off point for few musculoskeletal symptoms, $+1$ *SD* was the cut-off point for many musculoskeletal symptoms and the intermediate group (between -1 *SD* and $+1$ *SD*) was classified as having a medium number of musculoskeletal symptoms. We also created a dichotomous variable, with 0 = few to a medium number of symptoms and 1 = many symptoms.

Psychosomatic symptoms

For the analyses in Paper II, participants were asked: “How often during the past three months have you had the following symptoms: headache; stomach ache; feelings of nervousness; feelings of irritation; and sleep problems”. The response options were 0 = never, 1 = seldom, 2 = occasionally, 3 = often and 4 = always. The internal consistency (Cronbach’s α) of the questions about psychosomatic symptoms was 0.75. The use of this measurement has been previously reported^{82,129}. A summation index was created with a range of 0–20 points. The index was divided based on standard deviations, where -1 *SD* was the cut-off point for few psychosomatic symptoms, $+1$ *SD* was the cut-off point for many psychosomatic symptoms and the intermediate group (between -1 *SD* and $+1$ *SD*) was classified as having a medium number of psychosomatic symptoms. We also created a dichotomous variable, with 0 = few to a medium number of symptoms and 1 = many symptoms.

Demographic data and control variables

To adjust for potential confounding variables within the study population, the following demographic factors, as well as control variables, were analysed:

Sex (Papers I–IV)

Age (Papers II–IV)

Parents’ country of birth (Papers II–IV)

Parents’ Civil status (i.e. separated parents) (Papers III–IV)

Parental employment status (Papers III and IV)

Subjective socio-economic status (Papers II–IV)

Physical activity (Paper II)

Body mass index (Paper II)

Alcohol consumption (Paper IV)

Single-player offline computer gaming (Paper II)

Chatting online (Paper IV)

Ethical considerations

In all research involving humans, ethical considerations are important and can influence the reliability of the research conducted. The SALVe is a study conducted by the County Council of Västmanland every other year with the aim of monitoring living conditions and health among adolescents in Västmanland. This study allows the county council and communities in Västmanland to join forces and work together for long-term prevention within the youth population. The SALVe also provides data for public health research on adolescents' health and living conditions. The study is based on a questionnaire that the students complete during school hours in the classroom. Participation is anonymous and respondents are informed both orally and in writing that their participation is voluntary and that they have the right to end their participation at any time without further explanation. The surveys are administered by school nurses and teachers who are aware that participation in the study is anonymous and voluntary.

According to the Ethical Review Act 2003:460, the following research is required by Swedish law to apply for ethical approval.

3 §—This law applies to research that includes handling of (1) personal information according to 13 § in PUL (1998:204) or (2) personal information about criminality according to 21 § in PUL (2008:192).

4 § In addition to 3 §, this law applies to research (1) that can cause physical harm to participating persons, (2) that is conducted using a method aimed at physically or mentally influencing the participant or that includes a risk of physical or mental harm to the participant, (3) that includes studies of biological material taken from a living human being that can be associated with that individual, (4) that includes a physical operation on a deceased individual, or (5) that includes studies of biological material taken from a deceased individual for medical research that may be identified as belonging to the deceased individual (2008:192).

PUL applies to information that may be associated indirectly or directly with a person. In our studies, there was no possibility that data could be associated with a specific individual because participation was anonymous and the questionnaire did not include questions that indirectly, directly or in combination could be tracked to a specific individual. The SALVe does not include sensitive personal information, as defined by PUL, or the chance of physical harm

to participants. In addition, the study did not include personal information relating to breaking of the law according to PUL. The study did not aim to influence the participants physically or mentally, and no biological material was collected in the present studies. All studies included in this thesis followed the Swedish guidelines for studies of social science and humanities according to the *Declaration of Helsinki*. In accordance with Swedish law (Ethical Review Act 2003:460), the studies included in this thesis did not require ethical approval by a medical faculty. In SALVe 2006, anonymous and voluntary saliva samples were collected from the participating students for genetic analyses in addition to the survey. The saliva samples and questionnaires were collected anonymously and combined through study-specific identification number, used to de-identify the participants. During the planning for SALVe 2006, the ethical review board in Uppsala was contacted. However, because the study design did not include any personal information that could be used to identify any specific individual, the SALVe 2006 study was not required to apply for ethical approval by a medical faculty. Nevertheless, an advisory statement was requested from the ethical review board in Uppsala, and the SALVe 2006 study was approved without any restrictions. Because SALVe 2008 and SALVe 2012 were nearly identical to SALVe 2006 in terms of the study design, questionnaire and procedures, except for the lack of collection of anonymous biological data in the two latest study, we did not apply for ethical approval for SALVe 2008 and SALVe 2012. The decision not to apply for ethical approval for these later studies was made following personal communication with the head of the ethical review board at Uppsala University in reference to the specifications of the Ethical Review Act 2003:460 and because of the similarity of these studies to the SALVe 2006 study. In recent years, attitudes towards ethical approval have changed both internationally and in Sweden. Even if the Ethical Review Act had not changed, studies that lack ethical approval are often questioned regardless of the study design and anonymity of study data. Because of this, before the start of SALVe 2014, a new advisory statement was requested from the ethical review board at Uppsala University and was once again given without restriction. It was not possible to apply for retrospective ethical approval for SALVe 2008 and SALVe 2012. However, the ethical committee at Uppsala University gave clearance to SALVe 2006 and SALVe 2014, and the head of the regional ethical review board of Uppsala confirmed that this type of study is not required to apply for ethical approval according to the Ethical Review Act because of its anonymous design. Regardless of whether or not researchers are required to apply for ethical approval according to the Ethical Review Act, the ethical issues involved in human research must be considered in detail. Frequent discussions among the researchers (in SALVe 1995-2014) considered how the questions included in the questionnaire may affect the participants and whether there would be problems performing the study during school time. Even if the par-

ticipants are informed both orally and in writing that their participation is voluntary and anonymous, they may feel obligated to participate. These ethical issues have been present since the beginning of SALVe in 1995. It is according to the Ethical Review Act, not the ethical approval committee's responsibility to review these ethical issues. Internationally, attitudes regarding ethical approval have gradually changed in recent years. International journals often require ethical approval before accepting a manuscript regardless of the study design or anonymity of study data. Consistent with these international changes in attitude towards requests for ethical approval, regardless of the lack of sensitive personal information in the study data and anonymous study design, we hope there will be a future evaluation and possible revision of the Swedish Ethical Review Act in relation to research involving humans. In conclusion, we are aware of the ethical issues involved in this type of study design that includes the use of anonymous surveys. Swedish law and the guidelines of the *Declaration of Helsinki* have been strictly followed in the collection of all data used in the four studies included in this thesis.

Statistical analysis

The statistical analyses in Papers I–IV were performed using SPSS Statistics (version 17, Chicago, IL, USA) and IBM SPSS Statistics (version 20 and 22, IBM Corp., Armonk, NY, USA). The zero-inflated negative binomial regression analysis reported in Paper IV was performed using STATA (version 12, StataCorp, College Station, TX, USA).

The *p-value* expresses the value of significance or the probability of wrongly rejecting the null hypothesis. The smaller the value of *p*, the greater the significance. A *p-value* is affected by the sample size; a large sample size may lead to significant results whereas there is a risk of missing significance with a small sample size. For all included papers (Papers I–IV), a significance level of $p < 0.05$ was set as indicating significance.

Cronbach's α represents the internal reliability of a scale, and values > 0.7 are considered acceptable. Cronbach's α was used to measure the internal consistency of some of the scales included in Papers I–IV.

Pearson's chi-square test was used to identify differences between the dichotomous and categorical variables included in Papers I–IV. A chi-square test does not require a normal distribution of the sample data and can be used to test whether two categorical variables are associated.

Fisher's exact probability test is similar to Pearson's chi-square test and provides a method of computing the exact probability of a statistic. It may be used with small samples of data (Paper III).

The *Mann–Whitney U test* is used for ordinal scale data and can be used to determine the differences in rank between two independent variables that are not normally distributed (Papers III and IV). It is a non-parametric test that shows whether there are differences between two independent samples.

Spearman's rho provides a standardized measure of the strength of a relationship between two variables. This test was used to investigate the relationships between outcomes and control variables in Paper II. It is a non-parametric test that does not rely on the assumptions of a parametric test. The values range from -1.0 to $+1.0$.

Cramer's V was used to investigate sex differences in Papers II–IV. It is a measure of the strength of an association between two categorical variables and may be used when one of the variables has more than two categories. Cramer's V was used to investigate correlations between outcome and control variables, and for nominal data.

Kendall's tau (Paper III) is another type of non-parametric statistical test of a relationship and is similar to Spearman's rho. It is used to examine the relationships between study variables and is preferred for skewed data with multiple zero-order measurements and with a large number of tied ranks.

Factor analysis is a multivariate analytic technique that is used to determine whether the observed variables are interrelated to each other or to latent variables within the data. Factor analysis can take the form of a linear model. Factor analysis (*Varimax with Kaiser normalization*) was used in Papers I–III. In Paper I, it was used to investigate the relationships between the different motives for playing computer games and to identify components or higher-order groups of gaming motives. In Paper III, factor analysis was used to examine the associations between gambling frequency and to identify higher-order groups of gambling frequency within different types of gambling forms. Only components with an eigenvalue >1.0 should be accepted. In Paper I, three factors with an eigenvalue >1.0 were identified regarding participants' gaming motives. In Paper III, only one component with an eigenvalue >1.0 was identified, which indicated that there was no higher order of groups regarding gambling frequency within the different gambling forms.

Binary logistic regression produces an odds ratio (OR), which indicates the strength of an association between a variable and an outcome. ORs were used in Papers I, II and IV. The value of 1.0 is the reference value. A value >1.0

shows an increased probability of an outcome related to the study variable, and a value <1.0 shows a decreased probability of an outcome. The interaction effects between independent variables in relation to the dependent variable were analysed in Paper IV. An interaction effect may reveal a combined effect of two or more predictor variables on an outcome variable.

Nagelkerke R^2 was used to examine the explained variance in the regression models (Papers I, II, IV). This test is used to investigate how well a regression line fits the real data points by measuring the relative predictive power of the model. An R^2 level of 1.0 means a perfect fit.

Zero-inflated negative binomial regression is the preferred regression model when the data are severely skewed, which was the case in Paper III because of the low number of adolescents who reported gambling for money. This method simultaneously estimates and combines two separate regression models: a logistic regression model that accounts for the excess of zero values and a negative binomial regression model that is used to analyse the expected values of the measurement.

Statistical methods used in the papers included in this thesis are presented in Table 1.

Table 1. Statistical methods used in the papers included in this thesis.

Statistical Method	Paper I	Paper II	Paper III	Paper IV
<i>p-value</i>	x	x	x	x
<i>Cronbach's α</i>	x	x	x	x
<i>Pearson's chi-square test</i>	x	x	x	x
<i>Fisher's exact probability test</i>			x	
<i>Mann-Whitney U test</i>			x	x
<i>Spearman's rho</i>		x		
<i>Cramer's V</i>		x	x	x
<i>Kendall's tau</i>			x	
<i>Factor analysis (Varimax)</i>	x		x	
<i>Binary logistic regression</i>	x	x		
<i>Multivariate binary logistic regression</i>		x		x
<i>Nagelkerke R^2</i>	x	x		x
<i>Zero-inflated negative binomial regression</i>			x	

Results

Paper I

A total of 44.7% of participants were MMORPG gamers: 71.3% of the boys and 18.0% of the girls. About one in four boys and one in 10 girls spent >5 hours a day gaming on weekends. Factor analysis (Varimax with Kaiser normalization) to identify groups of motives revealed three components of motives for playing with an eigenvalue >1.0: *Fun/Social*, *Demand/Status* and *Escape motives* (Figure 5).

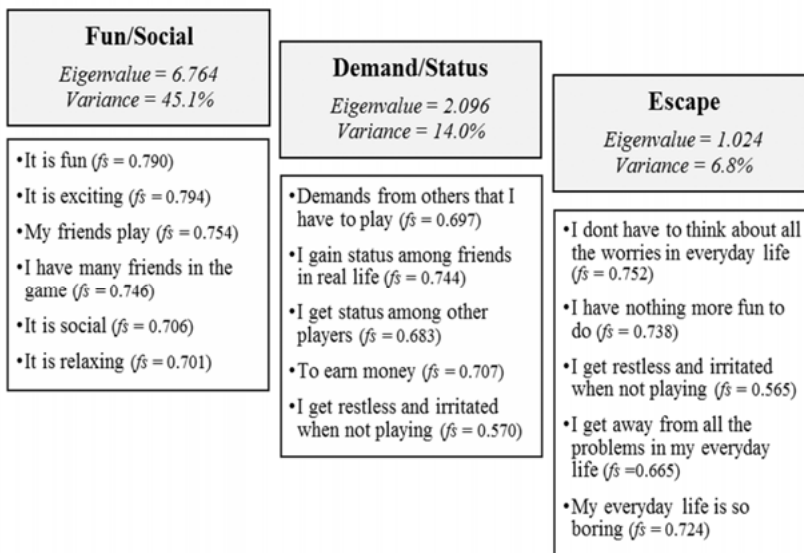


Figure 5. Groups of higher-order gaming motives shown in the factor analysis in Paper I (fs = factor score).

The most common motive for adolescents for playing MMORPGs was fun or social reasons. About 50% of the participating adolescents claimed to play because they had nothing else to do, and more than 20% of both boys and girls played to escape from problems in their everyday life or to escape from thinking about their worries. Boys were nearly twice as likely as girls to become irritated or restless when they were not playing.

Even though gamers spent more time gaming on weekends than on weekdays, self-reported negative consequences of gaming occurred more frequently on weekdays than on weekends. Most of the gamers reported experiencing negative social consequences as a result of gaming. The more frequent users were getting less sleep, not having time to do school assignments and having conflicts with parents and/or siblings because of gaming. More boys than girls reported not having time to spend with friends because of gaming and staying home from school to play. By contrast, more girls than boys reported not having time to eat because of gaming.

The multivariate analysis adjusted for time spent gaming ($R^2 = 26.5\%$) showed that gaming for fun or social reasons was associated with a reduced probability of negative social consequences. Gaming because of demands from others or to gain status increased the probability of negative social consequences and escapism motives were the strongest predictor of negative social consequences associated with gaming (Table 2).

Table 2. ORs^a for negative social consequences related to different motives for play and time spent on MMORPGs

Motives/time spent	OR	95% CI	p
<i>Gaming for fun or social motives</i>	0.679	0.596–0.774	<0.001
<i>Gaming for demands or status motives</i>	1.574	1.423–1.740	<0.001
<i>Gaming to escape</i>	1.855	1.673–2.056	<0.001
<i>Time spent gaming</i>	2.110	1.829–2.434	<0.001

^aThe data were analysed by multivariate logistic analysis.

Adjusting for time strengthened the associations between gaming for fun or social reasons and fewer negative consequences. By contrast, such adjustment weakened the relationship between gaming because of demands from others or escapism and negative consequences (Table 2).

Paper II

The aim of Paper II was to investigate whether the findings from Paper I about the influences of time spent gaming and motives for gaming on negative social consequences were associated with depressive, musculoskeletal or psychosomatic symptoms. Girls were more likely than boys to report depressive, musculoskeletal and psychosomatic symptoms. A higher proportion of boys were online gamers.

The correlation analysis identified significant associations between escape motives and depressive symptoms ($r = 0.293$, $p = \leq 0.001$), musculoskeletal symptoms ($r = 0.159$, $p = \leq 0.001$) and psychosomatic symptoms ($r = 0.210$, $p = \leq 0.001$). Negative associations were found with gaming for fun or social motives: depressive symptoms ($r = -0.048$, $p = \leq 0.01$), musculoskeletal symptoms ($r = -0.052$, $p = \leq 0.001$) and psychosomatic symptoms ($r = -0.120$, $p = \leq 0.001$). The probability of having depressive, musculoskeletal or psychosomatic symptoms increased with increased online gaming time, especially on weekdays.

However, similar to our findings regarding negative social consequences in Paper I, the motives for playing had a stronger association with depressive, musculoskeletal or psychosomatic symptoms compared with time spent gaming. Those who played games online for >5 hours a day on weekdays in combination with escape motives had a higher probability of depressive symptoms (OR = 4.614, 95% CI = 3.230–6.590), musculoskeletal symptoms (OR = 2.494, 95% CI = 1.598–3.892) and psychosomatic symptoms (OR = 4.437, 95% CI = 2.966–6.637) compared with non-gamers.

Although those playing for >5 hours a day with strong escape motives had a higher probability of ill health compared with non-gamers, the same was not true for gamers who played for the same amount of time but with different motives, such as weak escape or strong fun/social motives (Table 3).

Table 3. Binary logistic regression analysis of the motives for playing combined with gaming time on weekdays in relation to depressive symptoms for three different motives for playing.

	Depressive symptoms		
	% ^a	<i>p</i>	OR ^b (95% CI)
Fun/social motive			
<i>Non-gamers</i>	22.2		1.0
<i>High-medium fun/social, ≤2 h</i>	20.7	<0.001	1.630 (1.338–1.986)
<i>High-medium fun/social, >2–5 h</i>	20.1	<0.001	1.661 (1.306–2.112)
<i>High-medium fun/social, >5 h</i>	25.1	<0.001	2.501 (1.851–3.399)
<i>Low fun/social, ≤2 h</i>	28.7	<0.001	1.491 (1.192–1.865)
<i>Low fun/social, >2–5 h</i>	39.2	<0.001	2.746 (1.656–4.551)
<i>Low fun/social, >5 h</i>	44.2	<0.001	3.693 (1.926–7.081)
			<i>R</i> ² = 0.123
Demand/status motive			
<i>Non-gamers</i>	22.2		1.0
<i>Low-medium demand/status, ≤2 h</i>	21.2	<0.001	1.381 (1.159–1.646)
<i>Low-medium demand/status, >2–5 h</i>	18.6	0.006	1.434 (1.106–1.859)
<i>Low-medium demand/status, >5 h</i>	23.5	0.003	1.882 (1.246–2.843)
<i>High demand/status, ≤2 h</i>	32.6	<0.001	3.749 (2.724–5.158)
<i>High demand/status, >2–5 h</i>	32.1	<0.001	3.773 (2.639–5.396)
<i>High demand/status, >5 h</i>	31.0	<0.001	3.930 (2.756–5.606)
			<i>R</i> ² = 0.140
Escape motive			
<i>Non-gamers</i>	22.2		1.0
<i>Low-medium escape, ≤2 h</i>	18.4	0.056	1.196 (0.995–1.437)
<i>Low-medium escape, >2–5 h</i>	14.7	0.294	1.164 (0.887–1.544)
<i>Low-medium escape, >5 h</i>	18.1	0.077	1.472 (0.958–2.262)
<i>High escape, ≤2 h</i>	42.9	<0.001	4.264 (3.224–5.641)
<i>High escape, >2–5 h</i>	39.9	<0.001	4.165 (3.020–5.744)
<i>High escape, >5 h</i>	37.3	<0.001	4.614 (3.230–6.590)
			<i>R</i> ² = 0.156

^a Percentages within each subgroup within each model with depressive symptoms,

^b Odds ratio adjusted for sex, age, body mass index, physical activity, parents' country of birth and socio-economic status.

Paper III

About 10% of the participating adolescents reported gambling on online poker games or casinos, which was the most common form of gambling among weekly gamblers. Nearly one in three reported gambling on lotteries, horse-racing, scratch cards or sports. Boys had a higher frequency of gambling in every form compared with girls. Among the 1412 gambling participants, 117 fulfilled the criteria for moderate risk of problem gambling in the PGSI and 73 fulfilled the criteria for problem gambling. Boys generally scored higher than girls on the PGSI.

Correlation analysis revealed moderate associations between all gambling forms and the PGSI, indicating that gamblers often use different gambling forms. ADHD symptoms and the PGSI were weakly although significantly correlated, and the ADHD symptoms index was only marginally significantly correlated with the different gambling forms. The zero-inflated negative binomial regression analysis showed that more ADHD symptoms, more frequent gambling and older age were associated with a lower OR for being non-susceptible to gambling problems.

Gambling frequency interacted with ADHD symptoms in the prediction of the probability of being non-susceptible to gambling problems (measured with the PGSI). However, for those susceptible to problem gambling, symptoms of ADHD did not modify the effect of gambling frequency on the expected magnitude of gambling problems. Figure 6 illustrate the descriptive relationship between gambling frequency and the PGSI in relation to the extent of ADHD symptoms.

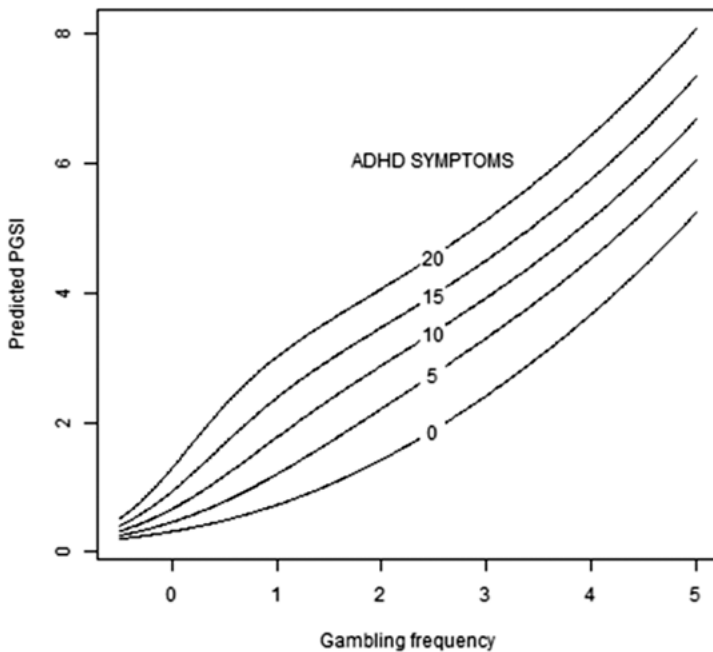


Figure 6. The effect of gambling frequency on the PGSI. The expected degree of gambling problems in the study population, irrespective of the level of risk, is plotted against gambling frequency for different extents of ADHD symptoms.

Paper IV

In Paper IV, we aimed to investigate previous suggestions that online gaming among adolescents is associated with online gambling. We found that the probability for online gambling was higher among online gaming girls (OR = 1.904, 95% CI = 1.610–2.253, $p < 0.001$) but not among online gaming boys (OR = 1.024, 95% CI = 0.956–1.096, $p = 0.502$). The associations between gambling and alcohol use were stronger for these boys (OR = 1.638, 95% CI = 1.477–1.818, $p < 0.001$) than for these girls (OR = 1.464, 95% CI = 1.171–1.830, $p < 0.001$). Another association was found between having at least one parent born outside Scandinavia and the probability of online gambling (boys: OR = 1.412, 95% CI = 1.019–1.957, $p = 0.038$; girls: OR = 2.036, 95% CI = 1.076–3.853, $p = 0.029$). Although online chatting was a common activity among the participants, it was not associated with online gambling.

Discussion

Methodological considerations

The major strength of the SALVe 2008 and SALVe 2012 data used in Papers I–IV is the inclusion of a large study population. This study design enabled us to collect data from most adolescents at the particular ages of interest. Students who were absent on the day of the study were given a second chance to complete the questionnaire, so that all students were given the opportunity to participate. The study population included in Papers I–IV can be considered representative of adolescents in Sweden because of the county's distribution of income, educational and employment levels, and the presence of both urban and rural areas. This strengthens the ability to generalize these findings to other adolescent populations in countries with a similar culture and living conditions. The response rate was high. It may be assumed that non-responders include those adolescents who are gaming and gambling the most, although late-respondents did not differ from the other participants in any of the main study factors. This may mean that the results of Papers I–IV might have underestimated rather than overestimated the reality. The restricted age range of participants may have influenced our results and the inclusion of other age groups may have produced different results. Computer gaming is also a popular activity among younger age groups, whereas gambling for money is probably more prevalent among young adults aged 18 years and over because of the legal age limit that applies in Sweden. It is interesting that we found underage adolescents who gambled for money despite this being illegal.

Cross-sectional study design

The study design for Papers I–IV was cross-sectional, which has both strengths and limitations. An observational study may be used for exploratory aims, such as those in Papers I–IV, and is often used within new research fields to understand the current situation in a study population without intervening. A cross-sectional study is preferred in prevalence studies to obtain information about the study population at a single time point¹³⁰. Causality can only be investigated in follow-up studies with a longitudinal design. However, this was not the purpose of the SALVe studies and, since we were unable to identify specific individuals in these anonymous studies, causality was not investigated. Cross-sectional studies can reach a large study population more easily

and at lower cost than qualitative studies and is therefore a preferred study design for exploratory epidemiological studies¹³⁰⁻¹³⁴. Despite the limitations of the cross-sectional design, Papers I–IV provide important insights into and new knowledge about adolescent gaming and gambling habits.

Questionnaires included in SALVe

The questionnaires in SALVe were written to obtain self-reported answers, and this type of questionnaire always includes an inherent risk of information bias associated with false answers or inaccurate responses. Another limitation of self-reported information is the risk of inaccurate recollection when participants must answer questions that relate to the past. However, adolescents are more likely than adults to leave correctly answers¹³⁵.

Confounding factors

Several possible confounding factors that were not included in the studies could have influenced the results. It is important to acknowledge that students who were absent from school and not included in the study might be those with gaming- and gambling-related problems or with musculoskeletal, psychosomatic or ADHD symptoms. As noted above, our results may be underestimated rather than overestimated¹³⁶ because of this. Another important issue is the overlapping nature of ADHD with depressive and psychosomatic symptoms³³.

Considerations related to the measurements (PGSI, ADHD, ASRS)

One of the major limitations of Papers I–IV is that the questions used to identify gaming motives have not been validated but were extracted and modified from a qualitative study to fit our quantitative design. However, questions about gambling have been used previously, and the PGSI is a valid measure of the severity of problem gambling^{123,138}. In Paper II, the questions asked specifically about depressive, musculoskeletal and psychosomatic symptoms and not the actual diagnoses of these conditions. ASRS-S is a previously used measure of the symptoms of ADHD, and the cut-off points recommended by Kessler¹²⁷ were used. Symptoms of depression were investigated using the A criterion in the DSRS (Cronbach's $\alpha = 0.84$), of the Diagnostic and statistical manual of mental disorders, 4th edition (DSM-IV) with a reported sensitivity of 96.1% and a specificity of 59.4%^{34,125}. Cronbach's α is 0.68 and 0.75 for musculoskeletal symptoms and psychosomatic symptoms, respectively^{82,129}. The studies included in the present thesis included large study samples with a

high response rate. Compared with previous research, our studies have greater statistical power and a low risk that the results are random findings.

Specific limitations of the studies

The multiple statistical analyses included in Papers I–IV could have been adjusted using the Bonferroni method to avoid type I errors. On the other hand, use of the Bonferroni method would have greatly increased the risk of type II errors, which were the main reason for not including this type of correction in our analyses¹³⁷. A major limitation of all papers is that we reached only about 80% of the target population. About one-fourth of the students were absent from school at the time of the study, although the responsible administrative teacher or school nurse attending was given questionnaires to distribute later to the absent students, who are referred to in the papers as late-respondents. These late-respondents were included in the general analysis, but we also used them for drop-out analyses in which we compared them with the rest of the study population. In our analyses, the late-respondents did not differ from other respondents in any major way. However, previous research has suggested that late-respondents differ from general respondents and are more similar to non-respondents¹³⁶. This suggests that our results might have been underestimated because gamers with excessive behaviours are more likely to be absent from school and to be considered non-respondents. We might have missed students with the most problematic gaming behaviour, who may also be the most likely to have health problems.

The results from Papers I and II require replication in other populations from different cultures and ethnicity before we can draw definite conclusions. In future studies of gaming, it would be interesting to investigate whether minimal parental monitoring, bullying, life satisfaction, family activities and poor eating habits are associated with gaming behaviour, as has previously been suggested⁷. Regarding Paper III, we aimed to investigate only ADHD symptoms and not the clinical diagnosis, and the ASRS-S is seen as an accurate and reliable method for this purpose^{85,128}. Self-reported screening for ADHD symptoms may be an effective complement for identifying adolescents at psychiatric risk^{85,128}. It is possible that adolescents with gambling problems may prefer to gamble instead of participate in school activities and may have been absent from school on the day of data collection. However, late-respondents did not differ from other participants in relation to any of the dependent or independent factors. Non-respondents tend to be similar to late-respondents in survey studies¹³⁶. The major limitation of Paper III was the magnitude of skew (i.e., the few gambling adolescents with gambling problems within the respondents). This prevented the use of ordinary statistical methods, such as general linear models, that are preferred for investigating associations between

study variables in relation to an outcome. The statistical method of zero-inflated negative binomial regression was chosen to adjust for the skew in the study population caused by an excess of zero measurements on the PGSI. How well the PGSI separates low-frequency gamblers from medium-frequency gamblers has been debated¹³⁸. The possibility of investigating interaction effects was limited by the low power because few adolescents in our sample reported gambling problems. This may be partly because gambling is illegal for people under 18 years of age in Sweden. Because the present study used only these categorical variables as descriptive measures and the continuous PGSI summation index for other analyses¹³⁸, we argue that there was a greater risk of underestimating effects than of overestimating them. Similar to the findings in Paper III, the severely skewed data in Paper IV limited our choice of analytical methods. The use of general linear models, Poisson regression and negative binomial regression was not possible. Therefore, we chose to dichotomize the outcome variable and to use a logistic regression analysis.

Motives for playing are more important than time spent gaming in relation to the consequences of gaming

Negative social consequences of gaming are reported by one-third of gamers, and it is important to understand the motives for gaming. Excessive gaming has been predominant in discussions about the associations between gaming and negative social consequences. However, our results indicate that the motives for playing online games predict negative social consequences and ill health (Papers I and II). Factor analysis identified three higher-order groups within the motives for playing online games: *Fun/Social*, *Demand/Status* and *Escape* motives. Previous research has reported different types of gaming motives¹³⁹, although most studies of gaming motives include gaming to escape real-life problems, gaming for social reasons and/or gaming for fun^{10,23,140,141}. The results in Papers I and II partly confirmed the motives for playing and the negative effects of pathological gaming. Hilgard et al. suggested that gaming to escape, the use of games as a social outlet and positive attitudes about the steady accumulation of in-game rewards are associated with pathological gaming¹³⁹. Escapism through in-game features encourages individuals who indulge in the gaming experience to avoid real-life problems. Although there is a relationship between escapism (in MMORPGs) and decrease in well-being¹⁴², little is known of the plausible mediators of these relationships²⁷. Furthermore, it has been shown that escape motives are related to stronger game realism beliefs and excessive time spent gaming¹⁴². The excessive gaming time further revealed increase in online support while offline social support was decreased¹⁴². Even though online support is freely available, it does not compensate for the lower availability of offline social support among escap-

ism gamers¹⁴². These findings¹⁴² imply that the underlying motives for gaming might be understood by investigating the psychological factors related to socialization and the social resources within games¹³⁹. In Papers I and II, the combined effects of time spent gaming (gaming for >5 hours a day) and escape motives were associated with the highest probabilities of negative social consequences and depressive, musculoskeletal and psychosomatic symptoms. Notably, those who reported gaming for fun or social reasons had lower probabilities of experiencing negative social consequences and depressive, musculoskeletal and psychosomatic symptoms. During adolescence, it is common to experience depressive, musculoskeletal and psychosomatic symptoms⁷⁵⁻⁷⁷. Because these health problems may persist into adulthood^{72,73}, it is important to provide preventive support at an early age for adolescents with these symptoms. Many of the health problems that occur in adolescence are related to lifestyle factors^{66,72,73,108}. We found stronger associations between online gaming on weekdays and depressive, musculoskeletal and psychosomatic symptoms compared with gaming on weekends. One explanation may be that, on weekdays, adolescents have responsibilities such as attending school and doing homework, which are easier to handle if they get sufficient sleep instead of gaming at night. Gaming before going to bed has a negative influence on the quality of sleep^{143,144}, which might explain why excessive gamers are often tired during the day¹⁴⁵. Sleep disturbance is also associated with depression³³. Links between excessive gaming activity and poor school achievement and insufficient sleep have been reported in studies of smaller populations, and are now supported by our findings in a larger study population^{5,17,145-150}. Possible explanations for our findings may reflect individual personality differences that affect issues such as impulse control, sensation seeking and the ability to cope with real-life situations. Living conditions might have an effect on adolescents seeking excitement in the world of gaming. Social support, social relationships and family and friends may be factors that influence an adolescent's lifestyle^{17,66}. Many gamers have different reasons for finding socializing within a game to be more appealing than socializing in real life, but this may actually lead to loneliness if gaming becomes the dominant activity in the gamer's life¹⁵¹⁻¹⁵³. The cross-sectional design did not allow us to investigate causal effects between variables, and thus it cannot be inferred that one factor leads to another; that is, we cannot distinguish between the idea that gaming leads to depression because of loneliness and withdrawal from other activities or the view that depressed individuals seek solace through gaming. However, the question about negative social consequences from gaming was formulated in such a way as to be able to infer a causal effect: "*Has your computer gaming/Internet use led to any problems in your everyday life?*" This allowed the participants to answer the question based on their own experience. The gaming industry has expanded markedly in recent years, and online gaming has become a common leisure activity among adolescents^{27,154,155}. It is therefore essential to explore the factors that contribute to or influence their behaviour.

Although only a minority of gamers develop addictive behaviour-like symptoms and experience negative consequences^{27,154,155} that may cause harm to their relationships, school achievement and sleep habits, the issue needs more attention. Online gaming has been suggested as the most frequent problem with Internet use²⁷. Problem online gaming is mentioned in DSM-5 under the name “Internet gaming disorder”. This might encourage further research to learn more about gaming and its effects. Sex differences in motives for playing online games imply that different interventions may be needed to help adolescent gamers find a balanced approach to gaming activities⁷.

ADHD symptoms in relation to problem gambling

In Paper III, we found that individuals with ADHD seemed to be more susceptible to developing gambling problems. However, among those who were susceptible, adolescents with ADHD symptoms were affected in similar ways to other susceptible participants based on their gambling frequency. To clarify, it seems that adolescents with ADHD may indulge in gambling more readily, which can lead to gambling problems. Adolescents are especially vulnerable¹⁵⁶, and the presence of ADHD symptoms probably increases their vulnerability in terms of developing unhealthy behaviours. Because impulsivity is part of ADHD, these adolescents are probably more likely to have difficulties in controlling their impulses. A quick win is part of many gambling forms, especially online gambling, and may be more appealing to people with impulse control difficulties. This suggests that people with impulse control problems may be at risk of developing gambling behaviour problems. The evidence supporting an association between ADHD and increased risk of gambling problems in adolescents is mixed, even though the evidence of such an association is stronger for adolescents with ADHD than for adults with ADHD¹⁵⁶. Online gambling has changed the global gambling scene¹⁵⁷, especially the rapid growth of gambling availability in Europe¹⁵⁸. Swedish adults over the age of 18 gamble on average 5599 SEK annually (not including illegal gambling)¹⁵⁹. According to Gainsbury and Wood¹⁶⁰, there were only 25 online gambling sites in 1995, but this had increased to 2500 sites by 2011. This could mean that the increase in availability is correlated with an increase in the number of gamblers. However, according to The Public Health Institute of Sweden^{44,50}, the number of gamblers did not increase from 1997–99 to 2009. Instead those who gamble wager more money than gamblers did in the past, and problem gamblers wager the most money^{44,50}. The growth in the availability of online gambling sites¹⁵⁷ in relation to the number of individuals with ADHD might be predictive of increased gambling activity. Individuals with ADHD symptoms have less impulse control⁸⁵, which might increase the risk of excessive gambling. ADHD and problem gambling include similar criteria such as *withdrawal* and *control difficulties*⁸⁵, which might explain some of the shared comorbidity between ADHD symptoms and problem gambling

found in Paper IV. Previous research⁸⁸ on the relationship between ADHD and gambling found no interactions between ADHD symptoms and gambling in relation to gambling pathology. However, differences between ADHD subtypes and gambling severity have been reported in relation to depression and emotional problems⁸⁸. Internalizing disorders are difficult to identify but are thought to be more common among girls than among boys^{87,88}. Gambling boys are plausibly more impulsive by nature than girls, and symptoms of ADHD are thought to be more common among boys than among girls⁸⁷. The subtypes of ADHD that are most common among boys are hyperactivity and less impulse control^{87,88}. Paper IV showed significant interaction effects between the degree of hyperactivity and gambling frequency in relation to PGSI scores but no significant interaction between inattention symptoms and gambling frequency. This is of interest for further research because both the subtypes of ADHD and strong engagement in gambling differ and are more common among one of the sexes.

Associations between online gaming and online gambling

The findings in Paper IV support and extend previous findings suggesting that there are sex differences in online gaming and gambling behaviours and the types of problems experienced as a result of these activities^{161,162}. The sensation-seeking personality is often mentioned as a stereotypic characteristic of a gambler^{44,163}. We found a relationship between online gaming and online gambling behaviour among girls. Notably, The Swedish Institute of Public Health has reported an increase in gambling-related problems among adult females^{50,163}. Moreover, even though gambling that includes monetary rewards exists in most countries, the presence of commercial money and social inequality promotes gambling¹⁶⁴. Young¹⁶⁵ noted that gambling in Western societies has moved from an activity that was considered to be immoral to one that is being encouraged by the rise of consumerism and economic interests, which has led to the mainstreaming of gambling in some populations¹⁶⁵. It is important to consider several risk factors for unhealthy gambling when developing programmes to prevent gambling problems at an early age. Our finding of a relationship between alcohol consumption and online gambling frequency among boys is of interest. The shared comorbidity between gambling and alcohol consumption has been discussed in research on adult gamblers^{50,166}. Both behaviours are illegal for people under 18 years of age in Sweden. Moreover, according to Clarke et al. alcohol consumption is an important influence on why people begin to gamble, whereas stress and loneliness influence whether gambling activity continues¹⁶⁶. In understanding why people begin to gamble, several factors must be considered. Social inducements and advertising are two important factors related to gambling behaviour¹⁶⁶. It may be speculated that the recent increase in the number of gambling advertisements directed towards female gamblers might explain why more women are gambling than before. Another

speculation is that the availability of gambling encourages people to gamble because most people can access online gambling sites, where the only restriction is the requirement that gamblers are at least 18 years old. In the past, women may have found it more difficult to gamble outside the home. Many gamblers, both male and female, find gambling to be a relaxing activity, and it is possible that women choose to gamble as a way of relaxing when they are alone^{44,50,163}. Qualitative findings suggest that men and women have different experiences in terms of stress, problems and responsibilities¹⁶⁷. One could speculate that girls who are gamers and gamblers have certain personality traits such as being sensation-seekers who find a thrill in the competitive experience or being emotionally vulnerable and having lower self-esteem than other girls. One model is based on five motives for gambling, including: *the dream of hitting the jackpot and being able to change one's living conditions, social rewards, intellectual challenges, mood enhancement and the chance of winning money*¹⁶⁸. This model includes several factors that may be gender specific. The challenges involved in playing, competing and obtaining thrills from gambling are more appealing to men, whereas women generally prefer repetitive and monotonous gambling forms that are based more on chance than on strategic skills^{156,163}. One might speculate that females who spend a lot of time playing online games as well as gambling for monetary rewards do so partly because of low self-esteem, and that they find these activities, which are performed alone, appealing because they reduce stress and help them to cope with real-life issues. Our speculations are consistent with previous research^{169,170} that has concluded that more females are gaming and gambling for escape-related motives. Moreover, gambling alone seems to be more appealing to female gamblers¹⁷¹, which might be relevant to online computer games. However, the gamers who are attracted to online games such as MMORPGs are predominantly boys. This predominance might be explained by the social rewards provided by games that make it possible to receive respect and admiration from other gamers for extraordinary performance, which creates a platform of similar interest and bonding¹²². Another important issue is that online gaming and gambling can be done anonymously, and some might find this compelling. Gender swapping in games is one indicator that males and females are taught to differ in within game characteristics, which some gender swappers have gained from taking advantage of, by pretending to be of the opposite sex¹³. It may be difficult to document sex differences in gambling behaviour when the study population is small because of the low number of girls who gamble. Delfabbro et al. argued that it is unlikely that gaming is a risk factor for pathological gambling during adolescence, even though they found a relationship between these factors¹²². They noted that their findings were not reliable because of the weak relationship and low effect size, which almost disappeared once they controlled for sex differences¹²². This may explain the findings in Paper IV in which the study population was large enough to be able to identify the girls who gambled. The findings in Paper IV confirm previous results indicating that gambling frequency is related to ethnicity^{44,50}.

Most of the adolescents who gambled had at least one parent born outside Scandinavia. Our findings further revealing that gaming is partly related to gambling (among girls) indicates that further investigation of sex differences is needed. The general risk factors for problem behaviours shown in Figure 5 and sex differences in the effects of personality and genetics may explain differences in gaming behaviour and unhealthy gambling³¹. The co-occurrence of addictive behaviour and different personality factors related to both substance use and addictive behaviours (i.e., problem gaming and problem gambling) have been suggested as important issues requiring further study. Previous research³¹ has reported positive correlations between problem gaming, problem gambling and substance addictions. Problem gaming correlated with cannabis use, whereas problem gambling correlated with cannabis use, tobacco use and alcohol consumption³¹. The same analyses also revealed different patterns of personality characteristics associated with different addictions. High impulsivity was the only personality characteristic associated with all included addictive behaviours, whereas depression and extraversion were specific to substance users³¹. Four characteristics have been shown to be specifically associated with problem gaming: irritability/aggression, social anxiety, low self-esteem and ADHD³¹. The many similarities between substance addictions and behavioural addictions such as gambling addiction have led to the inclusion of problem gambling within the same category as substance addictions in the DSM-5^{31,33}. However, problem gaming should be investigated further before it is included^{31,33}. Research on brain activities has shown that the neural substrate involved in cue-induced gaming cravings in online gaming addiction is similar to that involved in cue-induced dependence craving⁵⁴. Furthermore, the same areas of the brain that contribute to cravings in substance abuse are involved in the online gaming urge⁵⁴. It has been suggested that gaming and gambling urges/cravings share the same neurobiological mechanism as substance addictions^{54,55}. This is consistent with previous suggestions^{31,33}.

Theoretical role of risk factors in gaming and gambling behaviour

A theoretical approach to understanding gaming and gambling behaviour provides possible explanations for the increased likelihood of engaging in problem behaviours. Knowledge about risk factors, considered separately or combined, may be helpful in understanding the development of problem behaviours, as well as an opposite to display protective factors on unhealthy behaviours among adolescents, who are more vulnerable to adapt to risky behaviours⁹¹. Behaviours are shaped by differences in personality and by macro- and micro-level health determinants, as shown in Figure 7.

The listed and unlisted determinants can induce unhealthy gaming and gambling behaviours. However, gaming and gambling may have both positive effects and negative effects from the individual's perspective and for society as a whole.

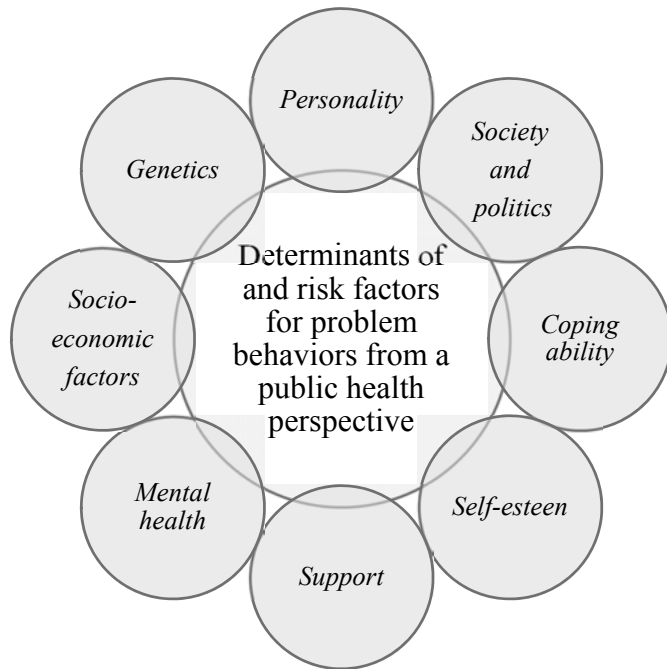


Figure 7. General health factors related to problem behaviours including gaming and gambling.

Conclusions and implications

The main findings of this thesis are as follows.

- Time spent on gaming was associated with negative consequences. This association was explained by the motives for playing online games.
- Increased gaming time on weekdays increased the probability of experiencing depressive, musculoskeletal and psychosomatic symptoms. The motives for playing explained differences in these relationships.
- Individuals with ADHD symptoms, older age and higher gambling frequency were more susceptible to gambling problems. However, among those susceptible to gambling problems, those with ADHD symptoms did not differ from other gambling adolescents in terms of the probability of developing gambling problems.
- The probability of online gambling was higher among online gaming girls than among online gaming boys. Increased alcohol consumption increased the probability of gambling among boys but not among girls. Having at least one parent born outside Scandinavia increased the likelihood of higher gambling frequency for both boys and girls.

Although the literature on gaming and gambling is growing, little is known about female gaming and gambling, and about gaming- and gambling-related problems in females. Papers I–IV contribute new knowledge about sex differences in online gaming and online gambling behaviours. Information about the factors related to gaming and gambling problems may be of particular interest to clinicians working in mental health care, psychiatry, psychology and social work, as well as to policymakers, parents, schoolteachers and social workers involved in adolescent health and development.

The large study sample provided the opportunity to generalize the findings to similar adolescent populations. The exploratory design and studies of the relationships between online gambling and previously suggested predictors, such as online gaming and alcohol use, have yielded important knowledge about these relationships. We suggest that the motives for playing should be considered a prime indicator of negative consequences, even more so than the

time spent gaming. These results contribute to research about the relationship between motives for playing and the negative consequences of gaming. The motives for playing should be considered when determining the risk of potential consequences of gaming and for developing preventive strategies for problem gaming behaviours.

We found that excessive gaming time and escape motives were associated with an increased probability of ill health among adolescents. Gaming motives may identify gamers in need of support to reduce unhealthy gaming behaviour and may identify individuals at risk of ill health. The results of Paper II add to the results of Paper I, which was based on the same study population (although other factors were investigated).

Paper III contributes to the growing literature on the associations between problem gambling behaviour and ADHD. To our knowledge, this is the first study to investigate the associations between the frequency of different gambling forms and ADHD symptoms in relation to problem gambling among adolescents. Regarding gambling activities among adolescents, having ADHD was related to being vulnerable to developing problem gambling behaviours. However, among those who were susceptible to problem gambling, those with ADHD were no more likely than other gamblers to show problem gambling behaviour. The results from Paper III together with previous research suggest that the relationship between ADHD and gambling is a complex issue that might need to be handled in different ways in future investigations.

Our results may explain the contradictory results found in previous research^{89,172}. The differences in results may reflect different measurement tools and the size of the populations studied. A small population may not be large enough to detect the low number of problem gamblers among adolescents. Gambling adolescents seem to use different gambling forms, and it is difficult to measure the prevalence of gambling among adolescents by investigating only one or two gambling forms.

Previous research on gambling has suggested that gaming activity might be a predictor of later gambling activity⁵⁰. Paper IV described associations between multiplayer online gaming and gambling frequency among girls. These findings contribute to the limited research on gambling behaviour among girls. However, our results revealed that gaming and gambling were only significantly associated among girls who gambled frequently but not among boys who gambled frequently. This suggests that sex differences may interact with the ability to predict the relationship between gaming and gambling activity.

Increased frequency of gambling among boys was associated with higher odds of alcohol use. The shared comorbidity between alcohol use and gambling

activity should be further investigated in longitudinal studies to understand the predictors of gambling. Having a parent born outside Scandinavia was associated with higher gambling frequency among both male and female gamblers. From both the macro and micro perspectives of health determinants^{65,66}, it is possible that having one parent born outside Scandinavia indicates families with at least some roots in other countries and that these families may have different lifestyles, living conditions and cultures than families in which all members were born in Scandinavia. These differences may have several effects on an individual's life and may (for some individuals) lead to lower self-esteem or a lower sense of empowerment, which may trigger unhealthy behaviours or coping strategies such as gaming and gambling activities. Adolescents are more vulnerable to such triggers⁹¹, especially when combined with other factors such as mental health issues or psychological diseases^{33,91,99,100}.

The differences in factors related to gambling between boys and girls suggest that the sexes should be analysed separately when investigating comorbidity in problem gamblers. Notably, in the DSM-5, IGD is classified in the section of areas that need further evidence before they may be included as a standard disorder³³. At the time of publication of the DSM-5, more than 250 studies had been published on IGD, which indicates the complexity of this issue. It has been suggested that IGD may be influenced by other mental health issues¹⁷³ and may provide an opportunity to cope with psychiatric disorders such as depression or ADHD^{4,41}. Epidemiological and longitudinal studies of larger populations are needed within the gaming and gambling field of research. Furthermore, additional studies on adolescent gaming and gambling behaviours are needed to identify the factors that influence gaming and gambling behaviour, and the effects these activities have on young gamers and gamblers.

Sammanfattning på svenska

Metod

Samtliga delstudier i denna avhandling är baserade på data ur befolkningsstudierna Liv och Hälsa Ung 2008 och Liv och Hälsa Ung 2012. Liv och Hälsa Ung utgörs av enkätstudier där samtliga Västmanländska elever i årskurs 7, 9 och gymnasiet årskurs 2 erbjuds att delta. I studie I-II deltog 7757 elever, och i studie III-IV deltog 4440 elever (endast åk 9 och gymn 2.). Deltagandet är anonymt och frivilligt och ingen elev kan identifieras vid analys av insamlad data. Ifyllandet av enkäter sker under lektionstid i skolan, där lärare eller ansvarig skolsköterska finns närvarande för att besvara frågor gällande enkäten och för insamlande av ifyllda enkäter. Ansvarig skolpersonal har i förväg delgivit information om studiens syfte och om vikten av anonymitet och frivillighet för deltagande.

Studie I

I den första studien undersöktes ungdomarnas datorspelande, tid att spela i relation till olika spelmotiv. Vidare studerades om spelarna hade upplevt att deras spelande hade lett till negativa sociala konsekvenser och i så fall vilka. Ungefär hälften av deltagarna i SALVe 2008 uppgav att de spelar online datorspel av den sort som kallas MMORPGs (Massively Multiplayer Online Roleplaying Games). Denna typ av spel spelas online oftast tillsammans med andra spelare (ex CounterStrike™ och World of Warcraft™). Resultaten visade att en majoritet av pojkar spelar MMORPGs och majoriteten av MMORPG spelarna uppgav att de ofta hade upplevt negativa sociala konsekvenser av sitt spelande. De mest vanligaste upplevda konsekvenserna av spelande var att få för lite sömn på grund av spelande på kvällar och nätter, men även att skolan blev försummad då spelarna upplevde sig lägga tid på spelande istället för läxor. Andra negativa sociala konsekvenser av spelandet var att man upplevde sig ha mindre tid för vänner i verkliga livet, bråk och gräl med föräldrar och syskon samt att man inte har tid eller glömmer bort att äta. Ju längre speltid per dag desto mer ökade sannolikheten för upplevda negativa konsekvenser. Dessutom visade sig spelmotiven ytterligare påverka sannolikheten för upplevda negativa sociala konsekvenser till följd av spelandet. De individer som spelade för att det var kul och socialt hade mindre sannolikhet för negativa sociala konsekvenser, medan de som spelade för att fly från problem eller på grund av krav från andra att spela eller för att uppnå status inom

eller utanför spelet hade ökad sannolikhet för upplevda negativa sociala konsekvenser.

Studie II

I den andra studien undersökte vi om de mönster vi fann i studie I också var gällande för ohälsa, där vi använde oss av depressiva, muskuloskeletal och psykosomatiska symtom som utfall. Vi fann liknande samband i studie II som i studie I. Speltiden hade betydelse, men spelmotiven hade större påverkan på huruvida spelarna upplevde ohälsosymtomen som undersöktes. Även i denna studie hade flyktspelare högre odds för negativa utfall än övriga, medan de som spelade för att det var roligt och socialt verkade kunna spela mycket utan samma effekter. Depressiva symtom hos flyktspelare som spelar mer än 5 timmar per dag var mer än fyra gånger mer sannolika än hos de spelare som spelade lika mycket men av andra anledningar.

Studie III

Trots att vi har en 18-årsgräns för spel om pengar i Sverige spelar underåriga om pengar. I den tredje studien ville vi undersöka pengaspelandet bland ungdomar i ålder 15-18 år samt undersöka om ADHD symtom kunde relateras till problemspelande enligt mätinstrumentet Problem Gambling Severity Index (PGSI). Våra resultat visade att ökad pengaspelsfrekvens liksom högre ålder kunde associeras till ökade spelproblem. Gällande ADHD symtom så fanns en relation men dock bara innan en individ hamnat i spelproblem. Individer med ökade ADHD symtom påvisade en ökad känslighet för att få spelproblem. Men vid analys av de som redan hade spelproblem så utmärkte sig inte individer med ADHD symtom från övriga spelare.

Studie IV

Tidigare forskning har föreslagit att det kan finnas samband mellan online datspelande och online pengaspelande. I den fjärde studien undersöktes om så var fallet. Av de deltagande ungdomarna uppgav 317 (7.7 %) att de spelat om pengar, av dessa var 264 (13.3 %) pojkar och 53 (2.5 %) flickor. Den vanligaste pengaspelsformen var online spelande på poker och/eller casinospel. Vidare visade resultaten i studie IV att det fanns samband mellan ökad frekvens av online datorspelande och ökad frekvens för pengaspelande men bara hos flickor. Hos pojkar fanns inte denna koppling. Hos pojkarna fanns istället samband mellan alkoholkonsumtion och pengaspelsfrekvens, vilket inte kunde ses hos flickor. Dock gällde för både pojkar och flickor att de som hade minst en förälder född utanför Skandinavien påvisade högre frekvenser av pengaspelande.

Konklusion

Denna avhandling presenterar resultat som ytterligare bidrar till ett forskningsfält där det finns uttalade behov av vidare kunskaper ur olika perspektiv och kontexter. Vi fann associationer mellan online datorspelsmotiv och upplevda negativa sociala konsekvenser och symptom på ohälsa vilket vi menar bör ses som en viktigare riskfaktor än den tid som läggs på att spela. Detta är något som kan vara av vikt att ta hänsyn till vid utformande av preventiva insatser för de spelare som behöver det mest i syfte att minska ohälsosamma spelvanor. Vidare fann vi att individer med ADHD symptom hade en ökad känslighet för att utveckla spelproblem och att spelproblem ökar med ökad ålder. Även detta kan vara viktigt att känna till för de som möter ungdomar med ADHD diagnoser, om inte annat för att uppmärksamma både de unga och föräldrar om att denna koppling finns, även här i syfte att minska risken för utvecklande av spelproblem även om det i detta fall gäller pengaspelande. När det gäller fynden i den fjärde studien är det mycket intressant att ett ökat online datorspelande hos flickor (men inte hos pojkar) ger ökad spelfrekvens gällande pengaspelande. Kanske bör insatser för att komma åt spelproblem utformas olika för pojkar och för flickor då det verkar vara delvis olika processer som ligger till grund för ohälsosamma spelbeteenden.

Resultaten i våra studier är begränsade av den studiedesign som användes, vilken inte tillåter att kausalitet kan fastställas. Användandet av enkätdata och självrapporterade uppgifter kan ytterligare ha påverkat våra resultat på ett sätt som vi inte kan säkerställa. Styrkorna med de inkluderade studierna utgörs främst av att vi har en omfattande studiepopulation med hög svarsfrekvens både i SALVe 2008 och i SALVe 2012. Behovet av ytterligare studier kring ungdomars spelvanor i relation till hälsa är fortfarande stort, främst i form av epidemiologiska och longitudinella studier men även gällande vilka faktorer som skiljer sig åt mellan spelande pojkar och flickor. Framtida studier bör ta hänsyn till de biologiska, sociala och psykologiska faktorer som kan förklara spelbeteenden ytterligare.

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