Regaining Control Over Gaming:

Clinical Features and Treatment of Gaming Disorder

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To Stefan, Alva and Saga

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ABSTRACT

Gaming has become increasingly popular and accessible worldwide over the past decades. Concurrently, a minority of gamers experience significant negative consequences from gaming and meet the criteria for the newly defined diagnosis of gaming disorder (GD). This thesis aims to explore the clinical characteristics of individuals seeking treatment for GD and to evaluate a psychological treatment for GD.

Papers I and **II** focus on the clinical population. **Paper I** compared adults and younger patients, regarding symptoms and progression into GD. The younger group reported a more rapid progression into problematic gaming, whereas no differences were observed in GD symptoms or psychiatric comorbidities. **Paper II** used qualitative interviews to identify factors that maintain excessive gaming, highlighting game-related factors, individual characteristics, and aspects of life outside gaming. **Papers III** and **IV** investigate whether a new cognitive-behavioral therapy reduces GD symptoms. **Paper III** reports an uncontrolled study significant and sustained reductions in GD symptoms, gaming time, anxiety, and depression. **Paper IV** describes the protocol for an ongoing randomized controlled trial comparing the treatment with a waitlist control condition.

In conclusion, GD is maintained by a complex interplay of factors, and psychiatric comorbidity is common among both younger and older patients. Cognitive-behavioral therapy is a promising approach, but more rigorous treatment studies are needed. The findings of this thesis may contribute to the development of treatments for GD, ultimately helping patients regain control over their gaming.

Keywords: Gaming disorder, Treatment, Adolescents, Adults, Clinical population

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SAMMANFATTNING PÅ SVENSKA

Dataspel har blivit alltmer populära och tillgängliga de senaste decennierna, inte minst i form av mobilspel. För det allra flesta är dataspelande ett nöje med övervägande positiva effekter. En mindre andel utvecklar dock ett omfattande spelande med tydliga negativa konsekvenser och svårigheter att kontrollera sitt spelande. Utifrån detta har det nyligen tagits fram en diagnos som beskriver denna problematik. Det engelska begreppet är *Gaming disorder*, vilket ungefär kan översättas med *Dataspelsberoende* på svenska. Målet med den här avhandlingen var att undersöka vad som utmärker patienter som söker vård för dataspelsberoende och utvärdera effekten av en nyutvecklad psykologisk behandling för dataspelsberoende.

Den två första delstudierna syftar till att fördjupa kunskapen om de som söker vård för dataspelsberoende. I **studie I** undersöktes om vuxna patienter (över 25 års ålder) skiljer sig från ungdomar och unga vuxna avseende psykiatriska symptom och utveckling av dataspelsberoende. Vi fann att de yngre rapporterade en mycket snabbare utveckling av problematiskt dataspelande, jämfört med de vuxna. Däremot såg vi inte några skillnader mellan grupperna avseende symptom på dataspelsberoende eller övrig psykisk ohälsa. **Studie II** baseras på intervjuer med patienter med dataspelsberoende. Vi undersökte vilka faktorer patienterna själva upplevde som bidragande till att vidmakthålla ett problematiskt dataspelande. De beskrev en kombination av faktorer kopplade till spelens uppbyggnad, eget mående och personlighet samt faktorer kopplade till hur deras liv såg ut utanför spelvärlden.

Studie III och **IV** syftar till att utvärdera effekten av ett nyligen utvecklat behandlingsprogram för dataspelsberoende, baserat på kognitiv beteendeterapi (KBT). **Studie III** beskriver en pilotstudie där vi undersökte hur patienternas symptom förändrades under behandlingstiden. Vi såg en tydlig minskning av symptom på dataspelsberoende, minskad speltid samt även minskade symptom på ångest och depression. Utifrån detta designade vi en större studie (**studie IV**) som syftar till att ge säkrare svar om behandlingseffekten. I studien lottas patienter till att få behandling direkt eller stå på väntelista i drygt två månader. Därefter jämförs hur symptomen förändras i dessa grupper. Upplägget för den studien beskrivs i **Paper IV**. Själva studien är påbörjad men ännu inte avslutad.

Sammantaget bidrar denna avhandling till ökad kunskap om patienter med dataspelsberoende och att möjliggöra effektiva behandlingar som kan hjälpa personer med dataspelsberoende att återfå kontrollen över sitt spelande.

LIST OF PAPERS

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

I. **Hofstedt, A**., & Söderpalm Gordh, A. (2024). Young and adult patients with gaming disorder: Psychiatric co-morbidities and progression of problematic gaming. *Fronters in Psychiatry*, *15*, 1423785. https://doi.org/10.3389/fpsyt.2024.1423785

II. **Hofstedt, A**., Ulin, K., & Söderpalm Gordh, A. Controlled by the game – interviews on why regaining control over gaming is difficult for patients with gaming disorder. *Submitted.*

III. **Hofstedt, A**., Mide, M., Arvidson, E., Ljung, S., Mattiasson, J., Lindskog, A., & Söderpalm-Gordh, A. (2023). Pilot data findings from the Gothenburg treatment for gaming disorder: a cognitive behavioral treatment manual. *Frontiers in Psychiatry*, *14*, 1162492. https://doi.org/10.3389/fpsyt.2023.1162492

IV. Arvidson, E., **Hofstedt, A.**, & Söderpalm Gordh, A. (2025). A flexible module-based cognitive behavioral therapy for gaming disorder: study protocol of a randomized controlled trial. *Trials*, *26*(1), 386. https://doi.org/10.1186/s13063-025-09147-4

CONTENT

ABBREVIATIONS

ACC	Anterior Cingulate Cortex
ADHD	Attention-Deficit/Hyperactivity Disorder
AI	Artificial Intelligence
ARPANET	Advanced Research Projects Agency Network
ASD	Autism Spectrum Disorder
ASRS	Adult ADHD Self-Report Scale
AUDIT	Alcohol Use Disorders Identification Test
AYA	Adolescents and Young Adults
BBQ	Brunnsviken Brief Quality of Life Inventory
C64	Commodore 64
BCE	Before the Common Era
CBT	Cognitive-behavioral therapy
DERS-16	Difficulties in Emotion Regulation Scale, Brief Version
DLPFC	Dorsolateral Prefrontal Cortex
DSM-5	Diagnostic and Statistical Manual of Mental Disorders (5th ed.)
DUDIT	Drug Use Disorders Identification Test
FPS	First-person shooter
GAD-7	Generalized Anxiety Disorder 7-item scale
GAIT	Gaming Addiction Identification Test
GD	Gaming Disorder
GDT	Gaming Disorder Test

GD-TLFB	Gaming Disorder Timeline Followback
ICD-11	International Classification of Diseases, 11th Revision
IGD	Internet Gaming Disorder
IGDS9-SF	Internet Gaming Disorder Scale – Short Form
I-PACE	Interaction of Person-Affect-Cognition-Execution
MI	Motivational Interviewing
MMORPG	Massively Multiplayer Online Role-Playing Game
MOBA	Multiplayer Online Battle Arena
MOGQ-14	Motives for Online Gaming Questionnaire, 14-item version
MUD	Multi-User Dungeon
NAc	Nucleus Accumbens
NODS-PERC	National Opinion Research Center DSM-IV Screen for Gambling
OFC	Orbitofrontal Cortex
PHQ-9	The Patient Health Questionnaire
RAADS-14	Ritvo Autism and Asperger Diagnostic Scale-Revised (14 Screen)
RCT	Randomized Controlled Trial
TAU	Treatment As Usual
TCP/IP	Transmission Control Protocol/Internet Protocol
VR	Virtual Reality
VTA	Ventral Tegmental Area
WoW	World of Warcraft

DEFINITIONS IN SHORT

Behavioral addiction	A non-substance addiction involving persistent engagement in a behavior despite harm.
First-Person Shooter	A digital game genre played from a first-person perspective in which gameplay is focused on real-time combat using ranged weapons.
Gambling disorder	A behavioral addiction involving persistent gambling despite harm, as defined in both ICD-11 and DSM-5.
Gaming	Playing digital games/video games. In this thesis, gaming refers to all forms of engagement with digital games irrespective of platform, with the exception of digital games that primarily concern gambling.
Gaming Disorder	A behavioral addiction involving persistent gaming despite harm, as defined in ICD-11 (World Health Organization, 2019).
Internet Gaming Disorder	A condition characterized by persistent gaming despite harm, as defined in DSM-5 (American Psychiatric Association, 2013, 2022)
MMORPG	A digital online game genre involving many players interacting simultaneously in a persistent virtual world, typically emphasizing social interaction and long-term character progression.

MOBA	An online multiplayer game genre where two teams compete in real time on a fixed map, each player controlling a unique character with specific abilities, with the objective of destroying the opposing team's base.
Multi-player games	Video games that allow more than one person to play simultaneously in the same game environment, online or offline.
Prevalence	Prevalence refers to how common a condition, characteristic or disease is in a population.
Single-player games	Video games played with input from only one player.

1.

1. INTRODUCTION

HUMANS AND PLAY

Playing video games is a new phenomenon in relation to human history. However, gaming (i.e., playing digital games) is also part of the broader concept of "play" and hence relates to activities that have engaged mankind for thousands of years. Play is inherently human in many ways. It is an integral part of the individual development of each human being, where play for example serves as an arena for learning, trying out new identities and practicing social skills (Pellegrini & Smith, 1998; Piaget, 1951; Vygotsky, 2016). Play is also an important part of human history and culture. The historic roots of play and playing games are for example evidenced by findings of dice dating back to the third millennium BCE in archaeological excavations (Eerkens & de Voogt, 2017). It could even be argued that play outdates human culture. In the classical book, *Homo Ludens*, Huizinga (1938) claims that play in fact should be considered a fundamental and necessary building block for forming human cultures. Play spans from being a brief pastime to a serious activity with heavy investments of time and energy, for example in the form of live action role-playing games where stories are acted out in real-time with props and costumes or in the form of sports tournaments engaging both the players and the audience.

Given the historical roots of play, it is not surprising that the digital evolution has been closely followed by the invention of digital games. It is hard, even in retrospect, to decide which have been the most influential innovations in the history of computer technology and digital gaming. Hopefully, a summary covering some milestones can still provide an illustration of the increasingly rapid development within these areas (for a summary, see **Figure 1**). As this thesis focuses on a newly defined diagnosis that is intrinsically linked to the emergence of digital games and the rapid digital evolution, this historical exposé will provide a historical context to the research presented here.

The first computer and the first-known digital game were both invented within a decade in the middle of the 20th century. The first programmable computer was built in 1941 (Trautman, 1994). Thereafter, the very first digital game *Bertie the Brain*, a digital version of tic-tac-toe, was developed in 1950 (Bateman, 2014). *Bertie the Brain* was designed to demonstrate the capabilities

of the computer it was built on, not for entertainment purposes *per se*, and was followed by several other games primarily designed as technological experiments.

The first digital game created for entertainment purposes was probably *Tennis for Two* in 1958. Using the screen of an oscilloscope to simulate a match of tennis, it allowed two people to play against each other. Because of its entertainment purpose, it is often defined as the first video game (Internetstiftelsen, 2016b). About a decade later, *Spacewar!* was developed by students and employees at Massachusetts Institute of Technology (MIT) in 1962, featuring a fight between two spaceships moving around the gravity well of a central star (Gault, 2014; Landsteiner, 2022). This was the first digital game to be installed on more than one individual computer, although the high price of computers at the time limited the audience to the programming community at universities. However, *Spacewar!* inspired the first digital arcade game *Computer Space* in 1971 (Wardrip-Fruin, 2021). This was closely followed by *Pong* in 1972, a two-player game that mimics table tennis and was the first commercially successful arcade video game (MacDonald, 2022).

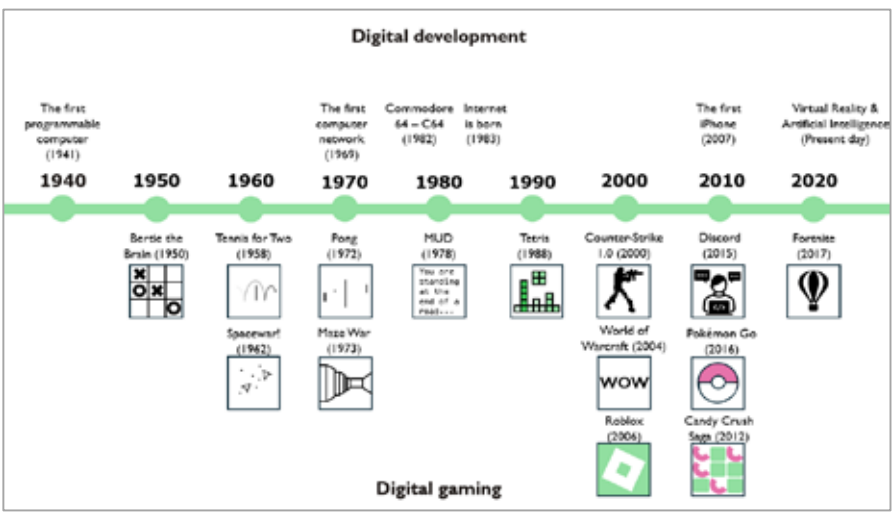

Figure 1 Milestones in the digital development and the development of digital gaming. The events above the timeline refer to milestones in digital development, and events below the timeline refer to the introduction of specific digital games or gaming-related platforms.

In addition to computers, the invention of the internet has also immensely affected the video game industry. The very first network of computers (ARPANET) was set up by the US military in 1969, and a good decade later the internet was born in 1983 when the network changed to the transfer protocols TCP/IP still used today (Melin, 2019). In parallel with this, games were developed that allowed players to play against each other on a network. The first game of this sort was probably *Maze War* from 1973, featuring a 3D labyrinth where players could move around trying to shoot each other (Internetstiftelsen, 2016a). Thereby, *Maze War* also became the first First-person shooter (FPS) game, one of the most popular game genres today. Another hallmark is the first text-based multiplayer role-playing game *MUD* (Multi-User Dungeon) that was introduced in 1978 (Wells, 2009). In *MUD*, players could experience and participate in a fantasy adventure using short text-based commands, in a game completely made of text. Still, all games of the time had simple black and white graphics, very different from the movie-like games played today.

The early 1980s saw computers becoming cheaper to build and making them accessible to private customers for use as home computers. Commodore 64 (C64), that was released in 1982, was one of the best-selling computers at the time, and especially suited for gaming due to its powerful hardware (Matthews, 2003). This paved the way for many new games, and C64 also made it possible to develop and code new games on your own home computer. It was also in the early 1980s that one of the most widely played games of all time, *Tetris*, was created. *Tetris*, a puzzle game where block shapes fall from the top of the screen challenging the player to place them into complete horizontal lines, gained wide-spread popularity when it was included in the handheld Game Boy system (Lasky, 2023), released by Nintendo (1989).

As computers have continued to improve and increase in processing power, games have become increasingly complex and feature far more advanced graphics. A decade later, at the turn of the Millenium, some influential games were released. *Counter-Strike 1.0*, a multiplayer FPS where two teams of terrorists and counter-terrorists compete to complete objectives, was released in 2000 (Valve, 2000). A few years later in 2004, another widely popular game, *World of Warcraft* (WoW) was released (Blizzard Entertainment, 2004). In this massively multiplayer online role-playing game (MMORPG) players create and develop their avatar characters in a fantasy world, interacting and completing quests together with other players.

The introduction of smartphones, with the first iPhone being launched in 2007, introduced a new digital device suitable for gameplay. The increasing use of smartphones has made gaming accessible around-the-clock for a large part of the population. One of the most popular mobile games *Candy Crush Saga* was released in 2012, first as a Facebook game but soon after complemented by a mobile version (King, 2012). More than a decade later, it is still among the top five most played mobile games (Kemp, 2025). Other games like the augmented reality game *Pokémon GO* (Niantic, 2016), where players move around in the real world to collect, train and fight Pokémon monsters, are specifically designed for smartphones.

Many games include and require cooperation with other players or double as a social arena with players discussing non-game issues while playing. These social aspects of gaming were facilitated by the introduction of the *Discord* platform (Discord Inc., 2015). This platform made it easier than through other existing services at the time to communicate via voice and video calls, and also provided discussion forums, making it a popular social tool for gaming. *Roblox* (Roblox Corporation, 2006) is another influential gaming platform. Although often referred to as "a game", it is in fact a gaming platform and tool for game development, containing millions of user-created games. More recently, *Fortnite* (Epic Games, 2017) was introduced in 2017, quickly building a large player base. *Fortnite* is a multiplayer game where up to 100 players fight until all but one is eliminated, and is still among the top five most played computer games (Newzoo, 2026)

All in all, during a period of approximately 50 years, digital gaming has gone from comprising two-colored screens with moving dots to being visually equivalent to a movie that you can enter and influence. All along following the digital development closely. With Virtual Reality (VR) this visual illusion is taken even further, where VR-headsets create a 3D-experience of entering a totally different world. At present, VR is accessible for personal use, but accounts for only a few percent of the total gaming market (IMARC Group, 2025). It remains to be seen how this will influence the types of games being played moving forward. Simultaneously, Artificial Intelligence (AI) has risen to global attention, probably with potential to substantially change both the gaming experience and game development. Thus, game development continues to closely follow digital development, changing the types of games that we are able to play.

GAMING IN THE GENERAL POPULATION

Gaming is an increasingly popular activity, and the number of active gamers has increased rapidly during the past decade. The global player base is estimated to have increased by over 1 billion between 2015-2024 (Duarte, 2026), reaching 3.6 billion players or 44% of the global population in 2025 (Newzoo, 2025). These figures include all types of digital gaming, from mobile games to computer gaming and gaming on other types of digital platforms. Mobile gaming is by far the most common type of gaming with 3 billion players, followed by computer gaming engaging nearly 1 billion and console gaming with 0.6 billion players (Kemp, 2025; Newzoo, 2025). For an illustration of the proportion of gamers using these different types of platforms, see **Figure 2**.

Overall, the most popular video game genres are shooter games (e.g., *Counter-Strike*) and action-adventure games (e.g., *The Legend of Zelda*), each played by approximately 50% of monthly gamers (Kemp, 2025). Among mobile games, both *Candy Crush Saga* and *Roblox* were among the top five games with most monthly active users in 2025 (Kemp, 2025), although *Roblox*, as previously presented, rather is a game platform than a specific game.

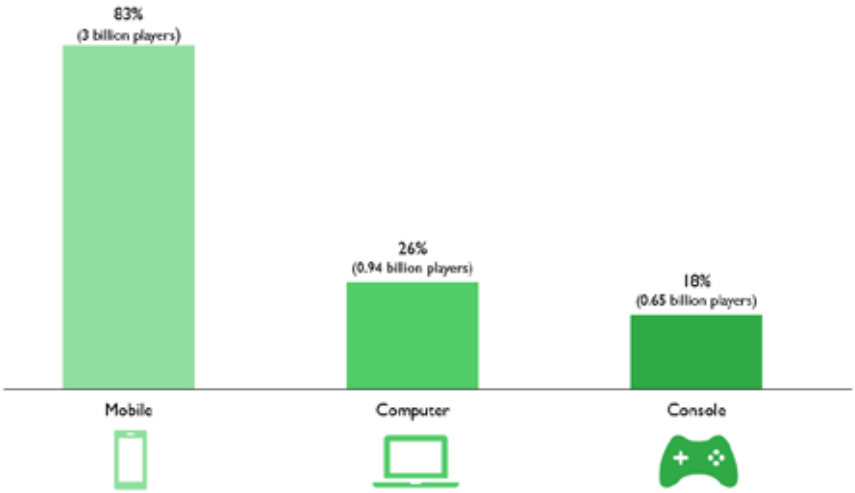

Figure 2 The proportion of gamers using the three most common gaming platforms; mobile, computer and console. Data from year 2025 (Newzoo, 2025).

Gaming is more common in younger ages, with about 90% of all internet users in ages 16-24 being video game players (Kemp, 2025). However, gaming is an activity that engages throughout the lifespan; among internet users above the age of 65 about 60% is estimated to be playing video games (Kemp, 2025). The average time spent gaming per week varies between countries. The global average among internet users aged 16 years or older is one hour of gaming per day, and data from Sweden is close to this average (Kemp, 2025).

There are also gender differences. Gaming among children and adolescents in Sweden has been monitored through biannual surveys. The latest report covers data from 2014 to 2024 (Andersson, 2025) and shows that 20-30% of boys aged 12-18 spend three hours or more per day gaming; while fewer than 10% of girls fall into this category. However, it has become increasingly common among teenage girls to engage in digital gaming to some degree. This increase in gaming among girls and women mirrors data from other countries (Brand, 2019; Statista, 2025), indicating an almost equal gender distribution across age groups.

DIAGNOSTIC DEFINITIONS AND PREVALENCE

DEVELOPMENT OF THE GAMING DISORDER DIAGNOSIS

As gaming has become more popular, concerns have grown about potential negative consequences, including excessive and addiction-like gaming, Research on this subject has been ongoing for several decades. Early research about excessive gaming used many different terms, e.g., *video game addiction*, *gaming addiction*, *internet addiction*, and relied on differing definitions (Petry et al., 2014), often adapted from criteria for substance use disorders or gambling disorder. Differences in terminology hamper comparisons. Nevertheless, research on problematic gaming has increased markedly over the past two decades.

The accumulating research (Petry & O'Brien, 2013) motivated the development of proposed diagnostic criteria for Internet gaming disorder (IGD), which was included in the fifth revision of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) as a condition for further study (American Psychiatric Association, 2013). Thus, instead of being incorporated into the main classification system, the IGD diagnosis was placed in a section meant to inform and stimulate further research (Petry & O'Brien, 2013), and it remains there in the revised version of the DSM-5 released in 2022 (American Psychiatric Association, 2022). However, a similar definition, gaming disorder (GD), became an official diagnosis in 2019 when it was included as a behavioral addiction under the umbrella category "Disorders due to addictive behaviors" in the *International Classification of Diseases, 11th Revision* (ICD-11) (World Health Organization, 2019). Thus, the two major psychiatric diagnostic classification systems have reached different conclusions about whether there is sufficient basis to define addiction to video games as an official diagnosis.

The development of the GD diagnosis has come about as part of the development of the broader research field of behavioral addictions. Gambling was the first behavior to be clinically considered as potentially addictive. Having been defined as a clinical diagnosis since 1980, gambling disorder was reclassified as an addictive disorder in the DSM-5 (American Psychiatric Association, 2013) and similarly in the ICD-11 (World Health Organization, 2019). **Figure 3** provides an overview of these gradual changes in terminology for gaming disorder and gambling disorder.

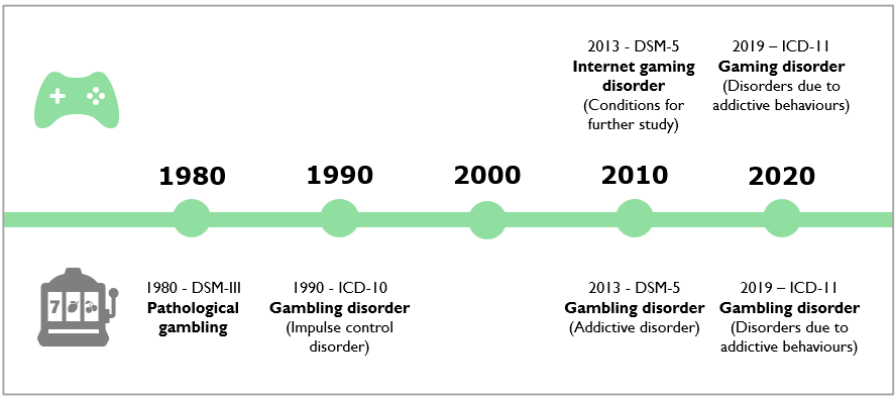

Figure 3 Changes in terminology and classification of gaming disorder and gambling disorder in the diagnostic classification systems DSM and ICD. The figure shows the years in which new editions of DSM and ICD were published, with diagnostic classification titles in bold and their respective section names provided in parentheses.

DIAGNOSTIC CRITERIA

The definitions of addiction to video games in DSM-5 and ICD-11 share many commonalities, but there are also differences in the diagnostic criteria and in how the diagnoses are constructed. The proposed IGD diagnosis in the DSM-5 includes nine criteria, of which at least five must be met for a diagnosis. In addition to these criteria, clinically significant impairment due to the amount of gaming is a prerequisite for diagnosis. The nine criteria are:

1. Unsuccessful attempts to control use
2. Preoccupation with gaming (gaming or thoughts about gaming dominate daily life)
3. Withdrawal symptoms (e.g., irritability, anxiety, sadness)
4. Tolerance (a need to spend increasing amounts of time gaming)
5. Using gaming to escape or relieve negative moods
6. Deceiving others about the amount of gaming
7. Jeopardizing or having lost significant relationships or life-opportunities due to gaming
8. Continued excessive use despite knowledge of psychosocial problems
9. A loss of interest in hobbies and entertainment, except for gaming

In comparison, the definition of GD in the ICD-11 is based on three criteria, all of which must be present for diagnosis. Similar to the DSM-5 definition, diagnosis requires that the amount of gaming causes marked distress or significant functional impairment. The diagnostic criteria comprise:

1. Impaired control over gaming
2. Increasing priority given to gaming, so that it takes precedence over other life interests
3. Continuation or escalation of gaming despite negative consequences

In addition to the GD diagnosis, the ICD-11 also includes a definition of hazardous gaming referring to gaming behaviors associated with an increased risk of negative consequences that do not meet all criteria for GD.

A comparison between the two definitions shows both similarities and differences. Both the DSM-5 and the ICD-11 employ a broad definition of gaming, encompassing digital gaming both online and offline, only excluding behavior focused on wagers (e.g., online casino) (American Psychiatric Association, 2013; World Health Organization, 2019). There is also an overlap in criteria (illustrated in **Figure 4**); all three diagnostic criteria in ICD-11 have corresponding criteria in DSM-5. However, since the ICD-11 requires all criteria to be fulfilled, it can be viewed as a stricter definition than the DSM-5 definition that allows for different combinations of at least five criteria. Differences in the clinical utility of these definitions are discussed further below in the section "Diagnostic accuracy in ICD-11 compared to DSM-5."

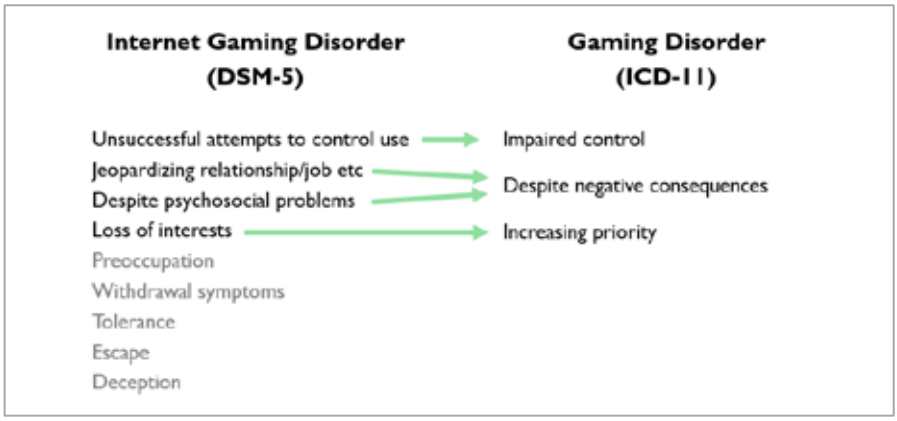

Figure 4 Comparison between diagnostic criteria in the DSM-5 and the ICD-11. Arrows point from specific DSM-5 criteria to corresponding criteria in the ICD-11.

There are also similarities with diagnostic definitions of other addictions. Comparing the IGD criteria with those for other addictive disorders in the DSM-5 shows that the diagnoses resemble each other to a large degree (American Psychiatric Association, 2013). In fact, eight of the diagnostic criteria for alcohol use disorder have corresponding criteria in the definition for IGD, and seven of the criteria of gambling disorder are identical to the criteria for IGD (see **Figure 5**). All in all, the diagnostic definition of IGD has no unique criteria, although the diagnosis is distinguished from other disorders by the basic requirement that the problems must specifically be caused by gaming.

Figure 5 Comparison between diagnostic criteria of Internet gaming disorder, Gambling disorder and Alcohol use disorder according to DSM-5. Criteria for *Gambling disorder* and *Alcohol use disorder* that are similar to criteria for *Internet gaming disorder are* written in black (non-overlapping criteria written in grey).

Although there are some differences between the DSM-5 and ICD-11 definitions, for the remainder of this text, the abbreviation GD will be used to encompass research that uses either of these definitions, unless specifically specified.

CONTROVERSIES ABOUT THE DIAGNOSIS

The classification of GD as a psychiatric diagnosis, including the placement alongside substance use disorders, has not been without controversy (Aarseth et al., 2017; Griffiths et al., 2016; Petry et al., 2014; van Rooij et al., 2018). The debate was at its height during the period surrounding the inclusion of the proposed definition of IGD in the DSM-5 and the introduction of the official GD diagnosis in the ICD-11, but it has not yet come to a close (Zheng et al., 2025). This is illustrated by the decision of the American Psychiatric Association not to include IGD as a formal diagnosis in the latest revision of the DSM-5 (2022), although GD had by then been included in the ICD-11 (World Health Organization, 2019).

The main themes of the debate (summarized in **Table 1**) cover the appropriateness of classifying GD as a separate condition, the criteria for diagnosing the condition and the scientific quality of research within the field.

Table 1 Overview of main questions in the controversies about the GD-diagnosis, and central arguments against and in favor of a formalized diagnosis.

✗ Main arguments against diagnosis	✓ Main arguments for diagnosis
Moral panic or a real problem?	
Formalizing a diagnosis is a result of a moral panic, and pathologizes normal behaviors.	A diagnosis is needed for proper treatment of those with negative consequences due to gaming.
Is gaming causing the problems?	
Negative consequences does not have gaming as the root-cause; they are caused by other pre-existing vulnerabilities.	Comorbidity is common in psychiatry and does not exclude GD from being a separate problem, in need of specific treatment.
Why "copy" criteria from other disorders?	
GD criteria are copied from other addictions and do not fit well with gaming.	GD and other addictions show similar core mechanisms. However, some of the GD-criteria should be further adjusted.
Over-inclusive criteria?	
The criteria can not distinguish between engaged and pathological gaming.	This is not an argument against diagnosis, and the diagnosis is not set in stone but should be adjusted based on continued research.
Premature to formalize diagnosis?	
More research is needed before decisions to formalize a diagnosis.	Substantial research support the existence of GD, and a formalized diagnosis is needed for continued research.

A core argument against the GD diagnosis is that the worries about excessive gaming constitute a moral panic (Aarseth et al., 2017; Blaszczynski, 2008; Markey & Ferguson, 2017; Wood, 2008), i.e., an exaggerated perception of a societal threat fueled by media and other authorities (Cohen, 2011). Critics argue that a diagnosis risks stigmatizing healthy gamers (Aarseth et al., 2017; van Rooij et al., 2018) and might even cause gamers without actual problems being diagnosed and treated for GD (Aarseth et al., 2017). Conversely, those in favor of diagnosis contend that numerous studies show significant negative consequences due to excessive gaming (Griffiths, 2008; Petry et al., 2014; Rumpf et al., 2018; Saunders et al., 2017), and that a diagnosis is needed both for clinical and scientific purposes (Rumpf et al., 2018). In addition, a diagnosis might offer an explanation to those affected, actually resulting in destigmatization (Király & Demetrovics, 2017; Kuss et al., 2017).

Further, critics argue that gaming is not the root problem for the minority who experience negative consequences of gaming (Blaszczynski, 2008; van Rooij et al., 2018; Wood, 2008). In their opinion, problematic gaming should better be understood as a symptom of pre-existing vulnerabilities, i.e., other mental illnesses (Blaszczynski, 2008; Kardefelt-Winther, 2014b; van Rooij et al., 2018; Wood, 2008). The opposing argument is that the existence of psychiatric comorbidities does not preclude GD from being a separate condition (Griffiths, 2008; Rumpf et al., 2018; Saunders et al., 2017). This is exemplified by substance use disorders where co-occurring psychiatric conditions are common, but separate diagnoses still are needed to provide proper care (Rumpf et al., 2018; Saunders et al., 2017).

Moreover, the specific criteria for GD have been debated. Critics object to the adaptation of criteria from other disorders, i.e., substance use disorders and gambling disorder (Aarseth et al., 2017; Blaszczynski, 2008; Ferguson et al., 2011; Kardefelt-Winther, 2015; Wood, 2008), arguing that this adaptation is neither scientifically acceptable nor logically sound (Blaszczynski, 2008) as these criteria fit poorly with gaming (Kardefelt-Winther, 2015; Wood, 2008). They also highlight a risk that future research will use a confirmatory approach, missing aspects unique to gaming (Aarseth et al., 2017; Kardefelt-Winther, 2015; van Rooij et al., 2018). Proponents refer to research showing similarities between GD and other types of addiction regarding core behavioral and neurobiological mechanisms (Brand et al., 2019a; Hellman et al., 2013; Saunders et al., 2017) and treatment techniques (Griffiths, 2008). However, even authors on this side of the argument contend that some of the diagnostic criteria, especially in DSM-5, are not perfectly suited for diagnosing gaming-

related problems (Griffiths et al., 2016) and should be revised based on continued research (American Psychiatric Association, 2013; Petry et al., 2014; Saunders et al., 2017).

One specific criticism of the diagnostic criteria for GD concerns the difficulty of distinguishing highly engaged gaming from pathological gaming (Deleuze et al., 2017; Przybylski et al., 2017; Wood, 2008), which makes the criteria over-inclusive, risks falsely diagnosing healthy gamers, and inflates prevalence estimates. Although this is acknowledged by proponents of the diagnosis, they argue that having agreed-upon criteria is a necessity for continued research and future refinement of criteria (Griffiths, 2008; Petry et al., 2014). Moreover, the ICD definition has left out the most debated criteria from the DSM-5 (Király & Demetrovics, 2017), hence making it better equipped to separate between engaged gaming and pathological gaming (Higuchi et al., 2017; Király & Demetrovics, 2017).

Finally, critics argue that the formalization of GD as a diagnosis is premature (Aarseth et al., 2017; van Rooij et al., 2018), as the research base is of low quality, often with a lack of data transparency and a scarcity of preregistered studies (van Rooij et al., 2018). The opposite side agrees that more research is needed (Griffiths et al., 2016; Király & Demetrovics, 2017; Petry & O'Brien, 2013; Petry et al., 2014). Overall, though, proponents argue that a common definition is essential for continued research (Griffiths et al., 2016; Király & Demetrovics, 2017; Petry & O'Brien, 2013), as scientific studies have been hampered by a lack of consensus on definitions.

In summary, the controversy concerns both whether GD is a disorder in its own right and, if so, whether formalization of a diagnosis should await more scientific support or if a definition is necessary for continued research. In addition, there is consensus on both sides on the need for continued evaluation of the diagnostic criteria.

DIAGNOSTIC ACCURACY IN ICD-11 COMPARED TO DSM-5

One challenge in research on and assessment of GD is to separate pathological gamers from highly engaged gamers (Billieux et al., 2019). Even before the tentative definition in DSM-5 was formulated, several studies highlighted the importance of identifying diagnostic criteria that can help with the distinction between engaged and pathological gaming (Brunborg et al., 2015; Charlton & Danforth, 2007). It was suggested that some criteria are "core criteria" that help identify the pathological group, whereas other commonly used criteria may be considered "peripheral" and less effective in contributing to this distinction.

Soon after the DSM-5 criteria was introduced, it was noted that this definition seems to include both peripheral and core criteria and hence have difficulties distinguishing between highly engaged and pathological gaming (Deleuze et al., 2017). An international expert consensus procedure was later conducted, comparing the criteria in DSM-5 and ICD-11, showing that all the ICD-11 criteria were perceived as having high diagnostic validity (Castro-Calvo et al., 2021). The corresponding DSM-5 criteria (see **Figure 4**) received the same rating, while two DSM-5 criteria (*Tolerance* and *Deception*) were judged to have poor diagnostic validity and no agreement was reached regarding the remaining three criteria (*Preoccupation*, *Withdrawal* and *Escape*). A more recent study has supported this assessment, showing that *Preoccupation* and *Escape* have low discriminatory power for estimating severity of GD (Bäcklund et al., 2024b), especially in samples with highly engaged gamers. Moreover, preoccupation with gaming has been shown to be endorsed by 77.3% of gamers in a sample of community gamers (Deleuze et al., 2017), indicating a lack of discriminatory value.

PREVALENCE OF GAMING DISORDER

Knowledge about the prevalence of GD is important for implementing adequate preventive measures, planning treatment availability, and tracking changes over time. Two meta-analyses of representative samples have estimated the global prevalence of GD to be between 1.96% and 2.4% (Kim et al., 2022a; Stevens et al., 2021, 2023). Taking possible publication bias into account using the trim-and-fill method produces an even lower prevalence estimate of 1.4% (Kim et al., 2022a). The prevalence of GD is thus in the same range as the global prevalence of gambling disorder, estimated at 1.39-1.95% (Gabellini et al., 2023; Tran et al., 2024), while alcohol use disorder, estimated to affect 3.7% of the global population, is 2.5 times more common than GD (World Health Organization, 2024).

Studies have repeatedly shown that GD is unevenly distributed in the population. Men are overrepresented among individuals with GD (Fam, 2018; Mihara & Higuchi, 2017; Müller et al., 2015; Stevens et al., 2021), with GD being 2.5 times more prevalent among men than women (Stevens et al., 2021). This overrepresentation of men is in line with data showing that boys overall spend more time gaming than girls do (Andersson, 2025). However, this gender difference might be changing. Data from, for example, Sweden (Andersson, 2025), the United States (Statista, 2025) and Australia (Brand, 2019) show an increase in gaming among girls, which corresponds to a possible trend of rising GD prevalence among females (Stevens et al., 2021). It has been suggested that this change might be driven by an increasing diversification in the types of gaming available, including more games integrated into social media (King & Potenza, 2020).

Gaming disorder is also more prevalent among adolescents than adults (Stevens et al., 2021), which might be expected as time spent gaming overall is higher in younger ages (Kemp, 2025). Professional gamers are another group with higher gaming time and higher levels of GD than the average gamer (Maldonado-Murciano et al., 2022). There are also cultural differences, with Asian countries consistently presenting the highest prevalence rates (Fam, 2018; Kim et al., 2022a; Stevens et al., 2021). Some possible reasons are that Asian prevalence studies include a higher proportion of high-school samples than studies from other regions (Stevens et al., 2021), and that measures of GD might be especially susceptible to over-inclusion when used in intense gaming cultures such as South Korea (Seok & DaCosta, 2012), but also that the true prevalence might be higher in Asia.

Obtaining reliable prevalence data is, however, challenging as GD is a newly defined diagnosis, and studies have historically used different definitions. Newer studies often use the DSM-5 definition, some uses the ICD-11 definition, and older studies often used a definition based on grammatically modified diagnostic criteria for gambling disorder (Fam, 2018; Stevens et al., 2021). Accordingly, the reported prevalence of GD differs considerably between different studies, ranging at least from 0.6% (Mentzoni et al., 2011) to 17.7% (Coëffec et al., 2015), making it difficult to interpret the data in a meaningful way.

Choice of measurement instrument also accounts for a large part of the differences in prevalence between different studies (Feng et al., 2017), explaining as much as 77.9% of the differences (Stevens et al., 2021). Specifically, the use of ICD-11 criteria results in substantially lower prevalence estimates compared to the use of DSM-5 criteria (Pontes et al., 2022; Zhou et al., 2024), supporting the assessment that the ICD-11 criteria may have higher diagnostic accuracy (Castro-Calvo et al., 2021) and may be better at distinguishing highly engaged gamers from problematic gamers (Higuchi et al., 2017; Király & Demetrovics, 2017). Even when the same instrument is used, different cut-off scores have been employed. Not surprisingly, prevalence rates are elevated when using lower cut-offs (Stevens et al., 2021).

In addition, many studies presented as prevalence studies suffer from major methodological weaknesses. Importantly, many studies have relied on cross-sectional surveys with self-selected participants (Kim et al., 2022a; Stevens et al., 2021), which likely results in non-representative samples. By contrast, the meta-analyses cited above (Kim et al., 2022a; Stevens et al., 2021, 2023), which reported prevalence estimates ranging from 1.4% to 2.4%, calculated their estimates exclusively on the basis of representative samples.

Due to inconsistent methodology, it is difficult to investigate changes in the prevalence of GD over time, and existing findings are mixed. A review covering studies from 1998 to 2016 identified no changes in prevalence (Feng et al., 2017), whereas a meta-analysis of studies published between 2009 and 2019 identified a slight increase (Stevens et al., 2021). Hence, additional studies with rigorous and similar methodologies are needed to more accurately measure prevalence, cultural differences and changes over time (Rumpf et al., 2019; Stevens et al., 2021).

THE RELATIONSHIP BETWEEN TIME SPENT GAMING AND GAMING DISORDER

Being affected by GD implies engaging in gaming to such an extent that it causes significant negative consequences. Unsurprisingly, individuals with GD devote a considerable amount of time to gaming. The DSM-5 suggests that individuals with GD spend at least 30 hours per week gaming (American Psychiatric Association, 2013). However, even higher averages of slightly more than 40 hours of gaming per week have been found in subsequent studies (Katz et al., 2024), and a mean of just over 50 hours per week in a clinical sample fulfilling criteria for GD (**Paper III**).

However, the relationship between GD and time spent gaming is complex. Overall, a linear association has been found between GD symptoms and time spent gaming, such that increased time spent gaming was associated with a greater number of GD symptoms (Katz et al., 2024; Pontes et al., 2022). Despite this, time spent gaming has been shown to be a poor indicator of GD (Billieux et al., 2019; Burén et al., 2023; Katz et al., 2024; Király et al., 2017). This means that, although individuals with GD on average play for longer times than those without GD, there is also a considerable share of gamers that play extensively without suffering negative consequences. Conversely, individuals may also develop GD when playing at relatively moderate levels (Burén et al., 2023), potentially because even moderate gaming can lead to problems under certain individual life circumstances (Griffiths, 2010).

Research shows that even weekly gaming time that may appear high, equivalent to half-time employment or more, can still be unproblematic. Studies among engaged gamers have shown that groups with no risk for GD still had an average gaming time of 20-27 hours per week (Katz et al., 2024; Pontes et al., 2022). Likewise, among engaged gamers playing at least 30 hours per week, only one third scored over the threshold for GD (Slack et al., 2022). This is also corroborated by research showing positive associations between time spent gaming and well-being (Johannes et al., 2021), for example through experiences of engagement, accomplishment and relatedness (Jones et al., 2014). Individuals who play video games have also been shown to experience greater well-being than non-players (Durkin & Barber, 2002).

Rather than screen time *per se*, findings indicate that poorer health outcomes are primarily associated with the extent of negative consequences resulting from gaming (Burén et al., 2023). Taking this reasoning further, King et al. (2024) suggested an alternative way of measuring gaming time, separating

gaming time that takes place during free time ("*Green Box*") and gaming taking place at times when the gamer should have been doing something else ("*Red Box*"). Hence, this measure focuses more on the issue of *when* gaming takes place than the total gaming time. This approach has shown superior diagnostic accuracy, compared to measures of total weekly gaming time, with a response of ≥ 9 hours per week in the *Red Box* corresponding to a 94% likelihood of having GD (Stevens et al., 2025).

In conclusion, time spent gaming alone is not a sufficient metric for determining problematic gaming. More decisive is whether gaming has significant negative consequences.

IMPORTANT RESEARCH GAPS RELATED TO GAMING DISORDER

Research on GD is now accumulating, providing a clearer picture of neural mechanisms (Zheng et al., 2025), psychiatric comorbidities (e.g., Coutelle et al., 2024; González-Bueso et al., 2018), other characteristics of individuals with GD such as motives for gaming (Király et al., 2022a), and several proposed theoretical models for the development of GD (e.g., Brand et al., 2019b; King & Delfabbro, 2014). However, despite these advances, important gaps remain. Most of the research on the characteristics of individuals with GD is based on cross-sectional quantitative studies conducted in general populations (Kim et al., 2022a), and the theoretical models still require further empirical validation (Brand et al., 2025). In addition, although treatment options for GD are being developed, rigorous controlled treatment studies with long-term follow-up remain scarce (Danielsen et al., 2024). There is therefore a clear need for research focusing on how GD is experienced and manifested among treatment-seeking individuals, as well as more state-of-the art randomized controlled trials (RCTs) to investigate treatment effects.

SUMMARY

In summary, digital games have proliferated alongside the rapid digital evolution that began in the 1950s. Gaming is now a widespread activity across all age groups, particularly mobile gaming. It is more common among younger age groups, and increasingly popular among girls and women.

Over the past decades, growing attention and research have focused on the minority of gamers who experience significant negative consequences due to gaming. Following a lively debate over whether excessive gaming should be defined as a psychiatric diagnosis, and about the diagnostic criteria, two partly overlapping diagnostic definitions of GD were included provisionally in the DSM-5 and officially the ICD-11.

Prevalence estimates for GD based on representative samples range from 1.4% to 2.4%, with men and adolescents overrepresented. While individuals with GD spend considerable amounts of time gaming, it is the consequences of gaming, and not time spent gaming *per se*, that are decisive for diagnosis.

Although research on GD is increasing, studies involving clinical populations and large RCTs remain comparatively scarce.

2.

2. AIM

The overall aim of this thesis was to expand clinically relevant knowledge about GD to inform the development of more effective treatments, and to investigate effects of psychological treatment for GD. The specific aims for the different studies were:

- To investigate if there are clinically relevant age-dependent differences among patients seeking treatment for GD (**Paper I**).

- To explore which factors patients with GD describe as making it difficult to control the amount of gaming (**Paper II**).

- To investigate the effects of psychological treatment for GD (**Paper III & IV**).

3.

3. THESIS OUTLINE

What needs to be done to regain control over gaming when GD has developed? That question is at the core of this thesis. Aiming to answer the question from a clinical perspective, the thesis is outlined as follows:

CHARACTERISTICS OF INDIVIDUALS WITH GAMING DISORDER presents clinically relevant data about psychiatric comorbidities and other health-related aspects associated with GD, and concludes with findings from **Paper I** which investigated differences between a younger and older group of patients.

WHY IS IT HARD FOR INDIVIDUALS WITH GAMING DISORDER TO CONTROL GAMING? This section presents factors that contribute both to the development of GD and to maintaining excessive gaming, including game-related, motivational, neurobiological, and cognitive factors. This is summarized in theoretical models about GD, complemented by additional information about maintaining factors acquired from interviews with patients reported in **Paper II.**

TREATMENT FOR GAMING DISORDER presents available treatments for GD, with a specific focus on cognitive-behavioral therapy (CBT), together with a description of the newly developed CBT that is the focus of **Paper III** and **Paper IV**, including results from a pilot study investigating the effectiveness and feasibility of the CBT.

Finally, Methodological considerations and Ethical considerations are discussed in relation to the studies included in the thesis, ending with Conclusions and future perspectives that summarizes the findings reported in the thesis and looks forward to important questions that remain to be answered.

4.

4. GAMING DISORDER: WHEN GAMING GETS OUT OF CONTROL

CHARACTERISTICS OF INDIVIDUALS WITH GAMING DISORDER

Moving on from the diagnostic definitions, it is now time to zoom in on the group of individuals that fulfill these diagnostic criteria. As presented in the section about prevalence, this group is predominantly male and many of them are adolescents. From a clinical perspective, in-depth information is needed about individuals seeking treatment for GD, as a basis for treatment planning. Therefore, this section covers common psychiatric comorbidities and other types of difficulties associated with GD, and presents preliminary suggestions of clinical subgroups that might be informative for development and planning of treatment. The contributions from **Paper I** will also be presented, providing additional information about age differences among treatment-seekers.

PSYCHIATRIC COMORBIDITIES IN RELATION TO GAMING DISORDER

It has consistently been shown that co-occurring psychiatric conditions, i.e., comorbidities, are common together with GD. Below, the most frequently reported psychiatric comorbidities are described.

ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

Studies consistently show a significant correlation between GD symptom severity and ADHD (Coutelle et al., 2024; Dullur et al., 2021; González-Bueso et al., 2018; Koncz et al., 2023). One meta-analysis showed a stronger correlation between GD and inattentive symptoms (Dullur et al., 2021). However, a larger meta-analysis published a couple of years later showed no such differences, but instead medium-sized correlations between GD and all types of ADHD presentations (i.e., predominantly inattentive, hyperactive-impulsive or combined) (Koncz et al., 2023).

Although the correlation between GD and ADHD-symptoms appears to have substantial support, the nature of this association over time is less clear (Dullur

et al., 2021; González-Bueso et al., 2018; Koncz et al., 2023), as most studies are cross-sectional and longitudinal research shows conflicting results. Several studies show that pre-existing ADHD predicts later GD symptoms (Ferguson & Ceranoglu, 2014; Peeters et al., 2018; Schoenmacker et al., 2020; Wartberg et al., 2019). However, a bidirectional association between inattentive symptoms and GD has also been identified (Marmet et al., 2018). In contrast, one study following children from age 8 to age 10 found no increased risk for GD over time associated with ADHD (Wichstrøm et al., 2019).

AUTISM

Gaming disorder is more common among both youth and adults with autism spectrum disorder (ASD), compared to individuals without ASD (Dell'Osso et al., 2023; Eltahir et al., 2025; Engelhardt et al., 2017; Murray et al., 2022a; Murray et al., 2022b; Simonelli et al., 2024). Several factors have been suggested as possible explanations for this association. Autism-related difficulties with impulse control and response inhibition may contribute to a heightened risk for GD (Mazurek & Engelhardt, 2013). The structured and rule-based nature of gaming environments may also be particularly appealing for individuals with ASD (Finke et al., 2018). In addition, the gaming context might also offer a shared interest and a predictable social setting, making social interaction easier than in offline environments (Finke et al., 2018).

However, having intense and restricted interest is also part of the clinical presentation of ASD *per se*. It has therefore been emphasized that clinicians must distinguish gaming that is best understood as a special interest integral to ASD from excessive gaming indicative of comorbid GD (Coutelle et al., 2022; Dell'Osso et al., 2023; Paulus et al., 2020). Separating GD from restricted interests may be difficult, but authors suggest that it could be important, as it may affect the types of interventions to integrate in treatment (Coutelle et al., 2022; Paulus et al., 2020). For example, if gaming is best understood as a special interest, it may be beneficial to use gaming to practice other abilities that are impaired in ASD, such as social skills (Coutelle et al., 2022). In contrast, if gaming is understood as GD, treatment may focus more on limiting gaming time and reducing negative consequences of gaming.

DEPRESSION AND ANXIETY

Symptoms of depression is frequently reported as associated with GD (Bäcklund et al., 2024b; Coutelle et al., 2024; González-Bueso et al., 2018; Király et al., 2022a; Männikkö et al., 2020; Ostinelli et al., 2021; Richard et al., 2020a). It is estimated that one third of individuals with GD fulfill criteria

for depression, and additional individuals have subclinical symptoms of depression (Ostinelli et al., 2021). Longitudinal data indicate both that depressive symptoms increase the risk of developing GD and that GD increases the risk for future depressive symptoms, i.e., a bidirectional association (Amendola et al., 2025). As noted by for example Richard et al. (2020a), diagnostic criteria of depression and GD partly overlap, especially regarding loss of interest in previous hobbies and experiences of negative emotions when gaming is not possible. This overlap might be important to take into consideration to avoid diagnostic uncertainty (Ostinelli et al., 2021).

Anxiety is also associated with GD (Bäcklund et al., 2024b; Coutelle et al., 2024; González-Bueso et al., 2018; Männikkö et al., 2020), and longitudinal data show that anxiety increases the risk for GD, but not the other way around (Amendola et al., 2025).

The relationship between GD, anxiety and depression is stronger among older individuals with GD compared to younger (Männikkö et al., 2020). Interestingly, it has also been shown that levels of depression and anxiety moderate the relationship between gaming time and GD. That is, the effect of gaming time on GD symptoms is significantly stronger for those with higher levels of depression or anxiety (Strojny et al., 2024). The authors hypothesize that these concurrent problems might amplify the gratifying effects of playing games and thereby heightening the risk for developing GD.

PSYCHOSIS

Some studies have also shown that a minority with GD suffer from psychotic disorders (Wang et al., 2025). Higher levels of problematic gaming also predict higher levels of psychotic-like experiences (i.e., paranoia and hallucinations but of lesser intensity than in psychotic disorders) one year later (Paquin et al., 2026). The association between psychotic experiences and GD might be mediated by insomnia and experiences of cyberbullying (Fekih-Romdhane et al., 2023). However, few studies have examined the links between GD and psychosis (Huot-Lavoie et al., 2023), leaving the evidence base limited.

SUBSTANCE USE AND SUBSTANCE USE DISORDERS

Substance use, especially the use of alcohol, tobacco, cannabis and stimulants (e.g., amphetamine) is common among individuals with GD (Liberacka-Dwojak et al., 2026). However, the evidence is mixed regarding the relation between GD and problematic use, i.e., substance use disorders. It remains unclear whether substance use disorders other than alcohol are over-

represented among individuals with GD (Di Carlo et al., 2023). Problematic alcohol use has, however, repeatedly been shown to be associated with GD (Byeon et al., 2022; Suchá et al., 2024; Wartberg et al., 2025). In contrast, other studies suggest that engaged gaming may be protective against problematic drinking (Erevik et al., 2019), and that GD does not increase the risk of subsequent alcohol use disorder (Borges et al., 2023). Interestingly, recent data suggest a U-shaped relationship between alcohol use and gaming, indicating that low intensity gamers drink less than both non-gamers and individuals with GD (Suchá et al., 2024). This suggests that a healthy level of gaming may be protective in relation to alcohol use, whereas GD may be associated with more problematic use. Although the evidence is somewhat mixed, it has been noted that GD and substance use share similar risk factors (e.g., emotional regulation difficulties and impulsivity), and that substances may sometimes be used to improve in-game performance (Liberacka-Dwojak et al., 2026).

GAMBLING DISORDER

There are several overlaps between gaming and gambling. Many games include micro-transactions, and in-game expenditure has been shown to be associated with gambling disorder (Raneri et al., 2022), particularly when purchases involve loot-boxes (Raneri et al., 2022; Spicer et al., 2022; Yokomitsu et al., 2021). Overall, problem gambling is more common among gamers than non-gamers, and especially among those who engage in gaming on a daily basis (Folkhälsomyndigheten, 2023). In addition, esports betting (i.e., betting on professional competitive gaming) has shown stronger associations to both GD and problem gambling compared to ordinary sports betting (Mangat et al., 2026). Although longitudinal data about causality is scarce, a Norwegian study indicates that individuals with problematic gaming have a heightened risk of later developing problematic gambling (Molde et al., 2019). Importantly, however, Karhulahti and Auranen (2026) highlight a risk of measurement errors when assessing gambling problems among gamers, as gambling measures might be misunderstood as gaming measures due to terminological similarities.

OTHER DIFFICULTIES ASSOCIATED WITH GAMING DISORDER

SELF-INJURY & SUICIDALITY

A few studies have examined the association between GD and self-injury and suicidality (Gillespie et al., 2026; Losaberidze et al., 2025). In a recent meta-analysis, all studies found GD to be associated with a higher risk of self-injury and/or suicidality (Gillespie et al., 2026). However, the pooled effect did not reach statistical significance, indicating that the overall level of evidence remains weak and the true magnitude of the association is uncertain.

Several recent longitudinal studies have further illuminated potential casual pathways. Xiao et al. (2025) found GD to heighten the risk of both suicidal behaviors and suicidal ideation, as well as more internalizing symptoms. In addition, Gong et al. (2025) reported that internalizing symptoms fully mediated the path from GD to non-suicidal self-injury. A third study, (Leino et al., 2024), found that the association between GD and non-suicidal self-harm and suicidal ideation applied only to females. Hence, evidence so far suggests that many factors may affect or explain this relationship.

EMOTIONAL REGULATION

Emotional regulation can be defined as the ability of individuals to "influence which emotions they have, when they have them, and how they experience and express them" (Gross, 1998). Meta-analytic data show that GD is associated with emotional regulation deficits (Gisbert-Pérez et al., 2024), and it has been suggested that the two most central problems for individuals with GD and emotional regulation deficits might be to identify or understand their emotions and a lack of strategies to handle them (Estupiñá et al., 2024)

SLEEP

Gaming disorder has also been shown to be associated with sleep problems (Kristensen et al., 2021; Lam, 2014; Slack et al., 2022; Sugaya et al., 2019). Problems include for example shorter sleep duration, worse sleep quality, daytime sleepiness and delayed sleep phase (Kristensen et al., 2021).

OBESITY

Results are somewhat inconsistent regarding the association between obesity and GD, but most studies show that children and adolescents with GD have increased rates of obesity (Che Mokhtar & McGee, 2025).

QUALITY OF LIFE

Quality of life refers to an individual's subjective experience of important aspects of life in relation to their personal goals and values (Skevington et al., 2004). Overall, gamers with GD report lower quality of life than non-problem gamers (Byeon et al., 2022; Bäcklund et al., 2024b; Qi et al., 2025; Slack et al., 2022). Regarding causality, meta-analytic longitudinal data indicate a bidirectional association between GD and life satisfaction (Amendola et al., 2025).

RISK FACTORS FOR DEVELOPING GAMING DISORDER

Identification of risk factors for GD, that is, factors that precedes and increases the risk for GD, is important for both prevention and treatment. Most studies presented as reporting risk or protective factors have used cross-sectional designs (Gao et al., 2022; Ji et al., 2022; Ropovik et al., 2023), hence in fact only providing evidence for associations and not causative relationships. In contrast, longitudinal studies can provide stronger evidence of causality by identifying factors that temporally precede an outcome over time. Using this approach, a wide range of factors have been identified as risk factors for GD.

Zhuang et al. (2023) analyzed modifiable risk factors (i.e., excluding stable demographic factors such as gender) based on longitudinal studies, and found that individual factors outweighed social factors in predicting GD. Among the strongest individual risk factors were time spent gaming, loneliness, social media disorder, aggression, anxiety and ADHD, while the strongest protective factors were self-control, conscientiousness and agreeableness. Key social risk factors included deviant peer affiliation and family violence, whereas peer relationships, parent-child relationships, and social support were protective. Somewhat surprisingly, parental control or restriction of gaming time were *not* identified as protective for developing GD, while parental supervision (indicating a broader knowledge of and engagement in children's activities and needs) had a small protective effect against GD. Only one environmental factor was included, namely school engagement, which was identified as a protective factor.

Further, based on a review of longitudinal studies, Richard et al. (2020b) proposed that risk factors for GD may vary in different developmental stages.

Identified risk factors in childhood are for example emotion dysregulation, autistic traits and problems with peers and parents. Loneliness and low self-esteem are examples of risk factors in adolescence, and low perceived life success is one of the risk factors in adulthood.

CLINICAL SUBGROUPS

Of interest for clinical purposes, some authors have tried to identify clinical subgroups, that might help guide the choice of interventions used in treatment of individual patients (Ko et al., 2023). Inspired by a theoretical model for the development of gambling disorder (Blaszczynski & Nower, 2002), Lee et al. (2017) suggested three subgroups of GD patients with different reasons for gaming; *impulsive/aggressive* gamers that use gaming to release aggressive impulses or alleviate boredom, *emotionally vulnerable* gamers that play for coping and mood modification, and *socially conditioned* gamers that play for social reasons. Based on clinical experience, Ko et al. (2023) suggested three similar groups: impulsive male patients with ADHD, patients with dysphoria and dysfunctional coping skills, and isolated patients with social anxiety.

Granero et al. (2021) instead used cluster analysis on clinical data and identified two subgroups of patients seeking treatment for GD. They found a younger group with earlier initiation of problematic gaming but also less psychiatric comorbidities, and an older group that both had a later onset of problematic gaming and more years of problematic gaming at treatment-seeking. In addition, the older group reported higher levels of psychiatric comorbidity.

AGE DIFFERENCES AMONG PATIENTS WITH GAMING DISORDER

Prevalence data show that GD is most common among younger groups (King et al., 2017), and many clinical studies exclude adults (King et al., 2017). However, the increasing engagement in gaming in all age groups, together with data indicating possible age-related differences in comorbidities (González-Bueso et al., 2018; Granero et al., 2021) and risk factors (Richard et al., 2020b) calls for further examination of whether the clinical presentation of GD varies in different age groups.

In **Paper I,** we aimed to address this research gap, by examining age-related differences in a sample of individuals seeking treatment for GD. Specifically, we investigated whether clinically relevant differences in symptomatology exist between adults (older than 25 years) and adolescents and young adults (AYAs; aged 25 years or younger). Gaming disorder diagnosis was determined based on a diagnostic interview. Symptoms of GD, along with symptoms of psychiatric comorbidities, were also measured using self-reported questionnaires. For an overview of instruments used, please refer to **Table 3** in *Methodological considerations*. Information about debut of gaming and of problematic gaming was also based on self-reported data. This study, like the other studies included in this thesis, was conducted at *Mottagning för spelberoende och skärmhälsa* at Sahlgrenska University Hospital, an outpatient clinic offering specialized CBT for gaming disorder and gambling disorder.

In summary, we found differences in progression into problematic gaming (the younger group had developed GD faster than the older group). However, the clinical profiles in terms of symptoms of GD and psychiatric comorbidities were similar across the two age groups.

One of our main findings was that the younger group had developed problematic gaming significantly faster than the adult group; progression into problematic gaming took about seven years for the younger group and eleven years for the adults (see **Figure 6**). As described in the introduction, there has been a rapid development of digital games during the last decades. Hence, the younger group have had access to partly different games during childhood, and availability of online gaming options to a higher degree in younger ages. Other studies indicate that early initiation of gaming can increase the risk of developing GD (Nakayama et al., 2020; Singh et al., 2021). Our results suggest that an earlier gaming debut may also increase the risk of a more rapid progression into GD, similar to findings on the association between age of initiation of drinking and progression to alcohol use disorder (Winters & Lee, 2008).

The age and gender distribution in **Paper I** (see **Figure 6**) differs considerably from population-based prevalence data. Although GD is more common in younger individuals (Stevens et al., 2021), half of our sample were adults, highlighting the need for clinical research and treatment options targeting adults with GD.

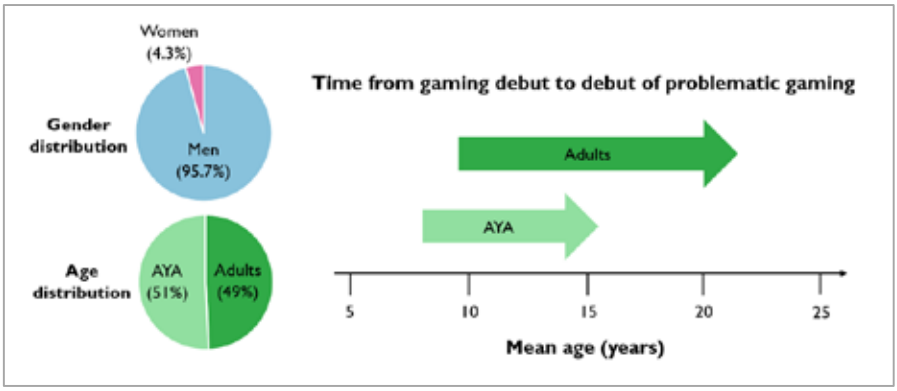

Figure 6 Main differences between adults and AYA identified in **Paper I**. AYA = Adolescents and Young Adults, defined as ≤ 25 years of age, and adults > 26 years of age. Mean age of gaming debut for AYAs was 6.7 years and debut of problem gaming occurred at 13.8 years of age, i.e., on average 6.9 years to develop problematic gaming. The adults started gaming when they were 9.9 years old and had developed problematic gaming when they were 21.0 years old, i.e., on average 11.1 years to develop problematic gaming. There was a statistically significant difference in years to develop problems.

The proportion of men was much higher in our clinical sample (96% men) compared to population-based estimations (71% men) (Stevens et al., 2021). What might be the reason for these differences in gender distribution? The underrepresentation of women seeking treatment may be influenced by the fact that women, on average, play different types of games and may not identify with the "gamer" label to the same extent as men (Paaßen et al., 2017), and therefore may not identify with the GD diagnosis either. King and Potenza (2020) also suggests that GD among females might be overshadowed by psychiatric comorbidities, immediate crises like for example self-harm or other types of risky internet-based activities like excessive use of social media.

Another possibility is that the gender distribution reported in prevalence studies does not apply to Swedish settings. None of the available representative prevalence studies have been conducted in Sweden (Kim et al., 2022a; Stevens et al., 2021, 2023). Consequently, it remains unclear whether the gender distribution of GD in Sweden differs from global estimates. The gender distribution in **Paper I** is though nearly identical to another Swedish study, that reported 95% males in their clinical sample (Bore et al., 2025), and close to the gender distribution in a clinical study from Spain with 92% men (Granero et

al., 2021). Thus, if the gender distribution in Sweden and Europe is comparable to global statistics, GD-clinics seem to have failed to reach women in an equivalent degree as men. Regardless, the increase of gaming among women (Andersson, 2025), now constituting almost half of the total player base (Kemp, 2025), underlines the importance of continuing to include women in future studies, to monitor changes in prevalence and to capture possible other differences between men and women regarding GD.

Contrary to our hypothesis, and findings from earlier studies (González-Bueso et al., 2018; Granero et al., 2021), we found no differences in psychiatric symptoms between the two age groups. However, and similar to findings from other studies (e.g. Coutelle et al., 2024), psychiatric comorbidities were common in our clinical sample (see **Figure 7**). It should, however, be noted that this study, like most other studies investigating comorbidities, relied on self-reported questionnaire data. Questionnaires used for screening generally result in higher prevalence numbers than those fulfilling criteria for a diagnosis, as these types of questionnaires are designed to be over-inclusive.

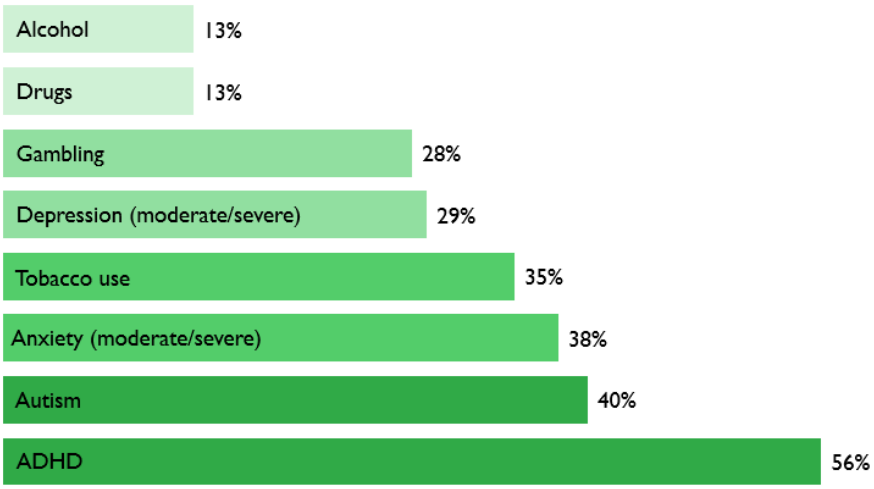

Figure 7 Psychiatric comorbidity as percentages of the total sample from **Paper I**. *Alcohol* refers to percentages with harmful use according to AUDIT, *Drugs* refers to harmful use according to DUDIT, *Gambling* refers to percentage above cut-off for suspected gambling problems on NODS-PERC, levels of *Depression* measured with PHQ-9, *Tobacco use* refers to self-reported use in any form, levels of *Anxiety* measured with GAD-7, *Autism* refers to percentages above cut-off on RAADS-14 and *ADHD* to percentages above cut-off on ASRS Screener.

Hence, the prevalence data for different diagnoses in our sample are probably at the higher end. For a more detailed discussion about methodological issues concerning measurements, see *Methodological considerations*.

ADHD was the most common comorbidity, similar to data from other clinical GD samples (Barrangou-Poueys-Darlas et al., 2022; Bore et al., 2025) and other predominately non-clinical samples (e.g. Koncz et al., 2023). Autism was also common in our sample, according to screening results. This aligns with research showing associations between ASD and GD (e.g. Eltahir et al., 2025), and with other clinical findings (Bore et al., 2025). Interestingly, almost one third of the participants scored above cut-off for possible gambling problems. This is well in line with other clinical data (Bore et al., 2025; Granero et al., 2021). It has though been noted that gambling questionnaires may be mistaken for gaming measures, due to terminological similarities (Karhulahti & Auranen, 2026). The clinical data, together with other findings about possible associations between gaming and gambling problems (Molde et al., 2019; Spicer et al., 2022), do however call for legislative and scientific focus on gambling-like elements in games, such as loot-boxes (Sánchez Belmar & Subramanian, 2025) .

SUMMARY

Gaming disorder is associated with a wide range of psychiatric disorders, sleep problems, emotion regulation deficits and lower life satisfaction. The causal relationships between GD and these factors are complex and, in some cases, remain unclear. In some instances, such as depression, the association appears to be bidirectional. Anxiety, for example, has been shown to increase the risk of GD. Gaming disorder, in turn, has been identified as a risk factor for gambling problems.

Paper I contributes additional clinical data on adult patients in comparison with adolescents and young adults. Results show similar clinical presentations in younger and older patients with GD, although the younger group reported a more rapid progression into GD. Overall, the study confirms earlier research showing extensive psychiatric comorbidity and underlines the importance of screening for other psychiatric conditions, and in particular ADHD, when working with GD patients. Given the increasing overlap between gaming and gambling, it is also worth assessing possible coexisting gambling problems.

WHY IS IT HARD FOR INDIVIDUALS WITH GAMING DISORDER TO CONTROL GAMING?

The etiology and maintenance of GD are best understood as the result of an interplay among multiple contributing factors. These factors can be grouped into gaming-related factors, individual factors and environmental factors (Király et al., 2023). Below these factors are discussed more in detail, starting with the influence of game genres and game design on the development of GD. This is followed by individual factors, including motives for gaming, neurobiology and cognition. Lastly, these findings are summarized with help from influential theoretical models in the research field of GD, and the contributions from **Paper II** are introduced, highlighting the importance of environmental factors.

GAME GENRES AND GAME DESIGN

Digital gaming comes in many different forms. From offline single-player games and online games with ranking systems but no other type of social interaction, to online multi-player games with large open worlds where the game continues around the clock and requires substantial amounts of social interactions and co-operation. The great variation of games raises the question about whether all types of digital games are equally addictive.

Some indications of early hypotheses on this topic can be found in diagnostic classifications and early research. The diagnostic label "Internet gaming disorder" in DSM-5 (American Psychiatric Association, 2013) highlights the notion that online games are the ones with most addictive potential, although this is not a strict diagnostic requirement. Early research on GD focused largely on MMORPGs and more specifically on gamers playing World of Warcraft (e.g., Pawlikowski & Brand, 2011; Peters & Malesky, 2008; Snodgrass et al., 2011). Some of the first self-report questionnaires about motives for gaming were in fact designed to be used for players of specific genres, such as MMORPGs (Yee, 2006).

More recently developed measures and the newer diagnostic classifications do not require or presuppose specific types of gaming (American Psychiatric Association, 2022; Demetrovics et al., 2011; World Health Organization, 2019). However, some types of games have consistently been associated with

GD. Research shows that online gaming more often than offline gaming predicts GD symptoms (Lemmens & Hendriks, 2016; Montag et al., 2021; Rehbein et al., 2010). There is also a stronger association between GD and games played on computer than games played on other devices (Montag et al., 2021; Paik et al., 2017), and games played in real time compared to turn-based games (Eichenbaum et al., 2015).

In addition, games in the MMORPG genre have often been found to be associated with GD symptoms (King et al., 2019; Rehbein et al., 2021), but associations have also repeatedly been reported in relation to first-person shooter games (FPS) and Multiplayer Online Battle Arena (MOBA) games (Rehbein et al., 2021). These three genres were also the most popular genres in the sample in **Paper I,** where we investigated differences between younger (ages ≤25; n = 35) and older (ages >25; n =34) individuals seeking treatment for GD (see **Figure 8**). The most common games played were MMORPG, followed by FPS and MOBA. In addition, we found two differences between the age groups, where FPS were more common in the younger group and mobile games were more popular in the older group.

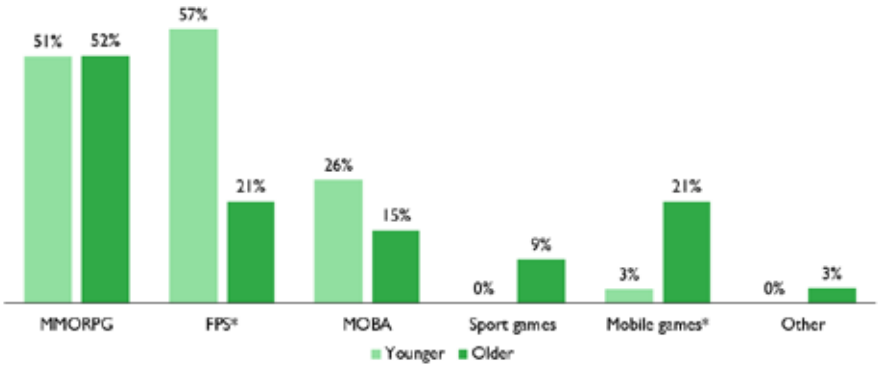

Figure 8 Most played genres in the younger and older age groups from **Paper I**. Genres reported as the most played in the clinical sample included in **Paper I**, with the games preferred by the younger participants (ages ≤25; n = 35) in light green, and by the older participants (ages >25; n =34) in dark green. Each participant could indicate more than one game. Games were classified in genres based on information from gaming platforms and internet forums. Significant differences (*) between the age groups were identified regarding FPS games that were more common among the younger, and Mobile games that were more popular in the older group. MMORPG = Massively Multiplayer Online Role-Playing Game; FPS = First-person shooter; MOBA = Multiplayer Online Battle Arena.

Several researchers have commented that in recent years, genres have tended to both diversify and blend, making it harder to use specific genres as distinct categories in research (André et al., 2024; King et al., 2019; Starosta et al., 2024). An alternative to genres could be to investigate structural characteristics of games (Saini et al., 2024). These characteristics could possibly also provide more meaningful explanations, since it is not the genre *per se*, but specific structural mechanics that are potentially addictive (King et al., 2019). Some examples could be a lack of endings, reward systems and monetization schemes or requirements of social interaction and co-operation (King et al., 2019; Rehbein et al., 2024; Saini et al., 2024). A recent study tested a taxonomy of game features suggested by King et al. (2010) using factor analysis, finding three primary factors; *social*, *control* and *reward*, where reward features and social aspects were found to be associated with GD (Carmona et al., 2025). Another flexible approach to categorize games could be to use tags assigned to games on gaming platforms, hence relying on the gaming community to assign these labels (Li & Zhang, 2020; Starosta et al., 2024). Yet another proposal is to categorize games depending on how they are played and financed, as suggested by André et al. (2024). Their study showed a statistical trend towards higher levels of GD symptoms among gamers playing casual, competitive and free-to-play games.

All in all, despite the difficulties of classifying games in a uniform manner, evidence indicates that games differ in their association with GD, probably due to differences in addictive potential, although the lack of longitudinal data limits conclusions about causality (Rehbein et al., 2021). Some game-features that seem to be particularly strongly associated with GD include online play, real-time gameplay, lack of a defined ending, requirements for social interaction, and reward and monetization systems that favor continuous playing (King et al., 2019; Lemmens & Hendriks, 2016; Montag et al., 2021; Saini et al., 2024). These features also apply, to a large extent, to the genres most strongly linked to GD (Saini et al., 2024). Interestingly, research also shows that some of the most popular games, such as puzzle or action games only have weak associations with GD (Lemmens & Hendriks, 2016), suggesting that the factors that make games popular does not fully explain their addictive potential.

MOTIVES FOR GAMING

The motives behind our actions are, together with the probability of success and the anticipated reward, key determinants of how frequent we will engage in a specific behavior (McClelland, 1985). Motives are therefore highly relevant in research into addictive disorders. The value of examining motives in addiction research has been demonstrated, for example, in studies of drinking patterns among young people, where variations in drinking motives have been shown to relate to frequency and amount of drinking (Kuntsche et al., 2005).

A broad variation of motives for gaming in general have been identified, including social motives, recreation, competitiveness and emotional coping (often labelled as "Escape motives") (Bäcklund et al., 2022; Demetrovics et al., 2011; Király et al., 2022a). Of these, some motives are especially common among individuals with GD.

The use of gaming for emotional escape has consistently been identified as the motive most strongly associated with GD (Bäcklund et al., 2022; Castro & Neto, 2025; Király et al., 2022a; Slack et al., 2022). Escapism has also been shown to mediate both the correlation between depressive symptoms and GD symptoms (Bäcklund et al., 2026; Király et al., 2022a), and the association between inattentive ADHD symptoms and GD (Koncz et al., 2024), suggesting that gaming in these cases functions as a maladaptive coping mechanism. However, as described above in relation to diagnostic criteria, the escape motive has low discriminatory value for GD diagnosis (Bäcklund et al., 2024b; Castro-Calvo et al., 2021), as escapist motives for gaming are also common among non-problematic gamers. It has therefore been suggested distinguishing between more adaptive and maladaptive forms of escapism may be more useful (Giardina et al., 2024), for example by differentiating escapist motives involving self-enhancing aspects such as mastery and positive affect from motives characterized by attempts to suppress or avoid negative emotions (Stenseng et al., 2021).

Gaming for competitive reasons is also among the motivations most strongly associated with GD-symptoms (Bäcklund et al., 2022; Wischert-Zielke & Barke, 2023). This aligns with findings that GD is overrepresented among esport players (Maldonado-Murciano et al., 2022). Social factors are also associated with GD, although not all types of social motives appear to play a role. For example, enjoying hanging out together in-game and engaging in teamwork are not associated with GD (Bäcklund et al., 2022). In contrast,

socializing in-game to compensate for feelings of loneliness might be one example of social motives that heightens the risk for GD (Yue et al., 2026).

Motivations for gaming have been suggested to be useful in treatment planning, as they could possibly be used to guide individual choices of alternate activities to replace time spent gaming (Steadman, 2019).

NEUROBIOLOGICAL FINDINGS IN RELATION TO GAMING DISORDER

Neurobiological studies have been conducted to compare the activity and connectivity of different brain regions among individuals with GD compared to healthy controls. Results indicate differences in brain areas related to reward processing, executive functions, and emotional regulation (Weinstein & Lejoyeux, 2020; Zheng et al., 2025), see **Figure 9**.

The brain reward system has been suggested to play an important role in addictive behaviors (Blum et al., 2000; Wise, 2002). The mesolimbic dopamine system is an important part of the reward system, and includes the ventral tegmental area (VTA), the nucleus accumbens (NAc), the amygdala, and the orbitofrontal cortex (OFC) (Wise, 2002; Zheng et al., 2025). Findings include increased volume of the NAc in individuals with GD compared to healthy controls, and that the connectivity between the NAc and other brain regions differ from healthy controls (Zheng et al., 2025). Studies have also shown an enhanced sensitivity to wins, with individuals with GD exhibiting increased OFC activity during winning outcomes (Fauth-Bühler & Mann, 2017). Gaming cues have also been shown to elicit an increased reaction in the mesocorticolimbic regions, presenting a possible neurobiological basis for urges to engage in gaming (Fauth-Bühler & Mann, 2017).

A variant of the dopamine D2 gene (the Taq1A1 allele), associated with fewer DRD2 receptors in the striatum, has also been shown to be more common among subjects with excessive videogaming compared to controls (Han et al., 2007). This aligns with the proposed reward-deficiency syndrome described by Blum et al. (2000), suggesting that individuals with lower dopamine levels due to dysfunctions in the dopamine system are more susceptible to addictive, impulsive and compulsive behavior because of how these behaviors activate the dopamine system.

Additionally, it has been shown for other addictions that, after having experienced a rewarding effect from a behavior or a drug, dopamine levels rise already at a signal that the reward is coming but *before* it has actually arrived (Wise, 2002). It has thus been suggested that dopamine might be more central for the motivation or urge to repeat the addictive behavior, than for the rewarding effects experienced during substance intake or engagement in an addictive activity (Wise, 2002).

Executive functions, i.e., abilities to exert cognitive control over one's behavior enabling goal-directed behavior, are primarily dependent on prefrontal brain regions and their associated brain circuits (Friedman & Robbins, 2022; Menon & D'Esposito, 2022). Alterations among individuals with GD have mainly been detected in the anterior cingulate cortex (ACC) and the dorsolateral prefrontal cortex (DLPFC). Findings include decreased connectivity in both areas (Zheng et al., 2025), lower densities of grey and white matter in the ACC (Weinstein & Lejoyeux, 2020; Zheng et al., 2025), and reduced grey matter volume in the DLPFC (Weinstein & Lejoyeux, 2020). When engaging in tasks that require the ability to inhibit a response, increased activity has been identified for individuals with GD although the level of correct responses have been equal to healthy controls, which has been interpreted as a sign of impaired function of the prefrontal cortex (Fauth-Bühler & Mann, 2017).

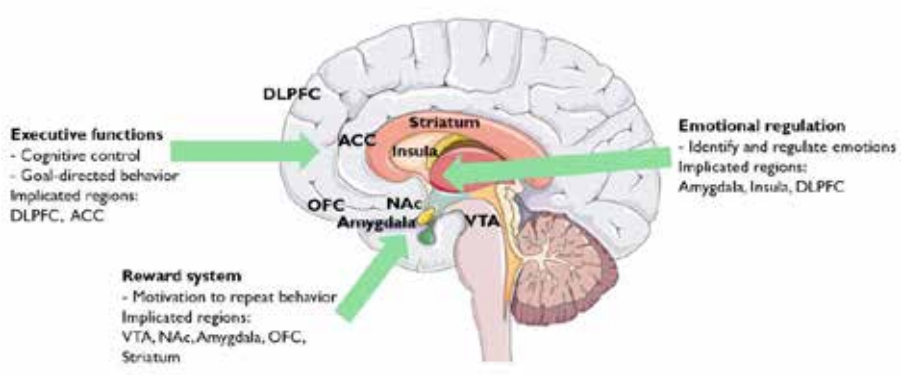

Figure 9 Brain regions associated with GD in neurobiological studies. Arrows point in the direction of areas implicated in the respective brain function. Listed implicated regions refer to the brain regions that have been identified as associated with GD. DLPFC = Dorsolateral prefrontal cortex, ACC = Anterior cingulate cortex, OFC = Orbitofrontal cortex, NAc = Nucleus accumbens, VTA = Ventral tegmental area.
Picture adapted from Servier Medical Art (https://smart.servier.com), licensed under CC BY 4.0 (https://creativecommons.org/licenses/by/4.0/).

The ability to regulate emotions relies on several brain structures, including the amygdala and the insula (Zheng et al., 2025). Higher cerebral blood flow has been identified both in the insula and the amygdala in individuals with GD, and both the amygdala and the left insula show reduced functional connectivity with the left DLPFC, a brain area responsible for the reappraisal of emotions (Zheng et al., 2025). Both the amygdala and the insula have also been shown to have reduced grey matter volume in GD (Weinstein & Lejoyeux, 2020).

In conclusion, it should be noted that many neurobiological studies are limited by small samples and heterogeneous inclusion criteria. In addition, the influence of comorbidities is often unclear, and contradictory results are not uncommon (Fauth-Bühler & Mann, 2017; Zheng et al., 2025), making the evidence weak. Further, most studies are cross-sectional (Zheng et al., 2025), preventing conclusions about causality. Moreover, recent neuroscience research stresses that identification of aberrations in specific brain areas is not the way forward, but rather to identify how different parts of the brain work together in large-scale functional networks (Menon, 2020; Menon & D'Esposito, 2022). In addition, aberrations in those brain networks have often been shown to result in transdiagnostic impairments, and not necessarily disease-specific impairments.

COGNITION IN RELATION TO GAMING DISORDER

Cognitive aspects of GD have also been examined, with studies identifying impairments across several domains. A meta-analysis of 40 studies with individuals with problematic internet use, but no separate analysis for GD, identified impairments regarding inhibitory abilities, decision-making and working memory (Ioannidis et al., 2019). Response inhibition has however also been experimentally investigated specifically in GD, corroborating impairments in response inhibition specifically in GD (Argyriou et al., 2017).

It is, however, not certain that laboratory findings about behavioral control translate directly into behavior in real-world situations. Interestingly, a recent study found no association between behavioral control measured in laboratory settings and perceived control or moments of impaired control over gaming in real-life situations (Knorr et al., 2026). However, higher momentary craving for gaming in real-life settings predicted perceived difficulties to control gaming, which in turn predicted moments of impaired control over gaming

(e.g. playing more than intended). Still, there was no direct link between craving and impaired control, indicating a unique contribution of inhibitory control on subsequent gaming.

Regarding decision making, findings suggest that individuals with GD may be more willing to make risky decisions in situations where potential gains are expected (Chung et al., 2021). In addition, and somewhat related to decision making, results also indicate that individuals with GD exhibit an attentional bias for gaming cues, that is, a tendency to preferentially and automatically attend to gaming-related stimuli (Chia & Zhang, 2020).

THEORETICAL MODELS EXPLAINING GAMING DISORDER

Research on factors associated with GD, including both risk and maintaining factors, has been summarized in a few different theoretical models. It has been suggested that GD can be understood from a cognitive-behavioral perspective (Dong & Potenza, 2014; King & Delfabbro, 2014), as a result of compensatory use of gaming (Kardefelt-Winther, 2014a), or as the result of an interaction between individual predisposing factors, cognitive, affective, and executive functions (Brand et al., 2025; Brand et al., 2019b; Brand et al., 2016).

King and Delfabbro (2014) suggested a *cognitive model* with four overarching factors underlying GD. The model posits that GD can be understood as the result of an overvaluation of game rewards, inflexible and maladaptive rules about gaming, gaming-based self-esteem and the use of gaming to achieve social acceptance. Relatedly, Dong and Potenza (2014) proposed a *cognitive-behavioral model* where the motivation and craving for gaming results from reward-seeking and efforts to relieve stress in combination with diminished cognitive control over these motivational drives.

In a critique of labelling excessive internet use, including gaming, as a mental disorder, Kardefelt-Winther (2014a) proposed a *model of compensatory internet use*. According to this model, excessive gaming is the result of an effort to fulfill un-met needs in real life, for example playing social online games to compensate for loneliness. This aligns with the use of self-determination theory to explain motivations for gaming, i.e., that the appeal of gaming is rooted in its ability to fulfill basic psychological needs of

competence, autonomy, and relatedness (Mills & Allen, 2020; Przybylski et al., 2010; Ryan et al., 2006).

One of the currently most cited theoretical models of GD is the *Interaction of Person-Affect-Cognition-Execution* (I-PACE) model (Brand et al., 2025; Brand et al., 2019b; Brand et al., 2016). As the name implies, the I-PACE model incorporates the above-mentioned models of cognition and motives, into a larger model that describes the development of an addiction. According to the I-PACE model, GD develops and is maintained through interactions between *predisposing variables* in the individual (e.g., genetics, early life experiences or specific motives for playing video games), *affective and cognitive responses* to gaming related stimuli, and *(diminished) executive functions*. The I-PACE model is not specifically developed for GD but is designed to be valid for different types of behavioral addictions and visualizes how the mechanisms underlying a behavior change from early to later stages of the addiction process. A simplified version of the I-PACE model, developed for psychoeducational purposes in the treatment manual for GD evaluated in **Paper III-IV**, is presented in **Figure 10**.

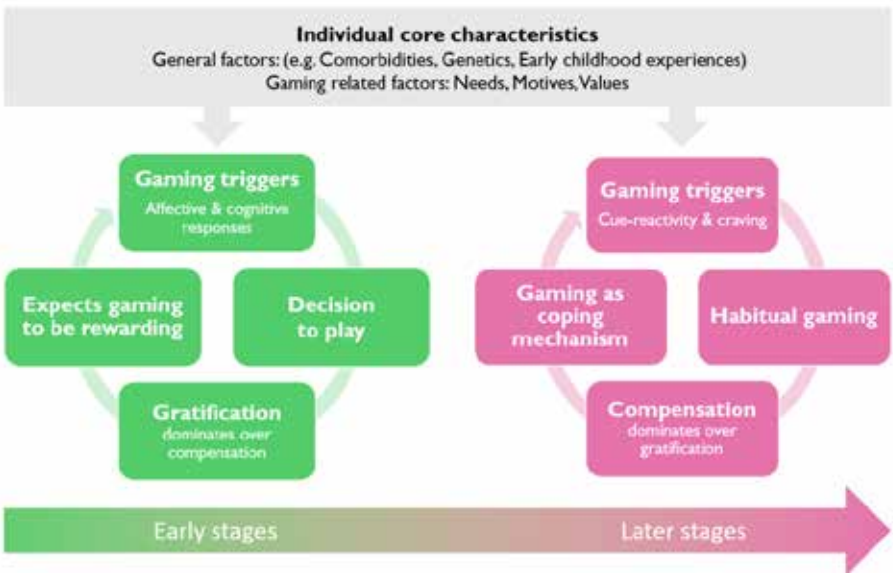

Figure 10 Simplified model of the development of GD, based on the I-PACE model presented by Brand et al, (2016, 2019, 2025). The green circle at the left shows the process in early stages of the addiction process, and the pink circle to the right shows the process in later stages of addiction.

The upper part of the I-PACE model describes core characteristics of the individual that may increase vulnerability to develop GD. It includes factors that in some parts are more permanent, and some are also general vulnerability factors for many types of psychiatric disorders. According to the I-PACE model, an individual may develop increased attention to gaming-related cues or triggers already in the early stages of the development of GD (illustrated in the green circle to the left in **Figure 10**), and experience urges to play video games when exposed to such triggers. This is followed by decisions to play, which may be partly impulsive, influenced by permissive thoughts, and overall affected by general inhibitory control. In the early stages, gratifying experiences are hypothesized to be the predominating effect of gaming, although compensatory effects (e.g., alleviation of negative mood) also can play a part. This process, over time, builds and strengthens expectancies that gaming is rewarding, gradually increasing urges to play when confronted by gaming triggers.

In later stages of GD (the pink circle to the right in **Figure 10**), cue-reactivity has developed, i.e., that many previously neutral stimuli have been associated with gaming and elicit a strong desire or craving for gaming. At this stage, gaming might be experienced as seemingly automatic because of reduced self-control, and after having repeatedly responded with a specific behavior i.e., gaming in specific situations. In these later stages, compensatory effects of gaming are proposed to dominate over gratifying experiences, and gaming becomes a dominating and increasingly inflexible coping mechanism. Overall, this process results in decreased control over gaming and increasing negative consequences in daily life.

COMPLEMENTING THEORETICAL MODELS WITH QUALITATIVE DATA

The I-PACE model is mainly based on quantitative studies, that in turn often are based on theoretical models from substance use disorders. This entails a risk of confirmation bias and a risk of missing aspects that might not align with substance use disorder paradigms (Aarseth et al., 2017). Surprisingly few studies about GD are conducted with qualitative methods, although these methods allow for more explorative research well-suited for a new research area.

The interview study presented in **Paper II** aimed to complement existing research by qualitatively investigating factors reported by patients with GD as contributing to maintaining excessive gaming. Twelve patients seeking treatment for problematic gaming, all diagnosed with GD, were interviewed and data was analyzed using thematic analysis.

The analysis resulted in thirteen subthemes, organized under five main themes, encompassing game-related factors, individual factors, and aspects related to life outside gaming that contributed to maintaining GD (see **Figure 11**). Several identified themes in **Paper II** align with and strengthen the I-PACE model. The participants reported still deriving rewarding experiences from gaming (the main theme Enjoying the game), even though all fulfilled a GD diagnosis and simultaneously experienced significant negative consequences from gaming. They also described feelings of being controlled by the game, similar to the seemingly automatic behaviors described in later stages in the I-PACE model. Furthermore, the impact of individual vulnerabilities and the use of gaming as a coping mechanism to manage or escape difficult emotions were described by the participants. Few participants explicitly linked psychiatric comorbidities to their use of gaming as a coping strategy. However, the widespread occurrence of psychiatric comorbidities in GD (as illustrated, for example, in **Paper I**) may constitute an important aspect of these individual vulnerabilities, potentially contributing to the maladaptive use of gaming.

Figure 11 Main themes and subthemes from **Paper II**, with subthemes complementing the I-PACE model highlighted in pink.

The interview study also identified additional maintaining factors that are not explicitly highlighted in the I-PACE model but may be important to consider to develop effective treatments for GD. Participants described how substantial investments in becoming competent and successful gamers contributed to continued engagement in gaming. The importance of gaming to fulfill basic human needs is covered to some extent in the I-PACE model, particularly through predisposing core characteristics and gaming motives. These factors may however be important to investigate further to get a more comprehensive understanding of the specific dynamics underlying GD.

Aspects of the games also appeared as important maintaining factors. Particularly the lack of clear endings and the constant possibilities for progress made it difficult to limit time spent gaming. Moreover, most participants described how empty time was an important factor for initiation of gaming and continued excessive use. In addition, life outside gaming and previously highly valued activities had become less interesting over time, making it harder for those activities to compete with gaming.

Hence, for a more complete understanding of how GD is maintained, and as a basis for treatment interventions, it is proposed that the I-PACE model more explicitly is placed in the context of the environment of the individual gamer (as illustrated in **Figure 12**). The I-PACE model explicitly concentrates on people's reactions, and consequences thereof, to describe how behavioral addictions are developed and maintained but does not integrate factors related to the environment. However, environmental issues might be especially important in GD, as individuals with GD typically spend a substantial part of their days on gaming (**Paper III**).

The participants in **Paper II** described empty time as contributing to their amount of time spent gaming. However, increasing amounts of empty time would also be the result if they cut down on gaming without having new activities as a replacement for gaming. Therefore, aspects of life outside gaming may be important factors to consider both as risk factors, maintaining factors, and factors important to specifically address in treatment to make changes possible and to prevent relapses.

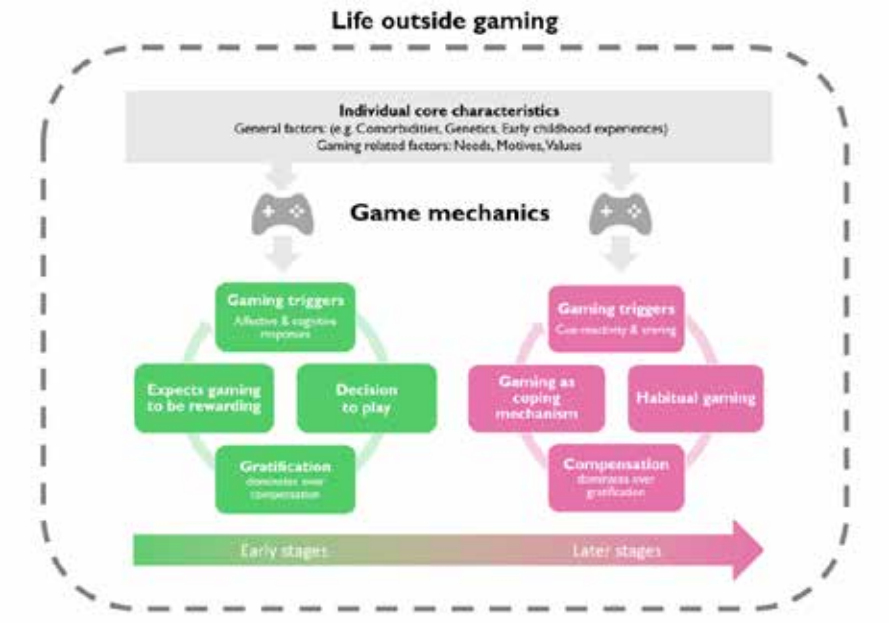

Figure 12 Simplified version of the I-PACE model (Brand et al., 2025; Brand et al., 2019b), situated in the context of life outside gaming, and with the addition of how game mechanics contribute to maintaining GD. The dotted grey line surrounding the I-PACE model is intended to symbolize the importance of situating the inner processes that maintain GD within the context of life outside gaming, which may also contribute to sustaining excessive gaming. Game mechanics are placed between individual core characteristics and the inner processes, to illustrate how game mechanics contribute to maintaining GD, both in their own right and intertwined with individual needs, motives and values.

Aspects of the game mechanics in the particular games an individual plays may also be important to consider as factors that maintain GD. Findings from **Paper II** underscore the importance of game genres and game design. Participants described several factors related to characteristics of the games they played as sustaining excessive gaming. These factors included games being rewarding and fun, providing experiences of focus and flow, incorporating social interactions, lacking clear limits or endings, and offering constant possibilities to progress. Striving to achieve and maintain rankings within the game, and having invested both time, and sometimes money, in the games also made it harder to decrease the among of gaming. Hence game mechanics appear to contribute to excessive gaming both in their own right (e.g., through the

absence of definite endings) and through their interaction with individual needs, motives and values (e.g., via ranking systems that may enhance feelings of accomplishment). This is illustrated by the addition of game mechanics in **Figure 12**. These findings underline the importance of game design and game mechanics for how GD is maintained, and suggest these factors also might be important to integrate into treatment. This is especially important as most patients wish to continue gaming in a controlled manner (**Paper III**), meaning that they will have to implement strategies to handle these game-related aspects to prevent a return to excessive gaming.

SUMMARY

Gaming disorder is proposed to result from addictive elements of video games in combination with individual motives for gaming, neurobiological aberrations affecting cognitive control, reward-processing and emotional regulation, and cognitive aspects such as an attentional bias for gaming cues.

Prevailing theoretical models primarily emphasize intrapersonal processes in explaining the development and maintenance of GD. However, the qualitative data in **Paper II** complement this perspective by highlighting the importance of both game-related factors and the broader life context outside gaming.

TREATMENT FOR GAMING DISORDER

AVAILABLE TREATMENT OPTIONS

Despite the increasing attention on GD, the availability of treatment is still limited and unevenly distributed (King et al., 2022; Kitayuguchi et al., 2025). Standardized treatment guidelines are lacking (Park et al., 2024; Radunz et al., 2025), help-seeking rates are largely unknown (King et al., 2022) and clinicians often have limited knowledge of how to treat GD (Dullur & Hay, 2017).

Treatment studies are though accumulating, and overall, treatments for GD show positive effects on symptom reduction, according to recent meta-analyses (Danielsen et al., 2024; Harpas et al., 2025; Wang et al., 2023). In addition to reductions of GD symptoms, treatment has also been shown to decrease time spent gaming, and reduce comorbid symptoms of anxiety and depression (Harpas et al., 2025; **Paper III**; Stevens et al., 2019; Wang et al., 2023). Improvements have also been shown to be sustained at follow-up three months after treatment (Harpas et al., 2025).

Studied treatments include for example behavioral interventions, psychotherapy (mostly CBT), family therapy, pharmacotherapy, physical exercise, non-invasive brain stimulation, virtual reality therapy and residential treatment camps (Danielsen et al., 2024; Dong et al., 2024; Harpas et al., 2025). The most commonly used pharmacological treatments are bupropion, methylphenidate and selective serotonin reuptake inhibitors (SSRI) (de Sá et al., 2023). Pharmacological interventions have shown significant effects, but most studies are small and only a few studies have been double-blind randomized controlled trials (de Sá et al., 2023). Some reviews suggest that it might be especially effective to combine different types of interventions, for example combining CBT with physical exercise (Núñez-Rodríguez et al., 2025), mindfulness (Kim et al., 2022b) or with pharmacotherapy (Wang et al., 2023).

COGNITIVE-BEHAVIORAL THERAPY

A recent meta-analysis showed that psychotherapeutic interventions had the highest effect size compared to other types of treatments, although the evidence base was judged to be too small to draw firm conclusions about treatment effects and which treatments are most effective (Danielsen et al., 2024). Cognitive-behavioral therapy is the most studied type of psychotherapeutic treatment for GD, and also the overall most studied treatment for GD (Danielsen et al., 2024; Dong et al., 2024; Harpas et al., 2025; Stevens et al., 2019). Results indicate that CBT might be effective in reducing symptoms of GD (Stevens et al., 2019; Wang et al., 2023), although few studies have investigated if these improvements are sustained over time. Some studies show sustained results at follow-up (Wang et al., 2023; **Paper III**), but other results indicate that improvements may diminish over time (Stevens et al., 2019).

EVALUATION OF A NEW TREATMENT MANUAL FOR GAMING DISORDER

The treatment study presented in **Paper III** aimed to contribute to the knowledge base regarding the effect and feasibility of CBT for GD, through a pilot study with 28 participants. Changes in symptom severity were assessed at baseline, post-treatment and a follow-up three months after treatment. The treatment manual used in the study is specifically developed for GD and includes elements from motivational interviewing (MI), and CBT-techniques such as stimulus control, cognitive restructuring and relapse prevention. For each patient, an individual treatment plan is formulated. The plan consists of interventions from the manual selected to address patient-specific needs, as assessed through, for example, situational analyses. Thus, treatment may vary in length, both in terms of the number of interventions included and the number of sessions required to complete these interventions. Treatment goals and interventions across different phases of the program are described in **Table 2**.

Table 2 Interventions included in the cognitive-behavioral therapy (CBT) used in **Paper III** and **Paper IV.**

Treatment phase	Goals	Interventions
Goal setting and psychoeducation	Formulate individual goals for treatment Establish a behavioral baseline Understand the rationale for cognitive-behavioral therapy (CBT)	Formulating specific and measurable goals, identification of valuable gaming time Self-monitoring via gaming diary Psychoeducation about gaming disorder (GD) and CBT
Practice new skills	Learn new skills to manage factors that maintain excessive gaming	Identification of individual triggers through situational analysis and gaming diary Time-management skills Stimulus control strategies Behavioral activation through alternative activities Practicing emotional regulation skills: identifying and managing emotions Cognitive restructuring: identifying and modifying unhelpful thoughts Practice strategies to handle procrastination
Relapse prevention	Formulate plans to maintain changes in treatment	Relapse prevention plan
Optional modules	Strengthen social support from significant others Implement strategies for between-session practice Implement strategies to handle problematic in-game purchases Implement general problem-solving strategies	Family sessions focusing on shared understanding of treatment goals and communication skills Identification of key problems through behavioral chain analysis and situational analysis: formulating individualized strategies based on this analysis Step-by-step problem solving

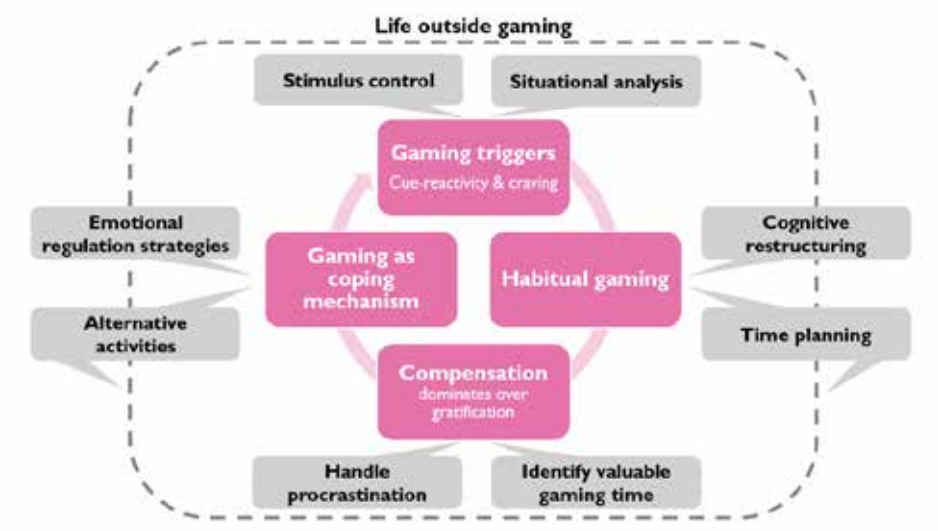

Figure 13 Main parts of the CBT for GD and how they relate to different parts of the I-PACE model (Brand et al., 2025; Brand et al., 2019b) and to "Life outside gaming". Grey boxes describe main parts of the GD treatment evaluated in **Paper III** and **Paper IV**, with arrows pointing at the factors in the I-PACE model (pink boxes) that the interventions mostly aim to target. The interventions "Alternative activities" and "Time planning" target both "Gaming as a coping mechanism" and "Habitual gaming" respectively, and the external factor "Life outside gaming" identified as an additional central maintaining factor in **Paper II**.

The interventions included in the CBT directly relate to the I-PACE model (Brand et al., 2025; Brand et al., 2019b), aiming to target factors that maintain the seemingly habitual gaming behavior, and establish skills that make it possible to engage in gaming in a controlled manner (see **Figure 13**).

Gaming triggers are proposed to be salient for individuals with GD, due to cue-reactivity, and associated with urges for gaming. This is addressed in treatment through stimulus control strategies, by identifying and reducing triggers as well as making it more difficult to start gaming. Situational analysis is also used as a tool to identify triggers and clarify individual patterns that result in excessive gaming. Further, based on situational analyses and stimulus control, habitual gaming is addressed through identification and restructuring of unhelpful thoughts that heighten the risk for problematic gaming. In addition, time planning is implemented to structure and plan activities ahead, to counteract

habitual gaming. Time planning also addresses life outside gaming, making it more predictable, and enables activities outside gaming to be prioritized and included in weekly plans. Compensation is suggested to dominate over gratifying effects of gaming at this stage of addiction. However, as most patients wish to continue gaming in a controlled manner, it is imperative to identify valuable gaming time that should be prioritized and to limit the remaining gaming time. Thus, the treatment aims to contribute to making the preserved gaming time more gratifying. Procrastination has been identified as a common problem among individuals with GD (Yeh et al., 2017). We hypothesize that this might contribute to the compensating effect of gaming and have therefore included strategies to handle procrastination. Finally, the use of gaming as coping mechanism is included in treatment through the implementation of emotional regulation strategies. Planning and practicing alternate activities in line with individual goals and aspirations may also be helpful, as many patients mention that restlessness and empty time is one factor increasing the risk for excessive gaming (**Paper II**). Alternate activities also contribute to making life outside gaming more meaningful and thereby providing an alternative to gaming. During treatment, patients are also encouraged to identify aspects of the games they play that make it especially difficult to control the amount of gaming, to either limit these aspects or make other plans on how to handle them, hence addressing how game mechanics and game design contribute to maintaining excessive gaming.

The study presented in **Paper III** showed that symptoms of GD decreased significantly between baseline and the three-month follow-up. Time spent gaming per week also decreased during treatment, from a mean of 52 hours per week to 20 hours per week at the end of treatment. We also identified concurrent significant improvements in measures of anxiety, depression and procrastination. Overall, this study aligns with and adds to the evidence base from previous studies showing CBT to be a promising treatment option for GD (Stevens et al., 2019; Wang et al., 2023).

Although research about treatment for GD is accumulating, the strength of the evidence is still weak, due to the design and execution of existing studies. Some of the weaknesses include that most studies are small with weak statistical power, incomplete reporting and that few studies have preregistered protocols (Danielsen et al., 2024). There is also a lack of standardization regarding symptom measures, making comparisons between studies difficult (Danielsen et al., 2024; Stevens et al., 2019). Encouragingly, study quality has

improved during recent years (Svendsen et al., 2026), although standardized assessment is still lacking and longer follow-ups are needed.

The aim of the study presented as a protocol in **Paper IV** is to contribute to the research field with a study that fulfils many of the quality requirements that have been missing in previous treatment studies. **Paper IV** builds on the results from **Paper III** and describes the protocol for a preregistered randomized controlled treatment study examining the effect of the manualized module-based CBT for GD tested in the pilot study (**Paper III**). The sample size, n = 128, in **Paper IV** is calculated using data about symptom reductions from **Paper III**. The design of the RCT study, including choice of control group and measurements are discussed more in detail below, in the section Methodological consideration. **Figure 14** shows a flow diagram of the study design.

RECOVERY FROM GAMING DISORDER

Most research studies about GD measure and define recovery merely as a reduction in symptoms (Gavriel-Fried et al., 2023). However, recovery might entail a much broader set of changes. When defining recovery, it is also important to take into account that for the majority of individuals recovering from GD, the goal is not abstinence but rather to continue gaming in a more controlled manner (Quinney et al., 2026; **Paper III**). Interestingly, a recent study suggests that identification as a gamer may complicate controlled gaming, as those engaging in reduced gaming experienced more gaming-related nostalgia and a lower recovery motivation than those recovering through abstinence (Quinney et al., 2026). The complexity of GD is further highlighted by the multitude of internal and external factors that maintain excessive gaming (**Paper II**), and that psychiatric comorbidity is common in clinical samples (**Paper I**). This calls for a broad treatment approach, that also addresses areas of life beyond gaming.

A possible starting point for defining the concept of recovery could be to investigate the reasons why patients seek treatment for GD. In a qualitative study, Karhulahti et al. (2023), identified 29 specific treatment expectations including, but not limited to, wishes of regaining meaning both in life and in gaming, to improve social relations and to ameliorate occupational, health-related and financial harms caused by gaming. The broad range of treatment

expectations calls for a holistic view of recovery from GD, covering more aspects than only decreases in fulfilment of diagnostic criteria. To some extent, this need is met in the ongoing RCT (**Paper IV**) where outcome measures after treatment include both psychiatric comorbidities, somatic symptoms, emotional regulation capabilities, quality of life and motives for gaming, in addition to symptoms of GD.

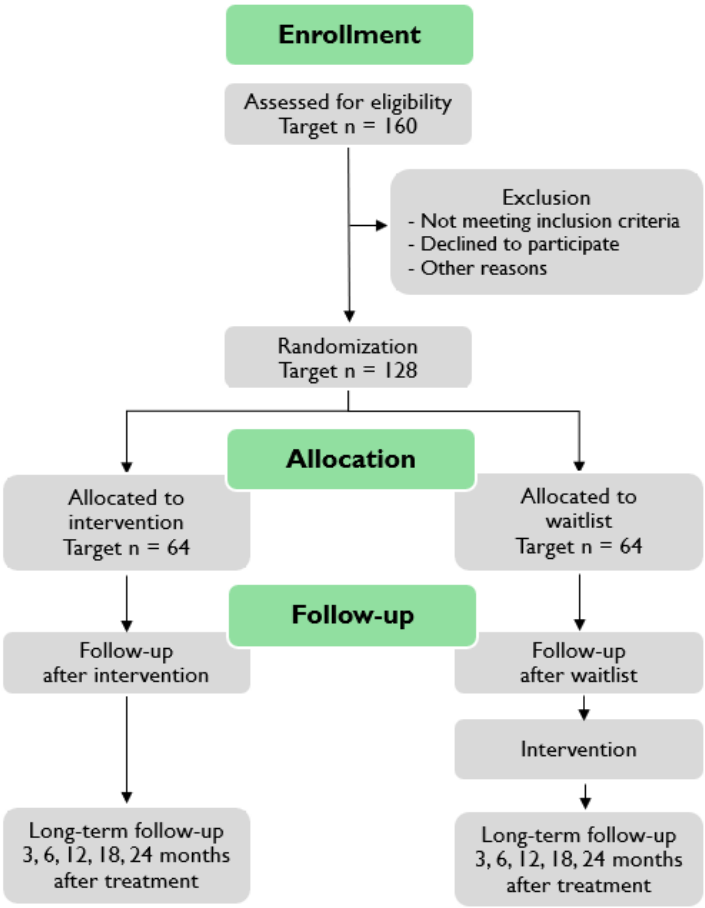

Figure 14 Flow diagram of the randomized controlled trial (RCT) described in **Paper IV**, comparing cognitive-behavioral therapy (CBT) with a waitlist control condition.

SUMMARY

The quality of treatment studies for GD has improved over the past decades (Svendsen et al., 2026), providing increasing evidence for treatment effects. Cognitive-behavioral therapy has the largest evidence base (Dong et al., 2024), but there is still a lack of larger studies with adequate samples sizes, thoroughly described interventions, and longer follow-up periods, resulting in difficulties to draw conclusions about treatment effects (Danielsen et al., 2024).

Paper III presents data showing significant symptom reductions after CBT. That study also provided data to calculate sample size for **Paper IV** which describes the protocol for an ongoing larger randomized controlled trial with planned follow-up two years after treatment. Together these studies contribute to the evidence base about the effectiveness of CBT treatment for GD. In particular, the larger ongoing RCT will add valuable data about treatment effects in a larger controlled sample.

5.

5. METHODOLOGICAL CONSIDERATIONS

This thesis consists of studies using both quantitative and qualitative methodology, including both studies with cross-sectional data and pre-post-tests. An overview of aims, design and assessment methods are presented in **Table 3** on the following page.

STUDY SETTING

All the studies included in the thesis were conducted at the outpatient clinic *Mottagning för spelberoende och skärmhälsa* at Sahlgrenska University Hospital, Gothenburg, Sweden. The clinic is a specialized unit providing treatment of gaming disorder and gambling disorder. Although the clinic is regionally funded, it accepts referrals from all parts of Sweden for individuals aged 16 with no upper age limit. Referrals may originate from other healthcare services or be self-referrals, the latter constituting the majority.

The clinical staff consists of psychologists providing CBT and a clinical social worker responsible for coordination with external services and community resources, as well as for offering family sessions for patients and their significant others. Both professions conduct intake assessments, which are discussed at treatment conferences prior to the formulation of individual treatment plans.

Treatment offered at the clinic is based on CBT and is delivered either on site or via video conferencing, in individual or group formats.

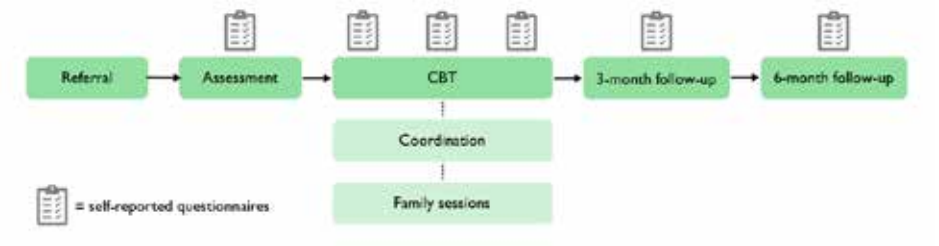

Figure 15 Schematics of the routine treatment process at the study setting. Light green boxes refer to optional coordination and family sessions, provided based on individual needs.

Table 3 Overview of methodology used in the studies presented in Papers I-IV

Paper	**I**	**II**	**III**	**IV**
Data collection (years)	2020-2024	2021-2022	2020-2023	2025 – (ongoing)
Participants	n=69 (n=35 AYA; n=36 adults)	n=12	n=28	n=128; (n=64 intervention; n=64 waitlist)
Aim	Compare symptoms and progression into GD between younger and older patients.	Explore factors maintaining excessive gaming, as experienced by GD-patients.	Evaluate changes in GD-symptoms after CBT.	Evaluate the effectiveness of CBT for GD.
Design	Cross-sectional study with between-group analysis	Qualitative interview study	Uncontrolled treatment study with pre- and post-measures	Randomized controlled trial
Assessment methods	Diagnostic interview GAIT GD-TLFB PHQ-9 GAD-7 ASRS Screener RAADS-14 DERS-16 BBQ NODS-PERC AUDIT DUDIT	Semi-structured interview guide	GAIT GD-TLFB PHQ-9 GAD-7 ASRS Screener RAADS-14 DERS-16 BBQ NODS-PERC PPS AUDIT DUDIT	Diagnostic interview IGDS9-SF GDT GD-TLFB MOGQ-14 PHQ-9 GAD-7 ASRS Screener RAADS-14 DERS-16 BBQ NODS-PERC AUDIT DUDIT NEQ
Analysis (test/ method)	Fisher's exact test Two-tailed *t*-test ANCOVA Cohen's d Odds ratios	Thematic analysis	Mixed-effects models fitted with maximum likelihood estimation Cohen's d	ANCOVA, adjusted for baseline values Multiple imputation using predictive mean matching
Results	AYAs had a more rapid progression into GD, but both age groups reported similar symptoms of GD and psychiatric comorbidities.	Structural game characteristics, reduced self-control, and satisfaction of basic human needs contribute to the maintenance of GD.	Symptoms of GD decreased following treatment and remained reduced at the three-month follow-up.	Results comparing active treatment and waitlist control will be reported after RCT completion.

Note: GD = Gaming Disorder; AYA = Adolescents and young adults; CBT = Cognitive Behavioral Therapy; GAIT = Gaming Addiction Identification Test (Vadlin et al., 2015); GD-TLFB = Gaming Disorder Timeline Followback (Hodgins & Makarchuk, 2003a) PHQ-9 =The Patient Health Questionnaire (Kroenke et al., 2001); GAD-7 = Generalised Anxiety Disorder Assessment (Spitzer et al., 2006); ASRS Screener = the World Health Organization Adult ADHD Self-Report Scale, V1.1 Screener (Kessler et al., 2005); RAADS-14 = Ritvo Autism and Asperger Diagnostic Scale Screen (Eriksson et al., 2013); DERS-16 = Difficulties in Emotion Regulation Scale, brief version (Bjureberg et al., 2016); BBQ = The Brunnsviken Brief Quality of Life Scale (Lindner et al., 2016); NODS-PERC = National Opinion Research Center DSM-IV Screen for Gambling (Wickwire et al., 2008); AUDIT = The Alcohol Use Disorders Identification Test (Bergman & Källmén, 2002); DUDIT = The Drug Use Disorers Identification Test (Berman et al., 2005); PPS = The Pure Procrastination Scale (Rozental et al., 2014); IGDS9-SF = Internet Gaming Disorder Scale – Short Form (Pontes & Griffiths, 2015); GDT = Gaming Disorder Test (Pontes et al., 2021); MOGQ-14 = Motives for Online Gaming Questionnaire, 14-item version (Bäcklund et al., 2024a); NEQ = The Negative Effects Questionnaire The Negative Effects Questionnaire (Rozental et al., 2016); ANCOVA = Analysis of Covariance; RCT = Randomized Controlled Trial

STUDY PARTICIPANTS

All study participants in **Paper I-III** were patients seeking treatment for GD and fulfilling diagnostic criteria for GD based on a semi-structured diagnostic interview. All participants had been referred to the clinic either from primary care, specialized psychiatric care or sought treatment at the clinic via self-referral. These recruitment methods and criteria for inclusion mean that all studies are based on clinical samples, making the findings relevant and transferable to patients seeking treatment for GD in general. The possibilities to generalize the findings to other clinical populations are strengthened by the inclusion of patients with GD in combination with other co-occurring psychiatric symptoms, as comorbidity has been shown to be common in GD (Coutelle et al., 2024; González-Bueso et al., 2018).

Conversely, it is not certain that the findings are representative of individuals in the general population fulfilling criteria for GD. It is possible that a treatment seeking population differs in some respects from those not seeking treatment. Possible differences could for example pertain to age differences, especially as a higher percentage of our participants were adults compared to what is usually identified in population-based prevalence studies (Kim et al., 2022a; Stevens et al., 2021). Likewise, our sample contained fewer women than could be expected based on the gender distribution of GD in prevalence studies (Kim et al., 2022a; Stevens et al., 2021). In addition to demographic differences, it is

also possible that those seeking treatment differ from others with GD in for example motivations, games being played and other variables, that could affect results from the study comparing younger and older patients with GD (**Paper I**) or the maintaining factors reported in **Paper II**.

DESIGNING A RANDOMIZED CONTROLLED STUDY

Randomized controlled trials are considered to be one of the methodologies that provide the strongest evidence for treatment effects, as the randomization to intervention or control condition makes it possible to draw conclusions about casual effects of treatments (Harrer et al., 2023). The participants in our uncontrolled treatment study (**Paper III**) showed significant reductions in GD-symptoms after treatment, but without a control condition it is not possible to draw certain conclusions on whether this reduction was caused by the treatment or other factors unrelated to treatment. It is for example possible that patients seeking treatment already are so motivated to change their behavior that they would have achieved those changes even if they had not received treatment. Therefore, following the promising results in **Paper III**, a RCT was designed to investigate the effectiveness of the newly developed CBT (the patient workbook used in the CBT is shown in **Figure 15**).

Randomized controlled trials of GD are accumulating, including RCTs evaluating the effect of CBT. However, there are still major weaknesses in existing research (Danielsen et al., 2024), similar to what often has been observed regarding RCTs in mental health research overall (Harrer et al., 2023), resulting in difficulties to determine the effects of treatments for GD (Danielsen et al., 2024). For an overview of design aspects of the RCT described in **Paper IV**, in relation to common weaknesses in previous research, please refer to **Table 4** and the flow diagram in **Figure 14**. Some of the main contributions of our RCT relate to the size of the study, the choice of main outcome measures and a long-term follow-up.

The RCT, that is currently ongoing, will be one of the largest controlled treatment studies for GD so far, if the target number of 128 randomized participants is met. With a few exceptions (André et al., 2023; Han et al., 2020; Pornnoppadol et al., 2020; Song et al., 2016), most controlled treatment studies to date have included less than 100 participants (Harpas et al., 2025). Because of the smaller samples, the statistical power has been weak, and in addition

often not calculated in advance (Chen et al., 2023; Danielsen et al., 2024; Zajac et al., 2020). The power calculation for this RCT is based on results from **Paper III**, from which we have extracted data from items corresponding to the items in a DMS-5 based measure of GD, the IGDS9-SF (Pontes & Griffiths, 2015). Sample size has been chosen to allow for a power of 0.80 to identify a clinically significant change in symptom scores.

We have also made changes in outcome measures from **Paper III** to **Paper IV**, to harmonize the main outcome measures with DSM and ICD-criteria. Previous studies have used inconsistent diagnostic approaches, making comparisons between studies difficult (Chen et al., 2023; Danielsen et al., 2024; Harpas et al., 2025; Stevens et al., 2019; Wang et al., 2023). In this study we are using well-validated symptom measures corresponding to both diagnostic systems. In addition to making comparisons with other studies easier, this will also add information about how these two measures captures changes in treatment, as the questionnaires mostly have been used and validated in non-clinical samples (King et al., 2020).

The planned long-term follow-up, up to 24 months after treatment, will also add valuable information, as follow-up often is limited to a few months after treatment (Harpas et al., 2025; Stevens et al., 2019; Wang et al., 2023).

Figure 16 The CBT manual in Paper III and IV; the picture shows the patient workbook.

Table 4 Design aspects of the RCT, in relation to common weaknesses in previous research

Design aspect	Common weaknesses	Design in Paper IV
Study size	Small studies with inadequate statistical power (Chen et al., 2023; Danielsen et al., 2024; Harpas et al., 2025; Zajac et al., 2020).	Sample size decided based on power calculations using data from Paper III. Estimated sample size n = 128.
Inclusion criteria	Participants with co-occurring disorders are often excluded, despite comorbidity being common in GD (Dong et al., 2024; Kim et al., 2022a). Previous research often includes samples with general internet addiction and GD, and not exclusively participants with gaming as their main problem (Harpas et al., 2025). In addition, subclinical cases are sometimes included (Harpas et al., 2025). Many studies exclude adults and/or females (Harpas et al., 2025)	Participants with psychiatric comorbidities are included in the study, and comorbidities are measured with validated questionnaires. Clinical GD diagnosis required for inclusion, validated by a semi-structured diagnostic interview. Includes teenagers from age 15 and the study has no upper age limit. No exclusion is made based on gender.
Randomization	Non-stringent randomization (Danielsen et al., 2024; Zajac et al., 2020) and still few randomized controlled trials (Kim et al., 2022a).	RCT with an allocation ratio of 1:1 to intervention or waitlist control condition. The study uses a computer-generated random numbers randomization. The randomization sequence is concealed using opaque envelopes and opened when all assessments before treatment are completed, leaving little room to influence randomization.

Intervention	Descriptions of interventions and fidelity checks are lacking (Dong et al., 2024; Kim et al., 2022a).	A module-based manualized CBT will be used, with a treatment manual for the therapists and a workbook for the participants. Fidelity checks will be made based on documentation about which parts of the manual that have been used in each treatment session.
Comparator	Control conditions have differed between studies, including treatment as usual (TAU), no treatment and waitlist (Danielsen et al., 2024). Especially TAU can hamper comparisons between studies (Gold et al., 2017).	Waitlist control condition. (See the following section for a detailed discussion of the choice of comparator.)
Outcome measures	Non-standardized outcome measures based on inconsistent diagnostic approaches are used, making comparisons between studies difficult (Chen et al., 2023; Danielsen et al., 2024; Harpas et al., 2025; Stevens et al., 2019; Wang et al., 2023)	Validated questionnaires based on both DSM-5 and ICD-11 criteria are used, enabling comparisons with other studies employing either diagnostic approach.
Follow-up	Follow-up is missing or is only conducted a few months after treatment (Harpas et al., 2025; Stevens et al., 2019; Wang et al., 2023)	Planned follow-up 3, 6, 12, 18 and 24 months after treatment.
Open science framework	Few studies use preregistered protocols (Danielsen et al., 2024).	Preregistered protocol (**Paper IV**) and preregistered at Clinicaltrials.gov (NCT05328596). Data available on reasonable request. The final report will be published with open access and written in accordance with the CONSORT guidelines (Hopewell et al., 2025).

Note: RCT = Randomized controlled trial; GD = Gaming Disorder; CBT = Cognitive-Behavioral Therapy; TAU = Treatment as Usual; DSM-5 = Diagnostic and Statistical Manual of Mental Disorders (5th ed.); ICD-11 = International Classification of Diseases, 11th Revision; CONSORT = Consolidated Standards of Reporting Trials.

CHOICE OF CONTROL GROUP

The treatment study presented in **Paper III** was an uncontrolled pilot study, while the ongoing RCT presented in **Paper IV** uses a waitlist control condition. In retrospect, it would have been a good idea to include a control condition also in **Paper III**, as this would have provided better data for our power calculations that decides the sample size in **Paper IV**.

Choosing control conditions in psychological research is a challenge. There is no perfect equivalent to a placebo pill, that allows both the participant and the clinician to be blind to whether an active or inactive treatment is being offered. There are though psychological treatment studies that use various forms of placebo treatments or "sham treatments", but it is for evident reasons not possible to blind a clinician from what type of treatment that is being offered. In addition, it will in most cases also be difficult to blind the participants (Harrer et al., 2023), especially if one of the treatments in the randomization is such a well-known treatment option as CBT. Another challenge is that it can be difficult to analyze in what ways the psychological placebo treatment differs from the active intervention. As these placebo treatments often differ considerably between different studies, they also make comparisons and meta-analysis difficult (Gold et al., 2017; Munder et al., 2022).

Another possibility is to use treatment as usual (TAU) as a control condition. Using TAU is affected by some of the same issues as the placebo treatments, in difficulties of separating the unique content in TAU from the active intervention. In addition, TAU can include different interventions for different participants (Gold et al., 2017). From an ethical perspective though, it is a reasonable choice, as this means that the control group also will receive treatment. In this case though, the clinic offers no other treatment, as GD is a new diagnosis in health care with limited treatment options. Specifically, there is no gold-standard treatment to compare this new treatment with. Hence, the newly developed treatment manual is simultaneously TAU at the clinic. Therefore, using TAU as control condition was not an option in these studies.

The use of a waitlist control is neither a perfect option. Studies using a waitlist control group risk ending up with inflated effect sizes (Cuijpers et al., 2024; Furukawa et al., 2014; Gold et al., 2017). The main reason for this is that patients on a waitlist risk improving less during the waiting period than they would if they were not waiting for treatment. This lack of improvement could for example happen due to a psychological effect of knowing that treatment will come further on and that this can cause participants to postpone solutions

that they would otherwise implement. Participants may also feel that the waitlist period is their last chance of "letting go" and thereby gaming more than ever. On the other hand, a waitlist control condition has the advantage of being a more equal option when used in comparisons between different studies. It is also a cost-effective control condition, which is an important aspect as it is costly to conduct RCTs. Weighing the pros and cons, we therefore decided on a waitlist control condition that will both make the study more feasible to conduct and will hopefully produce results that will be based on conditions more comparable to other studies.

The choice of comparator also has ethical dimensions. For a further analysis of these factors, see the section about Ethical consideration.

HOW TO MEASURE GAMING DISORDER?

Choosing measurements has been a challenging aspect of this doctoral project. Although GD is a newly defined diagnosis, the challenge has not consisted of a scarcity of instruments, rather the opposite. Since the definitions of GD were introduced in DSM-5 and ICD-11, and even based on preliminary definitions before that, a vast array of measuring instruments has been developed, as different research teams have developed new similar instruments to measure the same criteria instead of validating existing instruments. A meta-analysis published in 2020 identified 32 instruments designed to measure GD, with no instrument being clearly superior (King et al., 2020). The lack of consensus on outcome measures clearly hampers comparisons between studies and aggregation of knowledge about GD (Svendsen et al., 2026).

Table 5 shows the different gaming-related instruments we have used in **Paper I-IV**. When choosing symptom measures to use in **Paper I** and **Paper III**, we tried to find instruments already available in Swedish and decided on using the GAIT (Vadlin et al., 2015), as this was the only instrument we found in Swedish at the time. The GAIT was developed before the introduction of IGD in the DSM-5, but the version used in our study was a later adaptation with two additional items resulting in an instrument with items corresponding to all nine IGD-criteria. However, when we re-evaluated our test battery for the RCT (**Paper IV**), we decided to change outcome measures. The main reason was that we wanted to align with previous research in the field, by using the DSM-5 based instrument IGDS9-SF (Pontes & Griffiths, 2015) that is one of the internationally most used instruments for measuring GD-symptoms (King et

al., 2020), thereby making comparisons with other studies easier. We also chose to include GDT (Pontes et al., 2021) covering the ICD-11 criteria, to make results comparable with other studies using either of these diagnostic definitions. In addition, it is still unknown which instrument best covers changes occurring in treatment, as few instruments have been used in clinical studies (King et al., 2020), and criteria suitable for deciding on diagnosis are not necessarily the best instruments to measure treatment responses (Brand et al., 2020). It might be the case that we do not yet have an instrument that covers the most central aspects for measuring treatment response in GD treatments. Development of such an instrument could possibly be an interesting direction for future research. With the chosen instruments, IGDS9-SF and GDT, we will though be able to measure changes in GD symptoms that cover at least a part of the expected changes through treatment. We also validate the GD diagnosis through a semi-structured diagnostic interview based on the DSM-5 criteria. Also in this respect, we lack a validated gold-standard interview guide that could contribute to more equivalent diagnostic assessments.

In addition to symptoms of GD, we also measure time spent gaming via the GD-TLFB. Although decreases in GD symptoms and not decreases in gaming time *per se* is the goal of treatment, it is of course an important additional measure, and for most patients their treatment goals will include decreases in time spent gaming. Since GD is a digital addiction, it could seem close at hand to use a digital, objective measure of gaming time, such as computer logs. However, even these "objective" measures come with problems in terms of for example technical and privacy issues, still making self-reported measures cost-effective in many settings (Pontes & Griffiths, 2026). Complementing symptom and time-based measures, the inclusion of an instrument to assess motives for gaming, the MOGQ-14 (Bäcklund et al., 2024a; Demetrovics et al., 2011), makes it possible to investigate whether motives change during treatment and whether gaming motives affect treatment response.

Overall, a challenge in clinical research is to include instruments that make it possible to answer the central research questions, but still not including so many instruments that it becomes too cumbersome for patients to answer all items. Therefore, the development of shorter instruments, like the MOGQ-14 (Bäcklund et al., 2024a) version of the original 27-item MOGQ (Demetrovics et al., 2011) questionnaire makes it possible to include a wider range of variables in studies like **Paper IV**, which is especially important in a new research field as GD where much still is unknown.

Table 5 Overview of all gaming-related instruments used in studies I-IV.

Measure	Description
Diagnostic interview	*Semi-structured diagnostic interview for gaming disorder* Diagnostic interview guide based on the nine IGD-criteria in DSM-5.
GAIT	*Gaming Addiction Identification Test* (Vadlin et al., 2015). Questionnaire with 17 items covering the nine IGD criteria in DSM-5, and additional items about craving and frequency of gaming. Responses to each item range from "Disagree" to "Completely agree", except for questions about frequency that are answered in hours and frequency of gaming per month or week. Total scores vary from 0 to 60.
IGDS9-SF	*Internet Gaming Disorder Scale – Short Form* (Pontes & Griffiths, 2015). Questionnaire based on the nine IGD criteria in DSM-5. Responses to each item range from "Never" to "Very often"; the total score varies from 9 to 45. Scores ≥ 32 points represent clinical severity (Qin et al., 2020).
GDT	*Gaming Disorder Test* (Pontes et al., 2021) Questionnaire based on the four GD criteria in ICD-11. Responses to each item range from "Never" to "Very often"; the total score varies from 4 to 20. There is no clinical cut-off, but higher scores indicate more gaming related problems.
GD-TLFB	*Gaming Disorder Timeline Follow-Back* Adapted from timeline follow-back measures to track alcohol consumption or problem gambling (Hodgins & Makarchuk, 2003b). Measures days of gaming and total hours of gaming during the past week.
MOGQ-14	*Motives for Online Gaming Questionnaire* (Demetrovics et al., 2011) Questionnaire measuring motives for gaming, with 14 items covering the seven factors Social, Escape, Competition, Skill development, Fantasy and Recreation. Responses to each item range from "Almost never" to "Most of the time". The 14-item version (Bäcklund et al., 2024a) is a shortened version of the original MOGQ-questionnaire.
Gaming questions	*Additional gaming related questions* Preferred games, main type of platform used for gaming and treatment goals for gaming.

STATISTICAL ASPECTS

The statistical methods used in the studies (**Paper I**, **III** and **IV**) are listed in **Table 3**.

The overall aim in **Paper I** was to compare clinical characteristics between younger and older patients seeking treatment for GD. This was done by analyzing cross-sectional data from intake assessments at first visit. Due to the cross-sectional design, the amount of missing data was low, and there was no need for statistical methods to handle missing data. The main analyses in **Paper I** consisted of group comparisons, where Fisher's exact test was used for categorical variables and a two-tailed *t*-test for the continuous variables. We also used ANCOVA to conduct analyses while controlling for the possible confounder ADHD. In addition, we reported effects sizes using Cohen's *d* and Odds ratios, as mere statistical significance does not show how large the observed differences are. Since effect sizes also control sample size, this makes a valuable contribution to analysis of the results. This was an explorative study, without prior power-analysis, and multiple statistical tests but no corrections made for multiple testing. This does admittedly imply that there is a risk for Type I errors, i.e., that a statistically significant difference appears in analysis by chance, even when there is no true difference in the population.

Statistics in **Paper III** were somewhat more complicated, as this study investigated changes over time. This means multiple testing with the same individuals, and in addition we lost participants to follow-up. For the main analysis in **Paper III**, we used mixed-effects models fitted with maximum likelihood estimation, to account for correlations between measurements based on data from the same individual and as this method handles missing data better than ordinary ANCOVA. Due to the attrition in the long-term follow-up, we also decided to exclude the 6-month follow-up in the analysis, as the amount of missing data would risk introducing a substantial level of uncertainty in the analysis. However, as long-term follow up data is scarce regarding treatment for GD, we included descriptive data from the 6-month follow-up.

In the analysis of the RCT presented in **Paper IV** we will use ANCOVA adjusted for baseline values for the main analysis, i.e., a simpler statistical method than in **Paper III**. The reason is that the main analysis will only compare measures from two time-points; start of treatment versus end of treatment, as participants in the waitlist control condition will be offered treatment directly after the waitlist period, for ethical reasons. Hence, statistical

tests that control multiple measurements with the same subjects will not be necessary. However, we will adjust for baseline values, so that the analysis will focus on changes between the two time-points irrespective of differences in baseline values.

Although the RCT does not include multiple testing with the same individual, the plan includes multiple tests, causing a risk for false positives (Type I errors). We will adjust for multiple testing in two different ways, when analyzing the data. For the secondary efficacy analyses (GDT and GD-TLFB) we will use an alpha level of 0.025 each. However, according to our analysis plan, we will transfer the entire probability mass to the next secondary endpoint if the first test is significant. This means that we can control the Type I error rate, while simultaneously avoiding employing an unnecessarily strict significance level for the next secondary endpoint. For our exploratory efficacy analyses we will use the Benjamini-Hochberg False Discovery Rate (FDR) correction at a 20% level to control for possible false positive findings.

Since we expect most of the participants in the waitlist control condition to choose active treatment when offered, it will not be possible to compare the two groups during the follow-up period after our RCT. Therefore, we have decided to analyze the follow-up data separately. Due to the planned long-term follow up (up to 24 months after treatment), we have identified a risk of missing data due to losing participants during the follow-up period. We plan to handle missing data, both during follow-up and during the intervention and waitlist period, using multiple imputation by chained equations with predictive mean matching, using auxiliary data for the variable in interest. Thereby, we will use our existing data to generate a prediction to replace individual cases of missing data. To reduce the amount of missing data, using our knowledge of the number of participants lost to follow-up in **Paper III**, we will also offer participants a small monetary compensation after filling out the follow-up questionnaires. Even though statistical methods to some degree can mitigate the effects of missing data, it is of course preferable to decrease the amount of missing data if possible.

We have also made power calculations to ensure that the size of the study is large enough to identify clinically significant changes. Power calculations always involve guesses to some degree. In **Paper IV** our power calculations are mostly based on our clinical data from **Paper III**. However, as the study reported in **Paper III** was an uncontrolled study, we had to extrapolate information about possible symptom changes during the waitlist period, based

on the symptom changes we saw from assessment to start of treatment in **Paper III**.

The resulting sample size from a power calculation is also highly dependent on the size of changes that the study should be able to identify. In treatment studies, the goal is to be able to identify clinically meaningful changes. This might sound evident, but defining what that corresponds to in scores on a questionnaire is not as evident, and differs substantially depending on calculation method (Franceschini et al., 2023). In addition, IGDS9-SF has seldom been used in clinical trials, despite being one of the most used GD-questionnaires (King et al., 2020), leaving no other studies to base our decision on. For our power calculations, we decided that a 5-point change on the IGDS9-SF would constitute a clinically meaningful difference, as it implies changes in severity of at least two GD symptoms, and corresponds to half the standard deviation of the change scores, which is one possible mathematical definition of the minimal clinically important difference (Franceschini et al., 2023). We then corroborated our power calculations by investigating what changes in gaming time that could be detected with the resulting sample size, finding that it would be possible to detect changes of at least eight hours per week, i.e., a full workday. All in all, this was decided to correspond to a clinically meaningful difference. However, small changes in choices of these parameters make a big difference in the resulting sample size and greatly affect the possibilities to identify changes.

Finally, the statistical analysis plan for **Paper IV** was published in advance (preregistration at ClinicalTrials.gov, ID: NCT05328596) and presented in a protocol paper (**Paper IV**). The preregistration adds to the integrity of the study, and to the strength of the statistical analysis as all our main analyses are planned ahead of data collection.

THE VALUE OF QUALITATIVE METHODS IN A NEW FIELD

One strength of this thesis is that it includes research conducted with both quantitative and qualitative methods. In particular, the qualitative study reported in **Paper II** adds valuable knowledge, as most studies so far are quantitative cross-sectional population-based studies. In comparison, **Paper II**

presents qualitative clinical data, that both supports and adds clinically important aspects to the knowledge about factors maintaining GD.

The main aim of **Paper II** was to explore factors maintaining excessive gaming. Reflexive thematic analysis was therefore chosen, as this approach is well suited for identifying and analyzing patterns across qualitative data (Braun & Clarke, 2006). In contrast to approaches such as Interpretative Phenomenological Analysis, which emphasize the lived experience of individuals, or Grounded Theory, which aims to generate a comprehensive theoretical model, our objective was to identify and describe the types of maintaining factors reported by patients and to compare these with existing theories of GD. Accordingly, the analysis was conducted within a realist (essentialist) framework, assuming that participants' accounts provide access to their experiences and perspectives on factors maintaining excessive gaming.

In comparison with quantitative studies, qualitative methods allow for a more open-ended approach. Consequently, qualitative methodology is especially well suited for explorative approaches, especially when investigating emerging and developing research areas such as GD. It is therefore somewhat surprising that the vast majority of studies about GD have relied on quantitative methods. One risk of predominantly relying on quantitative methodology in a new field, especially one in which many theories and definitions are borrowed from another research domain (i.e., substance use disorders), relates to how quantitative studies are designed. Specifically, quantitative research is based on variables that are defined beforehand, meaning that findings are constrained by the predefined variables or items used for data collection. This may limit the identification of novel or unanticipated phenomena and introduce confirmatory bias (Aarseth et al., 2017).

In contrast, qualitative studies can be used to explore a topic with less predefined variables, making it possible to discover more unexpected results or findings that may complement existing theories. In **Paper II** this is illustrated by the broad range of identified maintaining factors encompassing both factors that are incorporated in prevailing theoretical models, such as the I-PACE model (Brand et al., 2025; Brand et al., 2019b), and factors related to the type of games played as well as individuals' lives outside of gaming, which are less emphasized in existing theoretical frameworks.

LIMITATIONS

Drawing on clinical data, the studies included in this thesis provide both qualitative and quantitative findings that contribute to a broader understanding of individuals with GD and the effectiveness of treatment. However, several limitations affect the conclusions that can be drawn from our studies. Some of the limitations follow from our selection of study sample. Our participants are treatment-seeking individuals. This means that our results regarding for example maintaining factors (**Paper II**) and progression into problematic gaming (**Paper I**), may not be generalizable to individuals with GD in the general population. We have neither compared our treatment-seeking groups with non-problematic gamers or individuals with hazardous gaming. Furthermore, our sample is limited to individuals aged 15 years and above and shows a skewed gender distribution favoring men, which means that results might differ in younger populations and among women with GD. Finally, our samples in **Paper I-III** are comparably small, due to relatively slow referral rates for GD, limiting the strength of the evidence.

Other limitations stem from our measurements and diagnostic procedures. We have validated GD diagnoses through a semi-structured interview. However, this interview, as well as the self-reported questionnaires used in **Paper I-III**, are based on DSM-5 criteria that risk being over-inclusive. We have also used self-reported data to screen for psychiatric comorbidities and debut of problematic gaming, leaving room for reporting biases. Questionnaires used for screening are also designed to be over-inclusive, making it plausible that our data about psychiatric symptoms are somewhat higher than would be the case if assessed through diagnostic interviews.

There are also some design and methodological choices that should be noted. As previously described, the choice of a waitlist comparison limits the strength of the evidence from the ongoing RCT. Our studies in **Paper I-III** are not preregistered. However, preregistration has been conducted for our ongoing RCT (**Paper IV**) strengthening the validity of statistical analysis and aligning with the open science framework.

6.

6. ETHICAL CONSIDERATIONS

All the studies included in this doctoral project involve human participants. In addition, all participants are also simultaneously patients at the clinic where the studies have been conducted. Conducting clinical research at a clinical treatment center entails numerous ethical dilemmas. These dilemmas are addressed in the Declaration of Helsinki (World Medical Association, 2024), that summarizes ethical principles as a guide for medical research. The declaration states that research conducted in a setting where it is combined with medical care requires that participation will not adversely affect the health of participating patients. The research must also be justified by its clinical value. On an overarching level, there is therefore a need to assess possible risks for participants, minimize the risks if possible, and weigh these risks against the clinical value of the research. The most important risks we have identified in our projects concern informed consent, answering sensitive questions, and offering a newly developed treatment in a clinical setting where participating patients also risk being randomized to a waitlist condition.

The size of the risks differs between our projects. In **Paper I** and **Paper III**, information is collected that is part of the ordinary assessment procedures and treatment follow-up, meaning that the patients are not exposed to any procedures that are not part of the standard care. However, in all the studies included in this thesis, participants consent to sensitive information being collected and analyzed for research purposes. In **Paper II** participants also consent to participation in an interview with questions about how they experience gaming, and in the RCT described in **Paper IV** they consent to being randomized to active treatment or waitlist.

INFORMED AND VOLUNTARY CONSENT

All our projects are built on patients giving their voluntary consent to participate. Free and informed consent is a fundamental part of the ethical principles in the Declaration of Helsinki, meant to preserve individual autonomy. While this may sound obvious and straightforward, it takes a little extra effort to enable informed and voluntary consent in a clinical setting. One potential obstacle is that the patients risk information overload when being informed about the research projects together with other information about their treatment plan. To counteract this problem, especially in the studies

described in **Paper II** and **IV** where participation differs from standard care, we have decided to provide information about the studies on two different occasions. We first provide brief information about the study at the first visit, and then book a new visit concentrating only on information about what the studies entail. During this second visit we have better opportunities to ensure that the patients have understood the information, and they have also had some time to consider their decision to participate or not.

Another potential problem is that the clinical setting entails a power imbalance between clinicians and patients seeking treatment that may affect the true voluntary nature of consent. Patients may feel pressured to consent, or fear that their decision may negatively affect the relationship with the clinicians or their opportunities to receive standard care. The first questions about participation are asked by clinicians at assessment and subsequent treatment sessions. There is therefore an inherent risk that the power imbalance will affect patients. To minimize this effect, the subsequent visit where more comprehensive study information is given and formal consent is obtained, is conducted by research assistants with no treatment relationship with the patients.

ANSWERING SENSITIVE QUESTIONS

All our studies include sensitive personal data about for example psychiatric symptoms. In **Paper II** this is even more pronounced as this study is based on detailed interviews about how the participants experience a condition that they are so affected by that it has led them to seek treatment. To minimize the risks for participants, in terms of possible discomfort when talking about issues that trouble them, we have aimed to include only questions that are relevant for the research question. In addition, the interviewer has given clear information about who to contact if participants need help with some of the issues that are touched upon during the interview.

Some important ethical considerations in **Paper I-IV** also regard storage of this sensitive research data. Storage of data has been conducted in accordance with data management policies detailed by the research principal to ensure that all sensitive personal information is safeguarded. For **Paper I-III** data has also been pseudo-anonymized, so that analysis is made with data that cannot directly be linked to individual participants.

OFFERING A NEW TREATMENT

Offering a new treatment poses several ethical questions. In particular, negative side-effects such as worsening of symptoms or feelings of hopelessness if the treatment does not have a positive effect, has been shown to occur for a minority of patients receiving psychotherapy (Rozental et al., 2019; Strauss et al., 2021). To identify the occurrence of such side-effects, we both measure symptoms of GD and other psychiatric symptoms throughout treatment. We also use a validated instrument, the Negative Effects Questionnaire (Rozental et al., 2019), at the end of treatment as a supplementary way to detect side-effects of treatment. Beyond these potential risks, we do not know the effectiveness of the treatment beforehand. However, the treatment offered is based on CBT, a treatment method that is tested and shown to be effective for many other psychiatric conditions (Cuijpers et al., 2025; Liu et al., 2026; O'Toole et al., 2025), including other types of addictions (Halicka et al., 2025; Riper et al., 2014), and with promising results for GD (Stevens et al., 2019; Wang et al., 2023). Hence, we have reason to believe that the treatment will be sufficiently effective to outweigh the possible side-effects. Importantly, as a treatment center, our clinic has a mission to offer treatment for GD. It could thus be argued that it is in line with ethical principles to include research and scientific evaluation when offering treatment for a new type of condition within a hospital setting. Most patients reported positive attitudes toward participation, emphasizing the value of contributing to improved treatments and knowledge. Participation in research may thus enhance participants' sense of agency.

RANDOMIZATION TO WAITLIST

Paper IV describes an RCT that, for methodological reasons, includes randomization of patients to either an intervention or a waitlist condition. The choice of control condition and the length of the control period have been central to risk minimization in the RCT. The ethical dilemma arises from evidence that assignment to a waitlist condition poses a risk of reduced improvement during the waitlist period compared to an active control (Cuijpers et al., 2024; Furukawa et al., 2014). Accordingly, the Declaration of Helsinki (World Medical Association, 2024) states that a new intervention should generally be tested against the "best proven intervention". Still, the use of a waitlist control may be acceptable in early phases of treatment development (Gold et al., 2017). Regarding GD, treatment development is still in its early

stages and there is currently no “gold standard treatment” which our new CBT intervention could be compared with.

In addition to the effects of the waitlist control, the level of risk inherent in the study population is an important consideration when making an ethical judgement about the control condition. For disorders with high risk, such as major depressive disorder with elevated risk of suicide attempts, randomization to a waitlist control condition raises greater ethical concerns than for conditions associated with lower risk (Gold et al., 2017). Gaming disorder is associated with psychiatric comorbidities and (González-Bueso et al., 2018), and although the evidence is limited, associations between GD and suicidality and non-suicidal self-harm has also been reported (Gillespie et al., 2026). However, overall, this population has not been assessed as high-risk to an extent that would preclude the use of a waitlist control.

Based on the lack of ideal comparators and the relatively low participation risk, it was therefore deemed ethically acceptable to test the treatment against a waitlist control. Nevertheless, since these patients have no alternative treatment options, the control period was intentionally shortened, to offer the participants CBT within a reasonable timeframe. This decision was motivated by the fact that the participants are treatment-seeking patients with GD, and that CBT for GD so far shows promising results with few associated risks. For ethical reasons, it was therefore decided that the control period would only apply during the intervention period, and that no control group would be retained for comparison during follow-up.

THE VALUE OF AN EVIDENCE-BASED TREATMENT

Finally, it is necessary to assess the value of the research in relation to the potential risks for participants. The development and validation of a new treatment, for a group of patients where no evidence-based treatments have been available is the ultimate goal of **Paper I-IV**. We believe that this is a contribution with a clear clinical value and with great value for the larger group of patients. In addition, to ensure ecological validity for treatment-seeking populations, it is beneficial to test treatments in clinical populations with common psychiatric comorbidities alongside GD, rather than in self-selected samples from the general population. This makes the clinical setting ideal and necessary for this type of clinical research.

However, an assessment that the benefits outweigh the risks is not sufficient. The bedrock of the ethical principles for research involving human participants is that the value for the larger groups of patients or for society can never outweigh the risks for the individual participants (World Medical Association, 2024). Accordingly, after designing our studies to minimize the risks, we assessed that the remaining risks to individual participants are sufficiently small to be ethically justifiable in relation to the clinical value of the research.

7.

7. CONCLUSIONS AND FUTURE PERSPECTIVES

The aim of this thesis was to explore the clinical characteristics of individuals seeking treatment for GD and to evaluate a CBT for GD. In essence, to expand the knowledge of why gaming gets difficult to control, and about what can be done to regain control when GD has developed.

The first two papers sought to deepen the knowledge about the clinical presentation of GD and factors that maintain excessive gaming. **Paper I** presented a comparison between adults and younger patients, regarding symptoms and progression into GD. The younger group reported a more rapid progression into problematic gaming, while no differences were observed in GD symptoms or psychiatric comorbidities. Overall, though, the treatment-seeking group reported high levels of psychiatric comorbidity, including symptoms of ADHD, autism, anxiety, depression and problematic gambling. This highlights the importance of doing a broad assessment when meeting patients seeking treatment for GD, addressing comorbidities in treatment when needed, and to follow the progression of not only GD symptoms but also comorbidities when evaluating treatment effects. The rapid progression into GD described by the younger patients also calls for further monitoring of how prevalence rates of GD develop over time.

The interview study reported in **Paper II** gave further clinically relevant information about factors that maintain excessive gaming. The participants described a range of different factors, where the use of gaming to cope with psychiatric symptoms and other vulnerabilities was one aspect, but also using gaming to escape from difficult thoughts and emotions in general and having gaming as an arena to feel competent and successful. In addition, aspects related to game design, such as games with no endings, and factors related to life outside gaming, for example having a lack of other activities, were mentioned as important maintaining factors. In conclusion, these results illustrated the importance of understanding excessive gaming as an interplay between the motives, needs and reactions of the individual gamer, game-mechanics and life outside gaming. From a clinical perspective, this means offering interventions that target all these aspects, as for example illustrated in the CBT evaluated in **Paper III-IV**. The multitude of maintaining factors identified in **Paper II** also underscores the importance of continuing to conduct non-confirmatory research, rather than relying solely on paradigms derived

from substance use disorder research, in order to identify features that may be specific to gaming disorder.

Papers III and **IV** describe the evaluation of a newly developed CBT for GD. **Paper III** reported an uncontrolled study showing significant decreases in GD symptoms, time spent gaming, anxiety and depression, maintained for at least 3 months after treatment. These promising results form the basis for **Paper IV**, which describes the protocol for an ongoing RCT comparing treatment effects with a waitlist control condition. There is a need for additional large treatment studies, that also investigate treatment effects over time, to provide evidence on the effectiveness of different treatments for GD. The ongoing RCT (**Paper IV**) will eventually provide additional data about the effectiveness of CBT for GD.

Looking forward, it would also be useful with research on which specific components of, for example CBT, that are the most effective in relation to excessive gaming. Some initial steps have recently been taken in this direction, by reviewing the most common elements in existing CBT-manuals for GD (Radunz et al., 2026). It would also be informative to investigate if there are certain patient characteristics that predict prognosis and treatment success, as this would make it possible to adapt treatments to different needs. Given the small sample sizes in many treatment studies, conducting multi-center studies may be a valuable approach to achieving larger, and preferably multinational, samples.

In addition, it would promote the field to agree both on specific diagnostic instruments (King et al., 2020; Király et al., 2022b), and on instruments to measure changes in treatment. These two must not necessarily be the same. For diagnostic measures, it is vital to find items and symptoms that separate engaged gamers from problematic gamers. However, useful measures of changes in treatment are those that are sensitive to changes in the processes that maintain problematic gaming. These might overlap to some degree but must not be identical (Brand et al., 2020). Measures of changes in treatment could ideally also measure aspects that are vital parts of recovery, according to individuals with GD themselves. More qualitative work on the experiences of changes in treatment and the meaning of recovery could be one interesting avenue forward. Long-term prognostic studies would also be informative, for example to examine relapse rates, the risk of developing other behavioral addictions and whether different treatment goals are differentially associated with outcomes over time.

Seeking treatment often takes time; the participants in **Paper I** reported having had problematic gaming for on average almost ten years before seeking treatment. Public health interventions are often described as a pyramid, where less intensive interventions reaching a large part of society are at the bottom, and more intensive intervention such as psychological treatments for a small minority (Frieden, 2010). Regulations and recommendations regarding gaming, constituting the lower levels of the pyramid, are still far behind for example gambling. Some suggestions with potential to reach individuals at an early stage, and of interest to investigate further, is to implement personalized warning messages to take breaks or providing individual information about the amount of time spent gaming (Király et al., 2018), similar to what has been evaluated as interventions for problematic gambling (Griffiths & Pontes, 2020; Hopfgartner et al., 2023). Future research could also explore the feasibility and preventive effects of proposed risk-level ratings based on the addictive potential of different games (e.g., Rehbein et al., 2024; Saini et al., 2024). The overlap between gaming and gambling (Sánchez Belmar & Subramanian, 2025; **Paper I**) also underscores the need for implementation of policy and legislation to achieve large-scale protection of vulnerable groups.

The present thesis advances the understanding of GD as it manifests in clinical settings. The findings indicate that GD is maintained by a complex interplay of individual, contextual and game-related factors. Psychiatric comorbidity was common in both adults and younger patients, with similar symptom profiles across age groups. Cognitive-behavioral therapy appears to be a promising approach; however, more rigorous treatment studies are warranted. An ongoing preregistered RCT aims to provide additional evidence regarding treatment effects. In conclusion, this thesis contributes to the development of effective treatments for GD, ultimately supporting patients in regaining control over their gaming.

8.

8. USE OF GENERATIVE AI

Generative AI, M365 Copilot (Microsoft), has been used for editing of minor sections of the text, translations of some terms, and for some preliminary information searches.

9.

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10.

10. REFERENCES

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