

From the Department of Clinical Neuroscience
Karolinska Institutet, Stockholm, Sweden

BRIEF ONLINE INTERVENTIONS FOR CONCERNED GAMBLERS IN A GAMBLING HELPLINE

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BRIEF ONLINE INTERVENTIONS FOR CONCERNED GAMBLERS IN A GAMBLING HELPLINE

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By

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SAMMANFATTNING PÅ SVENSKA

Att spela om pengar är vanligt, ungefär 60% av alla vuxna i Sverige har spelat om pengar det senaste året. Att delta i lotteri är den vanligast typen av pengaspelande i Sverige. Ungefär två procent i den vuxna befolkningen har problem med sitt spelande. Det kan vara problem med ekonomin, arbete/skola, relationerna till andra eller hälsan. Bland de som har spelproblem är det vanligt att spela på snabba spel, alltså spel där det är kort tid mellan insats och utfall. I forskarvärlden har det debatterats om vissa spelformer är farligare än andra. Resultatet från den här avhandlingen visade att personer som testade sina spelvanor via ett online-test i stor utsträckning spelade på nätkasino och att nätkasinospelande var starkt kopplat till att ha omfattande spelproblem.

Bland de som har spelproblem är det vanligt att inte söka hjälp inom kommunen eller hälso- och sjukvården för spelproblemen. Många söker andra vägar för att hantera sina spelproblem, till exempel på nätet, hos en hjälplinje eller hos självhjälsgrupper. I den här avhandlingen har vi undersökt hur personer med spelproblem använder olika korta interventioner via nätet, både med och utan stöd av en behandlare. En utvärdering av ett program utan behandlarstöd visade att få loggade in mer än en gång och att de som var med i programmet en kortare tid minskade sina spelsummor medan de som använde programmet under en längre tid ökade spelsummorna. Vi undersökte också genomförbarheten och effekten av ett kort internetbaserat behandlingsprogram baserat på kognitiv beteendeterapi (KBT). Resultatet från den studien visade att det var ganska svårt att rekrytera personer till studien och att få fullföljde studien. När vi jämförde den grupp som fått KBT-programmet med en grupp som enbart registrerat sina spelvanor under behandlingstiden såg vi att båda grupperna minskade sitt spelande och mådde bättre. Det verkar som att hjälpsökande i sig hade positiv effekt på både spelandet och måendet.

Under början av Coronapandemin ställdes de flesta sportevenemang in och det fanns en oro att sportspelare skulle börja spela på nätkasino i stället och att rekommendationer om social distansering skulle leda till ett ökat problemspelande i befolkningen. I en studie mätte vi spelvanor och hur man påverkats av COVID-19 restriktioner bland personer som spelat under det senaste året. Resultatet visade att inga sportspelare övergick till att spela enbart nätkasino. Vi fann att spela på en snabb spelform och oro för den psykiska hälsan på grund av pandemin var kopplat till att ha spelproblem under pandemin. Vi såg ingen koppling mellan olika typer av samhällsrestriktioner och spelproblem under pandemin.

ABSTRACT

Background: Problem gambling (PG) is common throughout the world and affects approximately 2% of the adult population in Sweden and most other western countries. Individuals who gamble in a problematic way experience negative consequences in various life domains, such as, economy, physical and mental health, work life and/or in the relations with family and friends. Few individuals with gambling problems (IGPs) seek formal help in the health care system, mainly due to stigma or a desire to solve the gambling problems on their own. Gambling helplines offer a natural first way of contact for IGPs. Previous research suggests that brief interventions offered in a gambling helpline setting can be effective to mitigate gambling problems. This thesis includes four original papers. The first paper is based on data from a problem gambling screener, the second on data from an online self-help program without therapist support, the third paper on data from randomized controlled pilot study on a brief online program based on cognitive behavioral therapy (CBT) with therapist support in conjunction to a help line telephone counselling session, and the fourth paper is based on data from a longitudinal web survey exploring the effects of COVID-19 restrictions on gambling behaviors and PG.

Aims: the aims of this thesis were three-fold, firstly, to describe the individuals who use the PG screener and to see which game types were associated with increased PG severity levels, secondly, to evaluate the feasibility of two different brief interventions in the context of a gambling helpline, and thirdly, the effects of COVID-19 restrictions on gambling behaviors and gambling problems.

Methods: Study I is an observational study (N=7,350) that investigated the association between different game types and PG as measured by the Problem Gambling Severity Index (PGSI) using two different approaches. First, an unsupervised learning algorithm was used to subtype IGPs based on gambling participation into different patterns of gambling activities (PGA). PGA were compared with regards to PG severity levels. Secondly, we tested the association between certain game types and PG while adjusting for involvement in other game types. In study II (N=4,655), we investigated the feasibility of a very brief online self-help program at the Swedish gambling helpline. Participants were followed for up to four years. Study III (N=43) is a randomized controlled pilot study investigating the feasibility and effect of a brief four-module therapist guided online CBT program in conjunction to a helpline telephone counselling session. Participants were randomized either to the CBT program or to log gambling losses once a week for six consecutive weeks. The main objective was to evaluate the feasibility of the program. In this study the participants were followed for 12 weeks. Study IV is a combined cross-sectional and longitudinal study (cross-sectional N=325 and longitudinal N=123) exploring migration from sports betting to online casino games and the effects of COVID-19 restrictions on gambling behaviors and PG during the first and second waves of the COVID-19 pandemic.

Results: In study I, we found that most participants gambled on online casino games and that few were engaged in several different game types. Moreover, PGA with high probability of online casino gambling were associated with higher PG severity levels compared to PGA with low probability of online casino gambling. We also found that the effect of adding more game types were weak for online casino games, Electronic Gambling Machines (EGM) and online poker, but strong for lotteries and horse betting. The result points in the direction that fast and continuous games, such as online casino games had strong associations with PG severity regardless of engagement in other game types. In study II, we found that it was relatively easy to engage individuals in a self-directed program at gambling helpline website. However, few logged in to the program more than once and gambling expenditures increased for those who logged their gambling expenditures for a longer period. Study III showed that it was relatively difficult to recruit participants and that attrition was high. Both the intervention group and the control group reduced their gambling losses and levels of anxiety and depression, but all between group comparisons were inconclusive. Study IV showed that few sports bettors added online casino games, and none migrated from sports betting to online casino games during the initial phase of COVID-19. Cross-sectional and longitudinal data revealed that restrictions due to COVID-19 were not associated with gambling problems nor increased gambling frequency. Engaging in high-risk games (online slots, live betting, or EGM) were associated with both gambling problems and increased gambling frequency during the first and second wave of the pandemic.

Conclusion: Online casino gambling was common among gamblers who screened their gambling habits. This game type was also strongly associated with increased PG severity level in this sample of gamblers. Brief online interventions in a gambling helpline setting may be helpful to mitigate gambling problems and improve mental health, however, it remains unclear if more extensive interventions are better than shorter. Finally, COVID-19-restriction do not seem to affect gambling behaviors nor gambling problems during the COVID-19 pandemic but engaging in high-risk games does.

LIST OF SCIENTIFIC PAPERS

- I. Wall, H., Berman, A. H., Jayaram-Lindström, N., Hellner, C., & Rosendahl, I. (2021). Gambler clusters and problem gambling severity: A cluster analysis of Swedish gamblers accessing an online problem gambling screener. *Psychology of Addictive Behaviors*, 35(1), 102–112. <https://doi.org/10.1037/adb0000674>
- II. Wall, H., Magnusson, K., Berman, A.H., Berwick, B.M., Hellner, C., Jayaram-Lindström, N., & Rosendahl, I.. Evaluation of a Brief Online Self-help Program for Concerned Gamblers. *J Gambl Stud* (2021). <https://doi.org/10.1007/s10899-021-10005-6>
- III. Wall, H., Magnusson, K., Hellner, C., Jayaram-Lindström, N., & Rosendahl, I. Evaluating the Feasibility of a Brief ICBT Program with Therapist Support for Individuals with Gambling Problems in the Context of a Gambling Helpline, a Pilot Study. Submitted.
- IV. Mansson, V., Wall, H., Berman, A.H., Jayaram-Lindström, N., & Rosendahl, I. Longitudinal Study of Gambling Behaviors During the COVID-19 Pandemic in Sweden. Submitted and resubmitted.

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LIST OF ABBREVIATIONS

ANCOVA	Analysis of Covariance
CBT	Cognitive Behavioral Therapy
DSM	The Diagnostic and Statistical Manual of Mental Disorders
EGM	Electronic Gambling Machine
GD	Gambling Disorder
ICBT	Internet-Based Cognitive Behavioral Therapy
IGP	Individual with Gambling Problems
IQR	Interquartile Range
IRR	Incidence Rate Ratio
MI	Motivational Interviewing
OR	Odds Ratio
PG	Problem Gambling
PGA	Pattern of Gambling Activities
PGSI	Problem Gambling Severity Index
RCT	Randomized Controlled Trial
RR	Random Ratio
Swelogs	Swedish Longitudinal Gambling Study

1 INTRODUCTION

I first encountered gambling as a kid back in the early 1980's. At that time children were allowed to gamble in Sweden (and to buy tobacco). I went to the local tobacco/gambling shop where my grandparents lived to place my grandfather's weekly bet on "måltipset", a lottery where you betted on which games would have the greatest number of goals. I also bought his "snus" (a finely grinded, very addictive, tobacco you put under your lip). A lot has happened since the 1980's – gambling machines, internet gambling, age restrictions to gamble (and to buy tobacco), the duty of care, etc. In 2010, I had just finished my studies to become a psychologist and by pure chance I encountered the Swedish gambling helpline. After a few years of counselling, development of new online interventions via the gambling helpline webpage and project management, I was offered the opportunity to become a PhD student. This thesis is hopefully a step forward towards better understanding of those who contact the gambling helpline and how their needs can be met.

Årsta, 2021

An account of the negative consequences of gambling from the 19th century comes from the Russian author Fjodor Michajlovitj Dostojevskij, who wrote the novel “The Gambler” (original title *Igrok*, 1894), much based on his own experience. Dostojevskij, himself a notorious roulette gambler, describes in a letter to his brother how he got carried away while gambling.

“And I believed in my system ... within a quarter of an hour I won 600 francs. This whetted my appetite. Suddenly I started to lose, couldn't control myself and lost everything. After that I ... took my last money, and went to play ... I was carried away by this unusual good fortune and I risked all 35 napoleons and lost them all. I had 6 napoleons d'or left to pay the landlady and for the journey. In Geneva I pawned my watch.” (“The Gambler”, 2018)

1.1 GAMBLING IN SWEDEN

The state has competing roles when it comes to gambling, both to supply and tax legal gambling opportunities and at the same time minimize the negative effects from gambling. The Swedish state's involvement in gambling extends to at least the 18th century, when Karl XII financed his campaign to Norway in 1718 by introducing stamp duty on play cards (Lotteriinspektionen, 2012). In 1939, the first gambling regulation was established. Only non-profit organizations, apart from the state, could organize lotteries in conjunction to a specific event, and the maximum cost of a lottery ticket was set to 0.25 SEK (1 SEK ~ 0.12 USD) and the highest win was not to exceed a value 5 SEK in non-monetary wins. Mechanical gambling machines were defined as lotteries and therefore allowed (Adolf & Möller, 1939). However, most gambling machines were prohibited in 1979 due to social concerns. In 1982, a new gambling act was introduced. From this time and onwards, monetary wins were allowed, but only as an exception, and the lottery should also have a reasonable return to the organizer. Gambling machines were allowed again and casino games at restaurants were introduced. A clear aim with the new act was to minimize harm from gambling for the individual (Sveriges Riksdag, 1981). In 1995, the 1982 gambling act was replaced by the 1994 gambling act. This updated act defined the return to the lottery organizer to be between 35% to 50%. A definition of lotteries, which were not in physical form was introduced, lotteries transmitted via electromagnetic waves (tele- and data-based communications), EMW lotteries (Lotteriinspektionen, 2012). In 1999, the casino act was introduced, allowing for up to six state-owned casinos with international rules (SFS:1999:355). From the 1990s and onwards the internet made its entrance, opening for gambling outside the national borders. In the 2017 it was estimated that approximately 25% of the market shares (more than 50% of the online gambling) was held by companies outside of the national market (Spelinspektionen, 2018). The fact that a great proportion of the gambling were outside the national market and the problems with match fixing led to the 2018 gambling act (SFS:2018:1138), which was introduced on Jan 1, 2019. From 2019 and onwards it is possible for private gambling companies to apply for license to offer online gambling and sports betting. The new gambling act has also placed responsibility on the gambling companies to monitor and discover problematic gambling behaviors and intervene to either reduce or cease problematic

gambling behaviors (the duty of care) (SFS:2018:1138). The net turnover from the Swedish regulated gambling market was 24 688 million SEK in 2020, and more than 60% of the net turnover came from online casino games (online poker and online bingo included) and online sports betting (Spelinspektionen, 2021).

1.2 GAMBLING DISORDER

Pathological gambling was first recognized in The Diagnostic and Statistical Manual of Mental Disorders (3rd ed.; DSM–III; American Psychiatric Association, 1980) in 1980, classified as an impulse control disorder, consisting of 10 criteria. Endorsing 5 criteria or more were set as a cut-off for the disorder. The latest revision of the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM–5; American Psychiatric Association, 2013) underwent major revisions, pathological gambling was renamed “gambling disorder”, GD, and was classified as a substance-related and addictive disorder among other addictions, such as alcohol use disorder. Further, one criterion, committing illegal acts due to gambling was removed and the diagnostic threshold was set to 4 or more criteria. Another change in the DSM-5 was that GD became dimensional, i.e., the severity of the disorder is now defined by how many criteria are met (mild = 4-5, moderate = 6-7, severe = 8-9). The International Classification of Diseases, 11th Revision, use similar, but not overlapping diagnostic criteria. For full listing of diagnostic criteria according to DSM-5, see Table 1.

Table 1. Diagnostic criteria for gambling disorder according to DSM-5

DSM-5

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

1.3 EPIDEMIOLOGY

Gambling problems can be seen on a continuum ranging from occasional negative consequences from gambling to severe negative consequences. Problem gambling (PG) means that an individual is experiencing one or more negative consequences from gambling and is considered a milder form of GD (Hodgins et al., 2011; Shaffer & Korn, 2002) and is viewed as a public health concern in many countries.

A review of the population prevalence rate of PG by Williams, Volberg and Stevens (2012), including 202 studies, showed that 0.5% to 7.6% suffer from PG world-wide, with the highest rates in Asia and the lowest in Europe. The authors highlighted the inherent problems in using different methods of distributing surveys and different instruments for measuring PG when comparing PG-levels. In Sweden, the prevalence rate of PG has been steady since the first measurement in 1998 up until the latest survey in 2018, fluctuating around 2% (Abbott et

al., 2013, 2014; The Public Health Agency of Sweden, 2019). It has been suggested that a new group of individuals with gambling problems (IGP) have emerged in Sweden, namely middle-aged and older women, who are supposed to comprise half of the new IGPs (The Public Health Agency of Sweden, 2019). Although gambling is prohibited for individuals below 18 years in most countries, youth gambling is not uncommon and the prevalence rates for PG among youth ranges from 0.2-12.3 % around the world and is estimated to 4.3 % in Sweden (Calado et al., 2017).

PG and GD are highly comorbid with other disorders, above all substance use disorder, mood- and anxiety disorders both in samples from the general population and among treatment seeking gamblers, internationally and in Sweden (Dowling et al., 2015; Håkansson et al., 2017; Lorains et al., 2011). A recent longitudinal study suggests that depression and anxiety precede the gambling problems whereas alcohol or drugs do not (Dowling et al., 2019).

1.4 ETIOLOGY

1.4.1 Risk Factors for Developing PG

It is well known that adverse childhood experiences, such as maltreatment or exposure to domestic violence during childhood or adolescence is associated with experiencing negative health outcomes later in life (Hughes et al., 2017). In a meta-analysis of early risk and protective factors associated with problem gambling, including 23 longitudinal studies, the strongest risk factors for later onset of problem gambling were current gambling severity, male gender, and poor school performance. Parental supervision and high socio-economic status were identified as the strongest protective factors (Dowling et al., 2017).

Furthermore, longitudinal gambling studies from Sweden, Australia, Canada, and New Zealand have identified lower age, male gender, and socio-economic factors to coincide with PG (Abbott et al., 2014, 2016; Abbott, Romild, et al., 2018; Williams et al., 2015). In a Swedish context, a case-control study was conducted as an in-depth part of the Swedish longitudinal gambling study, swelogs, consisting of 2400 adults identified as PGs and three times as many controls. The authors found the strongest support for substance use problems, impulsivity, previous gambling problems and an insecure upbringing as risk factors for developing PG (Statens Folkhälsoinstitut, 2013).

1.4.2 Availability of gambling opportunities

A prerequisite for problematic gambling behaviors to occur is the availability of gambling products. Several studies have explored both how the introduction of new legal gambling opportunities (as in the introduction of a new lottery or a land-based casino) and the density of gambling opportunities affect the levels of problem gambling in a population. These studies have shown that the levels of IGPs increase when new gambling opportunities emerge (Chóliz, 2016; Ofori Dei et al., 2021; Ofori Dei et al., 2020; Welte et al., 2016), and that the density of gambling opportunities in an area is associated with both PG and insolvency (Badji

et al., 2020; Storer et al., 2009; Williams et al., 2021). As mentioned earlier, in a Swedish context, the prevalence of PG has been stable over the last decades despite the introduction of new gambling opportunities. However, the gambling participation in Sweden has decreased over the years, and at the same time, the gambling revenues have increased. This suggest that fewer individuals spend more money on gambling (Abbott et al., 2014).

1.4.3 The psychology of PG

At the behavioral level, operant and classic conditioning aim to explain how gambling can become habitual and eventually harmful. Gambling on Electronic Gambling Machines (EGM) for instance can be seen as a standard operant learning model, which is compromised by three events. First, the discriminative stimulus, the gambling machine itself signals the availability of a potential reward. Second, the behavior, the gambler presses the button to start the spinning wheels. Third, the wheels stop, and the gambler is presented with the outcome (win or loss), however, there is no contingency between the behavior and the outcome, it is decided by the random number generator (Zack et al., 2020).

These so-called random ratios (RR) reinforcement schedules in EGM, which provides intermittent reward, have shown strong conditioning properties (Skinner & Ferster, 2015), especially in conjunction to early wins (Haw, 2008). Classic (or Pavlovian) conditioning refers to the process where a conditioned stimulus (e.g., logging in to one's online gambling site) becomes associated with an unconditioned response (such as a feeling of thrill) via an unconditioned stimulus (Zack et al., 2020). Research has shown that both the RR reinforcement schedules (via reward uncertainty), and classic conditioning affect the dopamine system in a way that gambling related stimuli becomes more salient relative to non-gambling stimuli. This way gambling initiation is positively reinforced whereas it becomes negatively reinforced as the gambling becomes habitual and leads to monetary losses and negative mood (Quintero, 2017; Zack et al., 2020).

From a neuropsychological point of view, it has been suggested that IGP have more distorted thoughts related to gambling, are more impulsive, have impaired concentration, executive functioning and decision making compared to healthy controls and recreational gamblers (Quintero, 2017).

1.4.4 Motives for gambling

The overall motive for gambling is the chance of winning money (Binde, 2013; McGrath et al., 2018). A recent meta-analysis including 44 cross-sectional studies support this notion, they found that financial gambling motives were associated with both gambling frequency and problem gambling (Tabri et al., 2021). In his model, Binde (2013) suggests a five-motive model, where four motives are optional, depending on individual preferences and game type factors: the dream of the jackpot, social rewards, intellectual challenge, mood alteration, and the fifth, the chance of winning, is a common motive to gamble for all gamblers. To exemplify how motives may differ: a lottery player may dream of winning the jackpot

whereas social rewards and intellectual challenge may be motives to gamble for horse bettors spending a lot of time at the horse track (Binde, 2013).

1.4.5 A Pathways model to PG

Based on available research on determinants of pathological gambling, Blaszczynski and Nower proposed a model where they suggest three different developmental pathways to problematic and pathological gambling (Blaszczynski & Nower, 2002). The first pathway is referred to as the *behavioral conditioned*, a group characterized by no premorbid psychiatric conditions or alcohol abuse, who via classical and operant conditioning habituate to gambling and over time lose control over gambling, which leads monetary losses and eventually debts. The following anxiety and depression are due to gambling, not the other way around. This group is thought to responds well to treatment and minimal interventions.

The second group is the *emotional vulnerable*, who in contrast to the first group have an emotional and biological vulnerability and gambling becomes a way to alter mood (either to elevate or dampen emotions). The path to problematic or pathological gambling goes via conditioning mechanisms, as in group 1. Women in this second group prefers games of chance, such as slot machines, whereas the males prefer sports betting. This group is more resistant to change, and the underlying comorbidities should be addressed in treatment. The third, and smallest group, is the *anti-social/impulsive*, this group also has the same premorbid conditions as the *emotional vulnerable* gamblers with the addition of impulsivity and anti-social behaviors, which makes this group the most challenging to get into treatment, with high attrition rates and poor treatment outcomes. The model was disconfirmed by (Turner et al., 2008), who suggested a four-component model instead (emotional vulnerability, impulsivity, erroneous beliefs, and the experiences of wins). Later studies, however, have confirmed the structure of the pathways model (Mader et al., 2019; Moon et al., 2017; Valleur et al., 2016).

Recently, Navas et al. (in press) proposed a new model to understand the motives to gamble building on the psychobiology of GD. In their three-dimensional gambling space model, based on sensitivity to negative or positive reinforcement, affect dysregulation and self-deceptive reasoning, they identified three different subtypes of gamblers with different motives to gamble. *The emotional vulnerable gambler* who gambles to alter mood via negative reinforcement, *the anti-social gambler* who gambles out of poor impulse control and affect dysregulation, and *the self-deceptive gambler* who via poor executive functioning have a false sense of mastery of gambling and therefore overestimates their chances of winning.

1.4.6 Gambling Game Characteristics

In population-based surveys on problem gambling fast and continuous games, such as EGM and casino games, have shown stronger associations with PG compared to slower games, for instance weekly lotteries (Binde, 2011; Dowling et al., 2005; Williams et al., 2021). It is also evident that EGM gambling and online casino games are overrepresented among help-seeking gamblers (Håkansson et al., 2017; Ledgerwood et al., 2012; Rodda & Lubman,

2014). One explanation for this is that the set-up of the features, or properties, of EGM type games make them harmful. These features are also called structural characteristics. The most central characteristic of a gambling game is the event frequency, i.e., how often it is possible to place a bet (Parke & Griffiths, 2007; Parke, Parke, & Blaszczynski, 2016). Games with high event frequency, such as EMG-type games, provide unlimited gambling opportunities, where contingent learning mechanisms can occur (i.e., reward are provided in proximity to the gambling behavior). Further, game characteristics such as near-misses (or almost wins) and losses disguised as wins (a win smaller than the placed wager framed as a win) trigger the dopamine system, modify mood and perseverance in gambling despite losses (Bonnaire et al., 2012; Dixon et al., 2017; Murch & Clark, 2015; Sharman et al., 2015; Slesnick et al., 2012; Stange et al., 2017; Zack et al., 2020).

It is important to underline that the interaction between different characteristics determine a game type's level of risk. For instance, a lottery usually has low Return-To-Player (RTP) (approximately 50%), low event frequency (one draw per week), low bet size and high volatility of wins (few high wins). Consequently, it has less risk of facilitating risky gambling behaviors. An EGM-type game on the other hand, are configured to have high RTP (up to 95%), high event frequency, variable bet size and medium volatility of wins (regular small wins and occasional large wins) and can therefore facilitate risky gambling behaviors (Dixon et al., 2017; Parke et al., 2016).

1.4.7 Game Types, Gambling Involvement and PG

As mentioned in the previous section, population-based studies have identified fast and continuous games, such as EMG and online casinos, to be associated with gambling problems. These studies have compared involvement levels in different game types between IGP and non-problem gamblers (e.g., see Binde, 2011; Williams et al., 2021). In parallel, research has emerged, questioning the adequacy of just exploring the association between involvement in certain game types and PG. This line of research propose that the overall gambling involvement should be controlled for, not only the involvement in a certain game type, when assessing the association with PG, since problem gamblers usually gamble more frequently and on more game types compared non-problem gamblers (Baggio et al., 2017; Gainsbury et al., 2015, 2019). Overall gambling involvement has been defined as either the *diversity* in gambling, i.e., total number of other games played during a certain time frame or the *intensity* of gambling, defined as either number of days gambling or money spent on gambling during a certain time frame (Afifi et al., 2014; LaPlante et al., 2009; Welte et al., 2004).

Several studies have explored the association between certain game types, gambling involvement and levels of problem gambling using game-centered approaches (i.e., regular regression analyses have been used to explore the association between game type and PG while adjusting for gambling involvement) (e.g., see, Afifi et al., 2014; Laplante et al., 2011; Welte et al., 2009). In a sample of American youth, Welte and colleagues (2009) explored the association between type of game and PG. Before adjusting for gambling involvement

(operationalized as number of games played or days gambled the previous year), casino gambling, card games and games of skill were significant predictors of PG. After adjusting for involvement, independent of type of operationalization of involvement, casino gambling (for both genders) and games of skill (for females) remained significant predictors of PG (Welte et al., 2009).

In Finland, on a large sample of adults, Halme (2011) explored the relationship between money spent on gambling, background variables and types of gambling and PG. Before adjusting for number of games played the previous year, spending more than 20 EUR per week on gambling was the strongest predictor of PG. Age, internet poker and EMG were also significant, but weaker predictors of PG. After adjusting for gambling involvement, only gambling on EGM remained a significant predictor of PG (Halme, 2011).

In the UK, LaPlante, Nelson, LaBrie and Shaffer (2011) explored the association between participation in 15 separate game types the previous year and PG with or without adjusting for involvement in other game types in a large dataset based on the general population. In their sample, those engaging in spread betting or EGM had the highest prevalence of PG. When exploring bivariate correlations between type of game and PG, several games had significant associations with PG, after adjusting for diversity in gambling; only EGM remained a significant predictor of PG. In subsequent studies on large samples of adult populations, similar patterns have emerged, all associations between type of game and PG, except for EGM, are strongly attenuated or disappear after controlling for either diversity or intensity in gambling (Afifi et al., 2014; Scalese et al., 2016; Yeung & Wraith, 2017).

While the previous studies have used samples drawn from the general population, the involvement effect has also been tested on active gamblers, LaPlante et al. (2013) explored it among casino patrons. When adjusting for diversity in gambling at the current visit to the casino or the typical gambling pattern the previous year, no game played at the current visit remained a significant predictor of PG. In a later study on an online gambling platform, most game types predicted PG, but the relationships disappeared after adjusting for either number of games played, or days gambled in the previous year (LaPlante et al., 2014).

Adjusting for involvement in other game types as a composite score in regression analyses (i.e., the sum of all game types) has been criticized by several researchers (Binde, Romild, & Volberg, 2017; Castrén, Perhoniemi, Kontto, Alho, & Salonen, 2018; Gainsbury, Angus, & Blaszczynski, 2019). They mean that this *modus of operandi* may introduce bias since there may be collinearity between the game type and the composite involvement score (i.e., the variables are highly linearly correlated). Estimates tend to change direction when involvement is added to the model (e.g., see Halme, 2011). This *modus* also assumes that there is a linear relationship when adding more game types (i.e., on average the same effect of adding extra game types regardless of if it is from zero to one or five to six other game types). However, this does not seem to be the case. For instance, Binde et al. (2017) showed that the effect of adding more game types vary for different game types. For EGM, they found no involvement effect, whereas the effect was strong for lotteries. They also argue that high

intensity in gambling (for instance daily gambling) is a prerequisite for PG and that all instruments measuring PG captures high intensity gambling. The PGSI for instance base four out of nine items on gambling too much and intensity in gambling should therefore not be adjusted for in models where PG is the outcome variable (Binde et al., 2017).

Another way to examine the association between different game types, gambling involvement and PG is to use person-centered approaches, i.e., to subtype gamblers based on their entire gambling behavior. In this way, the different game types and involvement in gambling is combined into a single measure. This can be done either via theoretical classifications (based on prior knowledge), data reductions methods (such as principal component analyses), or via unsupervised learning algorithms (which create clusters based on similarity between different patterns of gambling). Studies which have employed theoretical classifications have shown that online gamblers experience higher levels of PG compared to land-based gamblers (Gainsbury et al., 2013; Kairouz et al., 2012). However, it has been suggested that it is not the internet gambling per se that explains these differences but gambling involvement (Baggio et al., 2017).

Nelson et al. (2018) used principal component analysis to identify four PGA based on intensity of gambling in 19 different game types. Skill-based gambling (Internet gambling, betting, and poker) and casino games at a venue were associated with increased PG severity levels, however, when adjusting for both diversity and intensity in gambling these associations disappeared (Nelson et al., 2018). Studies that have employed latent class analysis or clustering algorithms have been able to identify PGA that differ in background characteristics, gambling involvement and levels of PG (de Luigi et al., 2018; Lloyd et al., 2010; Ronzitti et al., 2016; Studer et al., 2016). A common pattern in these studies was that a small group of highly involved gamblers with high PG severity levels was identified (de Luigi et al., 2018; Ronzitti et al., 2016; Studer et al., 2016), but given the methodological differences between the studies (game types, study populations and statistical methods) no clear pattern on which game types cluster together can be identified, although a dominant pattern into which most gamblers are categorized are identified in all studies.

Up until today there is no consensus on how to measure a game type's risk level and no study has used both game and person-centered approaches on the same data set to identify game types and patterns of play associated with PG. Further, few studies have explored the involvement effect among help-seeking self-identified IGPs.

1.5 HELP FOR IGPS

For individuals who are either at risk of developing or already have developed gambling problems, a continuum of support is available, ranging from written information to formal treatment. Even though face-to-face treatments are effective (Cowlshaw et al., 2014; Pallesen et al., 2005), few IGPs seek formal treatment (Slutske, 2006). Among those who seek treatment, a third drop out, mostly before treatment initiation (Melville et al., 2007). Shame, wanting to solve the gambling problems by oneself, mitigating the gambling

problem, or language issues are referred to as barriers for help-seeking (Gainsbury et al., 2014). Moreover, many IGPers report that they prefer self-help services compared to face-to-face treatments (Cunningham et al., 2008; Hing et al., 2015). Today, most self-help for IGPers are available online or via telephone and encompass; written information, peer support, personalized feedback, self-directed interventions, web support, counselling, or treatment (Rodda et al., 2016). Online self-help services increase the availability of support regardless of geographical location, lowers the barriers for help-seeking, and can be accessed at any time (Lal & Adair, 2014)

1.5.1 Gambling helplines

Gambling helplines have been around since the early 1980's and offer a first way of contact for many IGPers (Clifford, 2008). Initially gambling helplines offered telephone counselling (Griffiths et al., 1999), but in recent years web counselling via chat or e-mail has emerged as a compliment to telephone counselling, or as stand-alone services (Asharani et al., 2019; Bastiani et al., 2015; Darbeda et al., 2020; Rodda & Lubman, 2014). Even though web counselling is getting more popular, more than three quarters of all helpline counselling contacts are made via telephone (Asharani et al., 2019; Darbeda et al., 2020). Male gender, younger age and online gambling are associated with choosing to chat over telephone counselling (Darbeda et al., 2020; Rodda & Lubman, 2014). While most telephone counselling takes place during office hours, web counselling often occurs later in the evening or at night (Asharani et al., 2019; Rodda & Lubman, 2014).

Men contact helplines to a greater extent compared to women, but women experience higher levels of PG severity (Griffiths et al., 1999; Ledgerwood et al., 2012). There are also gender differences when it comes to game types among helpline callers, women show a preference for non-strategic game types such as EGM and bingo while men, apart from EGM, also engage in strategic game types, such as betting and poker (Bastiani et al., 2015; Darbeda et al., 2020). High levels of stress, anxiety, depression, and substance abuse are commonly reported among helpline callers (Griffiths et al., 1999; Ledgerwood et al., 2012).

Furthermore, suicidal ideation (SI) is not uncommon, one study reported a prevalence of 11% (Carr et al., 2018), while another reported 2.8% (Fernández-Montalvo et al., 2021). Financial problems, younger age, and psychiatric comorbidities were identified as risk factors for SI. Furthermore, studies report that up to 90%, depending on the definition of help-seeking, seek further help after a helpline contact (Kim et al., 2015; Ledgerwood et al., 2013; Rodda et al., 2014; Valdivia-Salas et al., 2014). Moreover, helpline callers report improved gambling and mental health related outcomes for up to 36 months after the helpline contact (Kim et al., 2015; Ranta et al., 2019).

1.5.2 The Swedish gambling helpline

The Swedish gambling helpline, "Stödlinjen", was founded in 1999, and offers anonymous support to gamblers and concerned significant others via telephone, chat, and e-mail and is financed by the State. Initially, the helpline offered telephone counselling, and in 2011 the

range of services were extended to chat and e-mail counselling. In 2013, a brief online self-help program was introduced, the program consisted of a PG screener with personalized feedback and three online modules based on Miller and Rollnick's stages of change (Miller & Rollnick, 2002). In 2015, the PG screener and the self-help were separated and set up as stand-alone services. The self-help was redesigned to a four-module program complimented with 10-weeks self-help tip via email. In 2019, approximately 1200 IGPs contacted the helpline for counselling, 1000 registered an account at the self-help, 22,500 used the online PG screener and more than 400,000 visited the helpline webpage (Stödlinjen, 2019).

1.5.3 Intervention studies in gambling helplines

Even though helplines have been around for almost 40 years, the research on interventions offered in a helpline setting is scarce. One study has evaluated the effectiveness of telephone counselling in a gambling helpline. Building on the work by Hodgins and colleagues (i.e., Diskin & Hodgins, 2009; Hodgins, Currie, et al., 2009; Hodgins et al., 2004), a large scale RCT on the effectiveness of telephone counselling was conducted in the New Zealand gambling helpline. They tested the effectiveness of four different brief interventions. The participants (N=462) were randomized to either 1) regular telephone counselling (TAU), 2) one session of motivational interviewing (MI), 3) one MI session plus a workbook (MI+WB), or 4) one MI session plus 4 booster sessions and a workbook (MIB + WB). Days gambled and net losses per day the previous month and goal attainment were set as primary outcomes and the participants were followed up at 1, 3, 6 and 12 months. The results showed that there were no differences between the groups during the follow up period; all had positive outcomes, which were maintained over time. Subgroup analyses showed that participants with more severe problems benefitted from receiving the most extensive treatment option (MIB + WB) (Abbott, Hodgins, et al., 2018).

Two studies have evaluated the feasibility and effectiveness of brief online interventions. In the first, participants (N=235) rated their readiness to change and perceived distress prior and after a chat session with a counsellor. They also rated how they perceived the quality of the chat session. The authors found chat sessions which were considered *smooth* were associated with increased readiness to change and less post session distress (Rodda et al., 2016). In a later study by the same research group, they compared self-help tips via SMS to TAU (the helpline's e-health services). The intervention set up was two-fold, for 12 consecutive weeks, the participants received one SMS with self-help tip followed by a SMS with a prompt to provide feedback if the tip was helpful or not. The effect of the intervention was inconclusive. However, both groups reduced their PG severity levels and spent less time and money on gambling (Rodda et al., 2018).

1.5.4 Brief interventions for IGPs

Most brief interventions for IGPs have been tested in non-gambling helpline settings. In this section a selection of relevant studies is presented. Firstly, limited evidence has been found for self-assessment and workbooks. Cunningham et al. (2012) compared normative feedback

(compared to the population average) on gambling behaviors and money spent on gambling to feedback without normative comparisons. Feedback without normative comparisons was found superior over normative feedback with regards to time spent gambling 12 months after the intervention. Inconclusive results were found for money spent on gambling (Cunningham et al., 2012). In one study, receiving a workbook with relapse prevention as one email, or via seven emails spread out over a year, reduced gambling expenditures for both groups, however, receiving the workbook portioned out over a year was not superior to receiving the full workbook on one occasion (Hodgins et al., 2007). In another study, reading a workbook sent via mail was found superior with regards to money spent on gambling compared to a wait list condition (Oei et al., 2018). One study compared normative feedback to a workbook with or without guidance for non-help seeking poker gamblers at a gambling website. All groups reported negative outcomes and up to 97%, dropped out from treatment depending on treatment arm (Luquiens et al., 2016). There is some support for the effectiveness of MI offered via telephone. It is, however, unclear if offering an additional workbook or booster sessions improve the outcomes (Boudreault et al., 2018; Diskin & Hodgins, 2009; Hodgins et al., 2001; Hodgins, Currie, et al., 2009).

There is a growing body of evidence for internet programs based on cognitive behavioral therapy (CBT). CBT is an umbrella construct for several different types of therapies, such as Cognitive Therapy (CT) and Behavioral Therapy (BT). Meta-analyses show that CBT offered online is effective for several psychiatric and somatic disorders (see e.g., Carlbring et al., 2018; Sijbrandij et al., 2016; Ye et al., 2016). In Sweden, Carlbring and Smit (2008) evaluated an interactive online version of a CBT workbook with therapist support via telephone. At the post treatment follow-up, online CBT was superior to a wait-list control. The positive outcomes were maintained over a 36-month period (Carlbring et al., 2012). Similar programs in Norway and Finland have been found effective to reduce gambling related harm in outpatient settings (Castrén et al., 2013; Erevik et al., 2020; Myrseth et al., 2013). A recent study compared two modes of support in conjunction to a CBT program, guided or unguided. Both groups improved with regards to gambling symptoms, gambling frequency and expenditures and gambling urges. Those who received guidance reported reduced gambling urges and gambling frequency compared to the unguided group (Dowling et al., 2021). Brief online entire self-help interventions have yielded some limited support, Hodgins et al. (2019) compared an entire self-help intervention to normative feedback, both groups improved, and all between group comparisons were inconclusive. Cunningham et al. (2019) found no support for any additional effects on gambling or mental health outcomes by adding a mental health intervention to an entire self-help gambling intervention.

Although there is growing support for the effectiveness of brief interventions for IGPs it remains unclear if more extensive interventions are better than briefer. One reason for this may be the high levels of self-recovery among IGPs (Hodgins & El-Guebaly, 2000; Müller et al., 2017; Slutske, 2006). Moreover, there is very limited research on interventions offered in a helpline context. To recite a common end line in many scientific articles “more research is needed”.

1.6 GAMBLING DURING COVID-19

The current COVID-19 pandemic affects the whole world and concerns have been raised that the effects of full- and partial lockdowns can have negative impacts on mental health and lead to an increase in various addictive behaviors (Håkansson et al., 2020; Király et al., 2020; Mestre-Bach et al., 2020; Price, 2020). In Sweden, the government did not implement a full lockdown like many other countries but relied on recommendations from the Public Health Agency of Sweden, such as working from home, if possible, avoid unnecessary social contacts, and limit travel to mitigate the transmission of the virus. During the initial phase of the pandemic a new legislation was passed in Sweden, which limited the number of spectators on public events (such as cinemas, theaters, and sports events) (SFS 2021:4). This type of legislation was observed all over the world and in combination with the uncertainty of how the COVID-19 virus would behave led to cancellation of most sports events from mid Mars 2020 to June 2020. This led to a concern that those who betted on sports would migrate to more harmful game types, e.g., online casino games, to compensate for the loss of betting objects, especially since most gambling companies offer several different game types at the same platform. To mitigate the consequences of this presumed migration to online casino games, a new temporary legislation was passed in July 2020, which limited the weekly deposits for online casino games (online poker included) to 5000 SEK per licensed gambling company and bonuses were limited to a value of 100 SEK. Further, a weekly loss limit of 5000 SEK was set for EGM (which are operated by the state-owned gambling company Svenska Spel) (Sveriges Riksdag, 2020). Initially the temporary legislation was to be due on December 31, 2020, but given the continued pandemic, the legislation was extended to at least November 14, 2021.

Early COVID-19 related gambling studies showed no evidence of migration from sports betting to online casinos, increased gambling expenditures or increase in problematic gambling behaviors (Auer, Malischnig, et al., 2020; Lindner et al., 2020; Wardle et al., 2021). In countries where online gambling is not so common, there was a concern that the pandemic would force gamblers to online gambling, however, an Australian study showed no increase in online gambling in conjunction to the lockdown. Moreover, most gamblers reported that they expected to return to their prior gambling habits once the pandemic is over (Gainsbury, Swanton, Burgess, & Blaszczynski, 2020). An early Swedish study showed that a segment of gamblers who increased their gambling during the initial phase of COVID-19 were more likely to engage in online casino games and experience more gambling problems (Håkansson, 2020a) and another study by the same research group showed that sports bettors who maintained sports betting, even though most sports events were cancelled, had increased levels of gambling problems compared to other types of gamblers (Håkansson, 2020b). None of the COVID-19 studies on gambling has so far followed individuals over time and there is a need to understand how a pandemic affects gambling behaviors and gambling related harms over a longer time-period since recent reports show that overall gambling expenditures have increased for online gambling during the pandemic (Spelinspektionen, 2021). It is urgent to see if this will lead to increased levels of PG as the pandemic proceed.

1.7 SUMMARY

Problem gambling is relatively common throughout the world. It is categorized by an inability to stop or limit gambling despite negative consequences for economy, work life, health and/or the relationships with others. The etiology of problem gambling is multifactorial, ranging from societal, game specific to psychological factors. It is well known that some game types are more prevalent among IGP, however, it is debated if it is due to the game types per se or the fact that IGP are more involved in gambling compared to non-problem gamblers. Furthermore, IGP are known to be reluctant to seek help within the health care system. For those individuals brief interventions offered in other contexts, such as a gambling helpline, can be a viable option. These interventions have shown positive outcomes, at least in the short perspective. However, it remains unclear if more extensive interventions are superior to shorter and for whom more support is needed. Moreover, during the initial phase of COVID-19 pandemic, when most sports events were cancelled, there was a concern that sports bettors would migrate to online casino games. There was also a concern that the imposed restrictions would increase the levels of problem gambling in the general population.

2 RESEARCH AIMS

The overarching aim of this thesis was to evaluate three different online interventions at the Swedish gambling helpline, a brief PG-screen with feedback, a self-program without therapist support and a four-module online CBT-program with therapist support. During the PhD studies, the COVID-19 pandemic broke out, the fourth paper evaluates the effect of COVID-19 consequences on gambling behaviors and PG. The aim of each study is listed below:

Study I is based on data from the online PG self-test at the Swedish gambling helpline. The aims of the study were 1) to see if it was possible to detect distinct patterns of gambling activities, PGA, based on past month gambling, 2) explore if diversity in gambling (number of games played) was related to PG severity level, 3) explore if the strength of the relationship varied by game type and 4) test if PGA with high probability of EGM and/or online casino gambling had higher PG severity levels.

Study II is a longitudinal feasibility study based on data from an online self-help program at the Swedish gambling helpline. The focus for this study was to describe how the users interacted with the program in terms of engagement in the different modules, module content, and for how long they used the program. We also explored how gambling expenditures developed over a four-year period for a sub-set of users.

Study III is a randomized pilot study of a brief online CBT program for problem gamblers contacting the Swedish gambling helpline. After an initial telephone counselling session with a helpline counsellor, participants were randomized to either a four-module online CBT program with therapist support or to log gambling losses on a weekly basis for six weeks. The primary aim was to evaluate the feasibility of the intervention as in, recruitment, adherence to the program, attrition, satisfaction with the intervention, and feasibility of the outcome measures. Effectiveness of the CBT intervention was set as a secondary aim.

Study IV is a longitudinal observational study where participants were recruited via social media and the Swedish gambling helpline. The aims of this study were two-fold; 1) to see if past year gamblers migrated from sports betting to online casino games during the COVID-19 pandemic and 2) to explore the effects of COVID-19 restrictions on gambling behavior and PG during the pandemic.

3 EMPIRICAL STUDIES

3.1 OUTCOME MEASURES

Table 2. Overview of outcomes used in the different studies.

Outcome	Measures	Study	Reference
Problem gambling severity index (PGSI)	Gambling problems in the general population the previous 3 months (study I) or 12 months (study III, IV)	I, III, IV	(Ferris & Wynne, 2001)
Timeline follow-back gambling (TLFB-G)	Gambling days and losses (study III) or expenditures (study II) during a set up interval (1 week or 1 month)	II, III	(David C Hodgins & Makarchuk, 2003)
Consumption Screen for Problematic Gambling (CSPG)	Overall gambling involvement the past 12 months	III	(Rockloff, 2012)
The NORC DSM-IV Screen for Gambling Problems (NODS)	Gambling symptoms the past 30 days based on DSM-IV criteria	III	(Wickwire et al., 2008)
Gambling Abstinence Self-Efficacy Scale (GASS)	Self-efficacy in gambling situations	III	(Hodgins et al., 2004)
Gambling Urges Scale (GUS)	Gambling urges	III	(Raylu & Oei, 2004; Smith et al., 2013)
Alcohol Use Disorder Identification Test - Consumption (AUDIT-C)	Alcohol use disorder the past 12 months	III	(Lundin et al., 2015)
Drug Use Disorders Identification Test Consumption (DUDIT-C)	Hazard use/dependence of illicit substances the past 12 months	III	(Berman et al., 2005)

Outcome	Measures	Study	Reference
World Health Organization's Quality of Life Assessment (WHOQOL-BREF)	Quality of life	III	(Skevington et al., 2004)
Patient Health Questionnaire-9 (PHQ-9)	Levels of depression the past 14 days	III	(Kroenke et al., 2001)
Generalized Anxiety Disorder 7-item scale (GAD-7)	Anxiety the past 14 days	III	(Spitzer et al., 2006)

3.2 STUDY I – GAMBLER CLUSTERS AND PROBLEM GAMBLING SEVERITY: A CLUSTER ANALYSIS OF SWEDISH GAMBLERS ACCESSING AN ONLINE PROBLEM GAMBLING SCREENER

3.2.1 Background

Several studies on different types of populations have shown that fast and continuous games, such as EGM, are strongly associated with PG, however these associations weaken or even disappear when an individual's entire gambling involvement is considered. To our knowledge, no study has explored the association between game type, involvement in other game types and PG in a sample of self-identified IGP's using both game-centered and person-centered approaches on the same dataset. We hypothesized that 1) it would be possible to identify distinct gambler PGA, 2) diversity in gambling was positively related to PG, 3) the strength of the relationship varied by game type and 4) PGA with high probability of EGM and/or online casino gambling were associated with increased levels of PG.

3.2.2 Methods

Participants were included in this cross-sectional study via the Swedish gambling helpline's online PG screener. At the PG screener participants filled out the PGSI, participation in 10 game types the previous month and background information (age, gender, and residence). Feedback and tips were provided based on PGSI category. The PGSI has nine items measuring gambling behaviors and negative consequences from gambling the last year. The nine items are answered on a 4-grade Likert-scale (0 = "never" to 3 = "almost always"). The total score ranges from 0-27. Scoring zero indicate "no gambling problems", 1-2 "low risk of

developing gambling problems”, 3-7 “moderate risk of developing gambling problems” and 8 or more “problem gambling” (Ferris & Wynne, 2001).

To be included in the study, participants had to fill out all nine PGSI items, provide complete background information, fill out at least one game type, tick a box that they filled out the test to learn more about their gambling habits (as compared to take the test for fun) and tick a box that they agreed to be included in future research studies. To ensure that anonymous participant did not provide more than one data point, entries were compared by date, gender, background information and game types. Among entries that matched, the first was kept. A total of 400 entries, or 5%, were considered duplicates. The PGSI was analyzed as count data, and to compensate for an underestimation of the standard errors, quasi-Poisson regression models were used. For the person-centered approach, we used an unsupervised learning algorithm to subtype gamblers into PGA based on which game types they had engaged in the previous month. We then compared PGA with regards to PGSI scores. For the game-centered approach, we analyzed the involvement effect for each game type by adding game types in an incremental manner, first the specific game type, second; the specific game type and one other (any) game type, third; the specific game type and two other game types, and so on up to six or more other game types.

3.2.3 Results

In this sample of 7,463 self-identified IGPs, 78% were males, and the mean PGSI score was 15.5 (SD=7.13). Online casino games was the most common game type, 69.7%, and among the female gamblers, 85.7% reported this game type. First, we identified seven different distinct gambler PGA using the person-centered approach. The *online casino* gamblers constituted the largest PGA (comprising 47.4% of all gamblers), followed by *horse/lottery* (18.5%), *online sports* (14.7%), *online sports/online casino* (10.9%), *casino/EGM* (4.6%), *casino/betting/poker* (3.2%) and the *diverse* gamblers (0.9%). Second, the results showed that diversity in gambling was associated with higher PGSI scores, an individual had to engage in five or more game types to see an increase in PGSI scores compared to gambling on just one game type (15.4 compared to 17.6). Third, the involvement effect varied by game type, the smallest effect was observed for online casino games and EGM and the largest for lotteries, horse betting and bingo, see Figure 1. Moreover, PGA with high probability of online casino gambling, *online casino* (PGSI=17.0, SD=6.19), *casino/betting/poker* (17.8, SD= 6.67), and *casino/EGM* (16.8, SD=6.36), did not differ with respect to PGSI score but with respect to involvement in other game types (median = 1, 6 and 3, respectively). Fourth, PGA with high probability of online casino gambling had higher PGSI scores compared to PGA with medium to low probabilities.

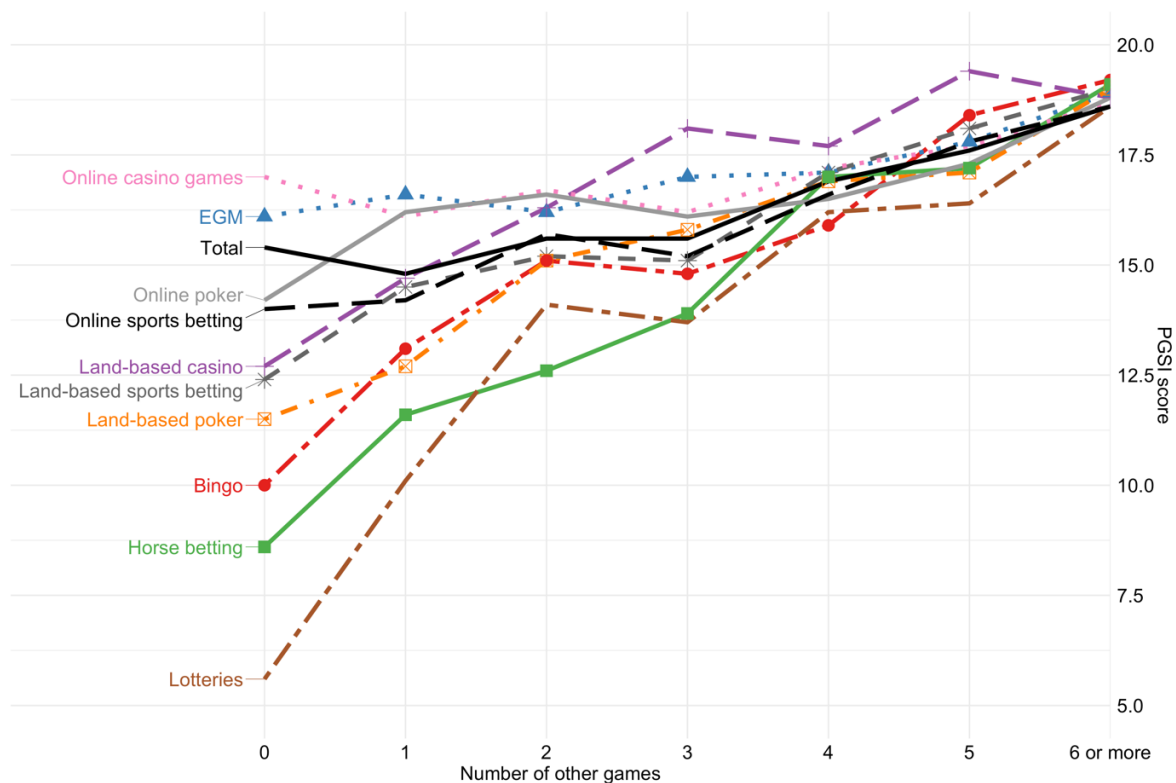


Figure 1. Effect on PGSI score by increased gambling involvement for ten different game types and on average for all game types.

3.2.4 Conclusions

In this study, we found that anonymous self-identified IGPs who used the online PG screener at the Swedish gambling helpline to the greatest extent were engaged in online casino games, and that females preferred this game type. Online casino games also had the strongest association with PG. We also found that the involvement effect varied by game type. Among game types, such as online casino games and EGM, the involvement effect was small whereas the effect was large for lotteries, horse betting and bingo. This has implications for policy, focus for prevention and regulation should be on the game types with the strongest association with PG, which in a Swedish setting are, online casino games and EGM.

3.3 STUDY II - EVALUATION OF A BRIEF ONLINE SELF-HELP PROGRAM FOR CONCERNED GAMBLERS

3.3.1 Background

It is well known that few IGPs seek help within the health care system. For this reason, brief interventions involving none to minimal therapist contact offered in other settings may be viable alternatives for this group of IGPs. Previous studies have shown that telephone counselling and brief online interventions in a problem gambling helpline can help reduce problematic gambling behaviors and improve mental health. In this study, we evaluated a very brief online self-help program without therapist support at the Swedish gambling helpline's webpage. The primary focus for this study was to evaluate the feasibility of the

intervention as in program engagement, module content and retention. The secondary focus was to explore how gambling expenditures developed over time.

3.3.2 Methods

To be eligible for inclusion in this longitudinal feasibility study, the participants had to be 18 years or older and provide complete background information (age, gender, and game types the previous month). The intervention consisted of four online modules: decision balance task, gambling log, gambling free activities planner, and relapse prevention planner. The modules were accessed via a personal start page at the Swedish gambling helpline webpage. See Figure 2 for decision balance module and Table 3 for description of module content. To enhance engagement in the program, the participants were awarded with virtual badges for working with the modules. The online modules were supplemented with 10 weekly e-mails with information on how to use the modules and behavioral change tips based on CBT and MI. E-mail reminders were also used to prompt participants to log in to the program and complete tasks in the different modules.

At the decision balance task, gambling free activities planner and relapse prevention planner, the users could add free-text entries. All free-text entries were added to a text corpus and based on term frequency (tf; how often a term occurred) and the inverse document frequency (idf; $\ln(\text{number of modules}/\text{number of modules containing the term})$), the product $tf*idf$ was calculated for each term. The 10 terms in each module with the greatest $tf*idf$ weights were considered the most important. Gambling expenditures, which contained an excess of zeros, were analyzed using a longitudinal marginalized two-part model for semi-continuous data, this model combine two generalized linear mixed-effects models (GLMM), a logistic GLMM for the zero part and a skewed continuous (G)LMM for the nonzero. This way change in expenditure refers to the overall expenditure including zeros.

På svenska | Cookies


Settings | Log out from self-help

Stöddlinjen

Test yourselfSelf-help programAbout problem gamblingA LanguagesAbout Stöddlinjen

⊗ ⊗ ⊗ ⊗ ⊗

☆☆☆☆i



Find your motivation

When you are planning to make a change it is always good to take a close look at what makes you want to play and what makes you want to change your gaming habits. By all means, take a bit more time to think about what will be better for you if you do decide to make a change. Good luck!

1. What is good about continuing gambling the way I do:

Add

Excitement

Winning money

Figure 2. Decision balance task.

Table 3. Description of module content

Module	Variables	Input
Motivational balance task	Positive and negative aspects of gambling	Pre-defined options available via drop-down lists. Options can also be added via free-text input.
- Identify pros and cons with changing the gambling habits	Negative aspects gambling	
	Negative aspects of changing gambling	
	Positive aspects of changing gambling	
Gambling log	<i>Set gambling goals:</i>	
- Set gambling goals	Expenditure	0, 50, 100, 200, 500, 1000, 2000
- Log gambling habits		SEK via drop-down list or via free-text input
- Get visual feedback		
- Get e-mail reminders	Time	0, 2, 5, 10, 15, 20 h via drop-down list or via free-text input
	<i>Weekly measures:</i>	
	Expenditure	0, 50, 100, 200, 500, 1000, 2000
		SEK via drop-down list or via free-text input
	Time	0, 2, 5, 10, 15, 20 h via drop-down list or via free-text input

Module	Variables	Input
	Cravings	VAS scale 0-4, with 0 representing “none” and 4 representing “a lot”
	Well-being	VAS scale 0-4, with 0 representing “bad” and 4 representing “good”
Gambling free activities planner <ul style="list-style-type: none"> - Plan activities and get e-mail reminders 	Gambling free activities	Activities are added as free-text input, time and date are set in a calendar-type view
Risk situations <ul style="list-style-type: none"> - Identify risk situations and strategies to manage them - Chose strategy in “hot state” - E-mail reminder to evaluate strategy 	Risk situations and strategies. Several strategies can be added per risk situation	Pre-defined options available via drop-down lists for risk situations and strategies. Options can also be added via free-text.

3.3.3 Results

In this study (N=4,655), 67.3% were males and 78.8% reported online casino gambling. We found that most users, 92% engaged in at least one module and that 23.5% engaged in all four modules. Most users engaged in the motivational balance task (88%) and least in the gambling log (35%). In the motivational balance task, *winning money* and *excitement* were the most common reasons for continuing gambling, whereas *feeling better* and *having money to do other things* were the most common reason for changing one's gambling habits. In the gambling log, few users were active in the log for more than 7 days (i.e., they used the log just once) and among those who used it for less than three months, the gambling expenditures decreased whereas they increased for those who used the log for a longer period (up to four years), see Figure 3 for retention in the gambling log and Figure 4 for gambling expenditures over time. The proportion of users who reached their set up gambling goal or reported 0 SEK expenditure increased from first to last log (48 to 56% and 41 to 46%, respectively). *Going to the gym* or *taking a walk* were the most reported gambling free activities, and the most common risk situation with associated coping strategy was “*getting paid*” and “*transferring money to someone close to you*”. In general, the result indicate that most users logged in on just one occasion and that few used the program for a longer period.

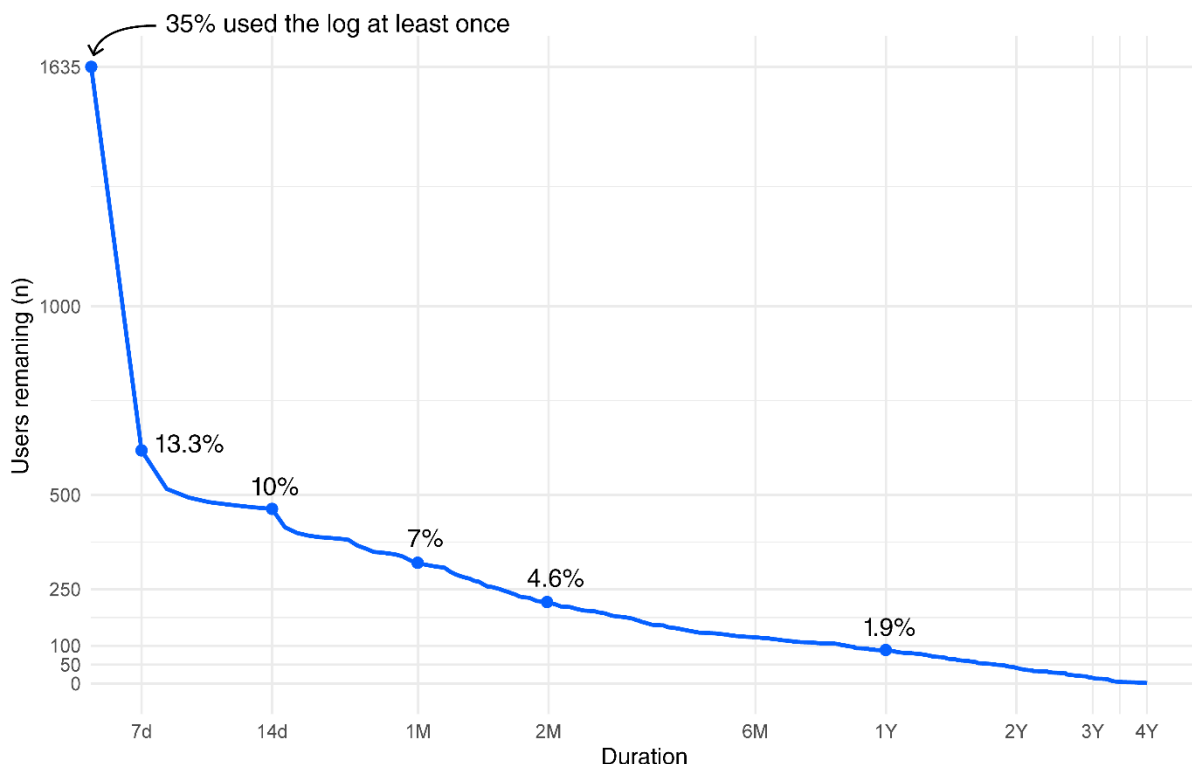


Figure 3. Duration in the log

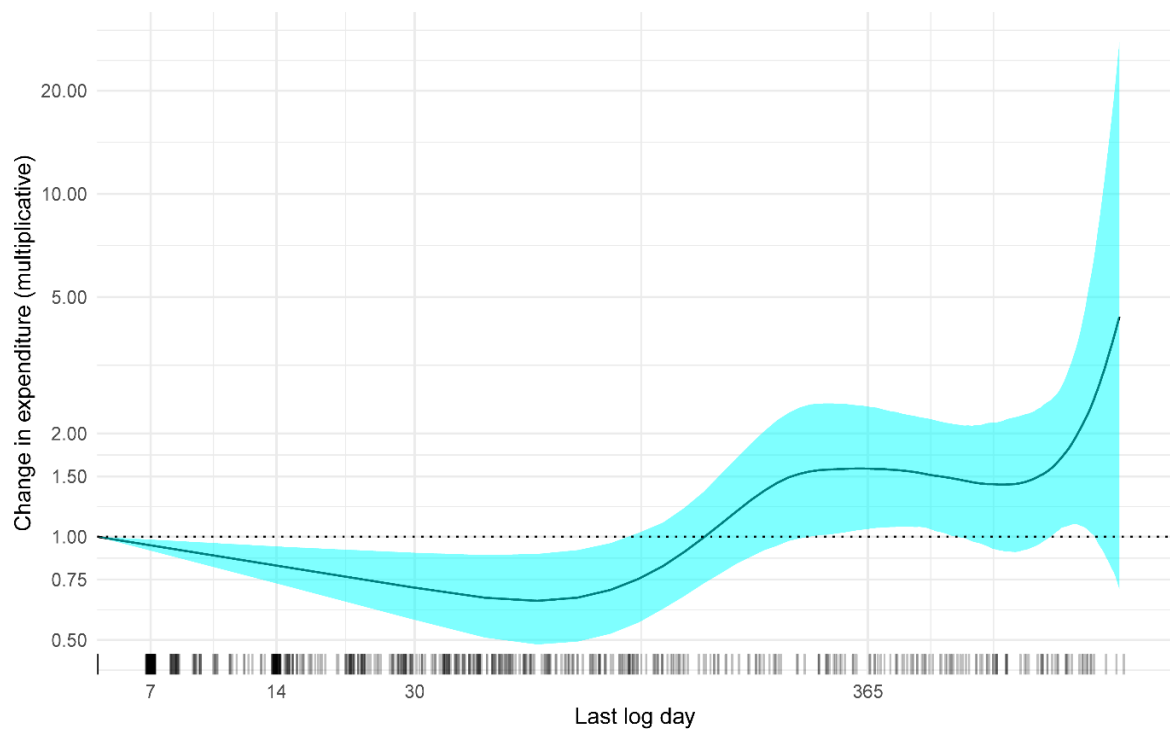


Figure 4. Change in gambling expenditure as a function of the duration of log usage. The y-axis shows the ratio of the expenditure at the last log over the pretest expenditure, values less than 1 indicate a reduction in gambling expenditure. Both axes are shown on the log scale. The rug below the x-axis shows the individual data points.

3.3.4 Conclusions

The results from this study showed that it is relatively easy to engage self-identified IGP in a self-directed online program available via a gambling helpline webpage. However, most program users visited the program just once. Future self-directed programs should focus on being relevant to its end users by engaging them in both the program content and the look and feel of the program. Furthermore, in general, self-directed programs have poor compliance, we therefore suggest that program content should be condensed to a minimal and offered immediately.

3.4 STUDY III. EVALUATING THE FEASIBILITY OF A BRIEF ICBT PROGRAM WITH THERAPIST SUPPORT FOR INDIVIDUALS WITH GAMBLING PROBLEMS IN THE CONTEXT OF A GAMBLING HELPLINE, A PILOT STUDY

3.4.1 Background

Gambling helplines are a natural first way of contact for many IGPers and offer a wide range of services to mitigate the gambling problems *per se* or to facilitate hot or cold referrals to treatment services. Although gambling helplines have been around for many years, little research has focused on the feasibility and efficacy of interventions offered in a gambling helpline. The primary focus for this study was to test the feasibility of a brief four-module online CBT program in conjunction to a telephone counselling session with a helpline counsellor. The secondary focus was to explore the efficacy of the CBT program.

3.4.2 Methods

Participants were recruited via the Swedish gambling helpline's webpage and telephone counselling to this randomized controlled pilot trial. A study specific webpage was set up where potential participants could read more information about the study and sign up for participation. To be eligible for inclusion, participants had to be 18 years or older, score 3 points or more on the PGSI, and not being severely depressed or psychotic. The participants were randomized to either an online four-module CBT program with therapist support or just to weekly logging of gambling losses for six weeks. Before randomization all participants received the gambling helpline's regular telephone counselling.

The themes of the CBT program were:

- Module 1. Introduction to the program, psychoeducation, and goal setting.
- Module 2. Analyses of gambling situations
- Module 3. How to manage gambling thoughts and urges
- Module 4. Relapse prevention

The CBT intervention contained texts, exercises, and homework. Each week the participants received an e-mail with feedback from their therapist on previous week's work. The participants in both groups filled out follow-up measures weekly during the intervention, immediately after the intervention (at six weeks), and after an additional six weeks (at 12 weeks). Gambling losses were measured using TLFB-G, which is a calendar function where gambling losses are filled out for each day. See Table 4 for outcome measures at each time point. Moreover, gambling losses, which contained an excess of zeros, were analyzed using a two-part model for semi-continuous data. This model combines two generalized linear mixed-effects models (GLMM), a logistic GLMM for the zero part and a skewed continuous (G)LMM for the nonzero expenditure. In this way, change in expenditure refers to the overall

expenditure including zeros. All other outcomes (see Table 2) were analyzed using ANCOVAs.

Table 4. Outcome measures at each time-point

Outcome measure	Time-point				
	Screening	Baseline	Weekly	Post treatment	12-weeks
CSPG	*				
PGSI	*				*
TLFB-G		*	*	*	*
NODS		*		*	*
GUS		*		*	*
GASS		*		*	*
PHQ-9	*			*	*
GAD-7		*		*	*
AUDIT-C		*		*	*
DUDIT-C		*		*	*
WHQQOL-bref		*		*	*

3.4.3 Results

A total of 70 individuals were assessed for eligibility and a final sample of 43 participants (49% females) were randomized to the two study arms. The mean age was 43.7 (SD=11.9) years and online casino games was the most common problematic game type (79%). A vast majority (90.5%) of the participants stated “quit gambling” as their treatment goal. On average, 2.15 participants were randomized per week, and most were recruited via the

gambling helpline's webpage (53%). Regarding adherence to the program, the median number of accessed modules were 4 (IQR=3), 12 users accessed all four modules, and three users did not access any module at all. At the post treatment follow up, 67% of the participants were retained in the study, and at the 12-week follow up 53%. The participants were in general satisfied with the program, 7.5 points out of 10, but they rated the program's helpfulness lower, 6.5 out of 10. The relapse prevention module received the highest grade 4.3 out of 5, and analyses of gambling situations received the lowest grade, 3.8 out of 5. Further, nine out of ten reported that they had reached their treatment goal to at least some extent. For all secondary outcomes, there were inconclusive results both at post treatment and the 12-week follow up, see Figure 5 for development of gambling losses at the different time points.

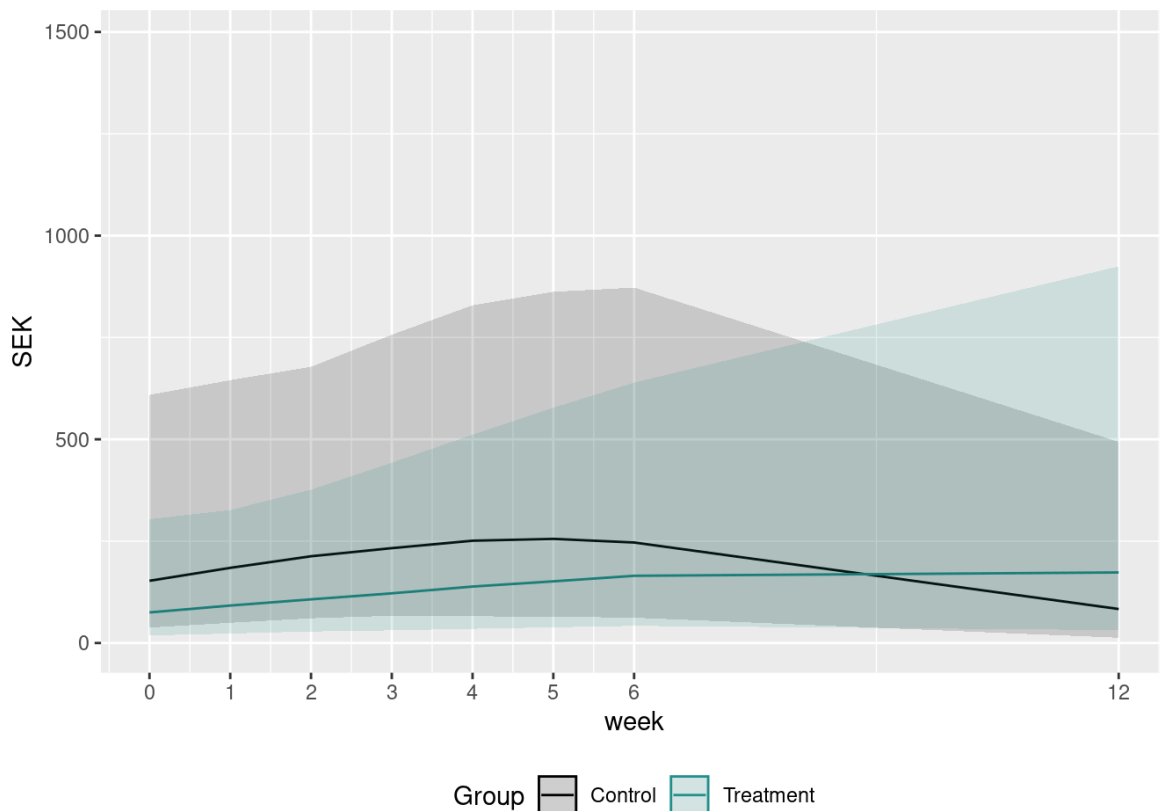


Figure 5. Average daily gambling losses in SEK per group from week 0 (first week of intervention) to week 12.

3.4.4 Conclusions

This study show that it was possible to recruit IGP's to an intervention study via a gambling helpline. However, with this recruitment pace it would take up to approximately 3.5 years to recruit 400 IGP's for a full-scale RCT, which cannot be considered effective. To conduct a study in a helpline setting, recruitment should be done in conjunction to the initial contact with the IGP's and not via an external recruitment site. Furthermore, there were inconclusive results for all between group comparisons, this may indicate that the more comprehensive

CBT-treatment was not superior to the brief control condition (logging gambling losses on a weekly basis). Future intervention studies conducted in a gambling helpline setting should consider both the scope of the intervention and which outcomes should be measured to best capture the helpline's role in mitigating problematic gambling behaviors.

3.5 STUDY IV. A LONGITUDINAL STUDY OF GAMBLING BEHAVIORS DURING THE COVID-19 PANDEMIC IN SWEDEN

3.5.1 Background

The COVID-19 pandemic is affecting the entire world, and as of today we do not know when the pandemic will be over. During the initial phase of the pandemic, from mid-March 2020 to mid-June 2020, almost all sports events were cancelled, which led to a lack of betting objects. Concerns were raised that sports bettor, who previously had not gambled on online casinos would migrate to online casino games. A general concern was that the lock downs (or even softer recommendation on social distancing) that were implemented in almost all countries would affect mental health and addictive behaviors negatively. The aims of this study were to explore if sports bettors migrated to online casino games and to which extent restrictions due to the COVID-19 pandemic affected gambling behaviors.

3.5.2 Methods

Participants (N=321) were recruited via social media and the Swedish gambling helpline's webpage between May 20, 2020, and Oct 31, 2020. A selection of the participants (N=121) agreed to answers a follow-up survey, which was distributed during the pandemics second wave, Nov 1, 2020, to Jan 31, 2021. All participants answered an initial survey consisting of a retrospectively estimated baseline where pre-COVID-19 gambling behaviors were collected, and in the second part of the survey, past month gambling frequency, PG severity level (PGSI), past month gambling problem, current COVID-19 restrictions, and negative consequences due to the pandemic were collected. The follow-up survey asked about the previous month's gambling frequency and perceived gambling problems, and negative consequences due to COVID-19 during the second wave of the pandemic. Self-exclusion status was collected at both timepoints. A 5-point cut-off on the PGSI for PG was used. The dichotomized PGSI data was analyzed with a logistic regression model. Gambling outcome data (gambling problems and gambling frequency), which were on an ordinal level, was analyzed as count data, using negative binominal regression models. These models offer more flexibility compared to Poisson regression models when the mean and variance is not equal. Three variables to capture engagement in game types with high risk of harm (online casino gambling, live sports betting, or EGM gambling) were created. *Start gambling on a risk game*, *continued gambling on a risk game* and *stop gambling on a risk game*. These variables related to change in gambling behavior, for instance *start gambling on a risk game* mean that an individual engaged in a risk game at the current time point but not at the previous.

3.5.3 Results

There was no migration from sports betting to online casino games, neither during the first nor the second wave. Moreover, COVID-19 restrictions did not affect gambling behaviors in a negative way. Being excluded from gambling (OR=27.6, $p < 0.001$), start gambling on a risk game (OR=19.8, $p < 0.001$), gambling on a risk game both during the first wave (OR=7.4, $p < 0.001$) and worry about mental health (OR=3.9, $p < 0.001$) were associated with past year gambling problems.

During the first wave of the pandemic, beginning to gamble on a high-risk game (IRR=2.0, $p < 0.001$), continuing to gamble on a high-risk game (IRR=1.3, $p < 0.001$), stopping high-risk game gambling (IRR=0.8, $p=0.018$), being self-excluded (IRR=1.29, $p < 0.001$) and worrying about mental health during COVID-19 (IRR=1.36, $p=0.015$) were associated with past month gambling problems. Furthermore, beginning to gamble on a high-risk game and continuing to gamble on a high-risk game were associated with increased gambling frequency (IRR=4.8, $p < 0.001$ and IRR=1.8, $p < 0.001$, respectively), stopping a high-risk game was associated with decreased gambling frequency (IRR=0.6, $p=0.018$).

Having stopped high-risk gambling and continued high-risk gambling were associated with gambling frequency at each time point (IRR=0.62, $p=0.032$ and IRR=1.38, $p=0.023$, respectively) for those who provided measurement during the second wave of the pandemic. We found no time-effect on gambling problems nor gambling frequency between the two waves.

3.5.4 Conclusions

Sports bettors did not migrate to online casino games during the first two waves of the pandemic and COVID-19 restrictions were not associated with increased problematic gambling behaviors during any of the two waves.

4 ETHICAL CONSIDERATIONS

The ethical dilemmas identified in relation to the studies of this thesis will be discussed below. All studies in this thesis have been reviewed and approved by the Stockholm regional ethics review board. There are always ethical questions to be considered when doing research. To achieve high integrity for the study participants, the file containing the participants names and contact information in study III was stored in a locked safe at the research department. Further, participant data which was stored in electronical data bases could only be accessed by research personnel. Participant data in study I, II, III and IV could only be accessed by an administrator (using a strong password). Furthermore, during the statistical analyses, data in all studies was anonymized to secure the participants integrity.

In all studies, participants were recruited via the Swedish gambling helpline. It is well known that gamblers contacting a helpline suffer from negative consequences due to gambling, often as large monetary debts, depression and consequently, suicidal ideation. In study III, we initially decided to exclude those reporting any type of suicidal ideation, but when the inclusion began, we recognized that almost all gamblers suffered from suicidal ideation, mostly suicidal thoughts. We reconsidered and changed the inclusion criteria to include those displaying suicidal thoughts on the basis that we wanted to recruit the actual population contacting the helpline. Further, we considered it even more unethical not to include them, since it is often difficult for gamblers to get professional help in their local community. There might also be negative effects on both gambling behaviors and mental health from participating in treatment studies like these. On the contrary, previous studies have shown that even participants in control conditions also change their gambling behaviors, which seems to be the case in study III. To further ensure integrity and security for the participants, a regular counsellor working at the helpline acted as therapist in study III. The counsellor also received regular supervision from a clinical psychologist. In study I and II, ethical approval was applied for afterwards, without formally asking for the participants for informed consent. In study I, no actual information identifying an individual was collected, our conviction is that the gains out-weigh the in practice non-existing harms for the participants in this study. Study II on the other hand, contains potentially sensitive information, as in gambling behaviors and reasons not to gamble. The self-help program is non-intrusive, and the collected data was only analyzed on a group level. Again, our conviction is that the gains from getting more knowledge on the outcomes from using the program out-weigh the potential harms for the participants. Gambling disorders, as well as other addictive disorders, are associated with shame and stigma. By doing research on different aspects of problem gambling, I believe that researchers can contribute to an increased awareness and that research studies like these can reduce shame and stigma, and in the long run enable more people to seek help for their gambling problems.

5 DISCUSSION

The overall aim of this thesis was to evaluate three different interventions in a gambling helpline with the focus on gambling patterns, PG and feasibility. The results from these studies can hopefully guide both policy makers and future research.

5.1 PGA, GAME TYPES, GAMBLING INVOLVEMENT AND PG

In study I, we found support for all four hypotheses. Firstly, seven distinct PGAs were identified, and almost 50% of all participants were found in one PGA, *online casino* gamblers. This finding is in line with two studies that identified one PGA containing a large proportion of all gamblers (de Luigi et al., 2018; Studer et al., 2016), but not with Ronzitti et al. (2016), where the participants were more evenly distributed among the PGAs. Secondly, diversity in gambling was associated with higher PGSI scores, in general, gambling on five or more game types was associated with higher PGSI score compared to engaging in just one. Furthermore, the PGA with the greatest gambling involvement (*diverse*) also had the highest PGSI scores. Both the game-centered and person-centered approaches pointed in the same direction, diversity in gambling was associated with higher PGSI scores. This is in line with a large bulk of research identifying diversity in gambling as a risk factor for PG (e.g., see Baggio et al., 2017; Gainsbury et al., 2019; Laplante et al., 2011; LaPlante et al., 2014).

Thirdly, we found that effect of increased diversity varied by game type. For online casino games and EGM, six or more game types had to be added to see an increase in PGSI score, whereas for lotteries and horse betting it was enough to add just one extra game type to see an increase in PGSI score. In the person-centered approach, we found that engagement in more game types was not associated with increased levels of PG in PGA with high probability of online casino gambling. There was one exception, the *diverse* PGA, categorized by high probability of gambling on all game types, also had the highest PGSI score. However, when scrutinizing the characteristics of the *diverse* PGA, it can be stated that it was a small group, less than 1% of the sample, a large proportion were younger than 18 years, compared to approximately two percent for the rest of the sample, and the median number of game types was 10. This is unlikely a proper subgroup, one can rather suspect that this group constitutes non-valid responses. In retrospect, this subgroup should have been excluded from the analyses. The view that the involvement effect vary by game type is in line with Binde et al. (2017), who found a similar pattern among past year Swedish gamblers from the general population. They found that the proportion of IGPs among EGM gamblers did not increase as diversity in gambling increased, but for other game types, the proportion of IGPs increased incrementally when more game types were added.

Fourthly, we also found that PGAs with high probabilities of EGM or online casino gambling were associated with higher PGSI scores. The *online casino* PGA, with high probability of online casino gambling, had higher PGSI scores compared PGA with medium to low probabilities of online casino gambling, i.e., *online sports/online casino*, *horse/lottery*, and *online sports*. These findings are in line with a large bulk of research that identify EGM as

associated with PG (e.g., see Binde, 2011; Dowling et al., 2005; Gainsbury et al., 2019; Williams et al., 2021). The view that IGP engage in multiple game types (Baggio et al., 2017; Gainsbury et al., 2019) was not supported in study I, the median number of games played was 1 and few, 6%, engaged in five or more game types. Finally, the strong association between online casino games and PG probably explain the weak effect of increased diversity.

In study I, we could also see distinct gender preferences regarding game types. The female gambling patterns constituted games of chance; online casino games (86%), EGM (13.5%), bingo (9.9%) and lotteries (9.4%). Few females wagered on online sports betting (3.9%) and land-based sports betting (2.5%). Males on the other hand had greater variability in their gambling habits; online casino games (65.2%), online sports betting (36.3%), horse betting (17.3%) and land-based sports betting (16.3%). Among the PGA, more than 75% of the females were classified as *online casino* gamblers whereas the males were more evenly distributed between the PGA. Furthermore, female gamblers had higher PGSI scores than male gamblers (17 compared to 15). This indicate that gamblers who seek out the helpline indeed are IGPs and not individuals at risk of developing gambling problems. Both findings are in line with previous research in helplines that have explored gender differences with regards to PG (Bastiani et al., 2015; Kim et al., 2015; Ladd & Petry, 2002; Rodda et al., 2014)

The results from study I may not have direct implications for the gambling helpline's daily operations. It is a well-known fact that the individuals who contact the helpline often have severe gambling problems. However, the results highlight the importance of effective regulation of the gambling market. With the new Swedish gambling legislation, it has become possible to self-exclude from all licensed gambling opportunities via the national self-exclusion register. Hopefully this opportunity, together with the gambling companies' increased responsibility to intervene when they detect problematic gambling behaviors, can help individuals who already have developed or are at risk of developing gambling problems to stop or reduce gambling.

In study IV, we investigated the association between game type and PG differently compared to study I, we explored the association between starting, continuing or stop gambling on a high-risk game and PG. Engaging in a high-risk game was operationalized as any EGM gambling, online slot gambling or online live sports betting. Starting and continuing gambling on a high risk-game were associated with increased levels of PG, both measured as a single item during the previous month and with the PGSI during the past year, whereas stop gambling on risk game was associated with reduced gambling problems the past month, but not the previous year (PGSI). Start gambling on a high-risk game can represent several things, it could for instance be an individual who relapse in gambling or an individual who has not engaged in this game type before and rapidly develop gambling problems. Given the strong association between gambling on high-risk games and PG, it is not surprising that stop gambling on a high-risk game was associated with less gambling problems and lower

gambling frequency. These findings are in line with a recent study from the UK, where Wardle and colleagues found that starting a new game type during the COVID-19 pandemic was associated PG for male gamblers (Wardle et al., 2021).

Study IV, highlight that gambling operators should pay extra attention to customers who start gambling on a high-risk game type, either as a new customer or as a returning customer who has had a break or relapse in gambling.

5.2 GAMBLING DURING COVID-19

The results from study IV did not show any migration from sports betting to online casino games during any of the two waves of the COVID-19 pandemic. Only two sports bettors added online casino games during the first wave of the pandemic, and none migrated to online casino games. Early COVID-19 studies based on gambling company data came to the same conclusion (Auer, Malischnig, et al., 2020; Lindner et al., 2020). COVID-19 consequences, such as working from home or being laid off, were not linked to gambling problems or increased gambling frequency in study IV. Worry over mental health due to the pandemic was linked to increased gambling frequency and gambling problems during the first wave of the pandemic. These IGPs could be the emotional vulnerable gamblers who gambles to alter negative affect. suggested by (Blaszczynski & Nower, 2002; Navas et al., in press). The direction of this relationship is however unclear in study IV, the worries could precede the gambling problems, or the worries could be amplified by previous gambling problems. Dowling et al. (2019) give some clues in the matter, they suggest that gambling problems precede mental health problems, this could be the case in study IV. An interesting finding from study IV was that 61% of those being self-excluded from gambling during the first wave of the pandemic, reported gambling during the second wave of the pandemic. This indicates that these gamblers seek out gambling opportunities outside the national gambling market.

5.3 FEASIBILITY OF STUDY II AND STUDY III

In study II, almost all participants (92%) engaged in the intervention, and in study III, 81% of the participant in the intervention group engaged in at least one CBT module. However, few participants engaged in all modules. In study II, 23.4% engaged in all four modules and in study III, 55% completed the whole intervention. These engagement levels are in line or even superior to similar studies. In an entire self-help program for IGPs, 57% accessed the program and 31% completed all modules (Hodgins et al., 2019), and in a recent study on the effect of therapist support in conjunction to an online CBT program, 33% completed at least one task (Dowling et al., 2021).

Moreover, in study II, few participants logged in to the program more than once, for instance just 10% remained for more than one week in the gambling log module. Similar attrition rates have been observed in other self-directed online interventions. In a feasibility study of an app targeting IGPs, a majority dropped out after one week, and none remained in the program after four weeks (Gayl & Bullen, 2019). Studies on entire self-help interventions for other

behavioral problems have shown that few users are retained over time (see e.g., Guertler et al., 2015; Johansson et al., 2016). This must be considered when new entire self-help interventions are developed.

The reasons for relatively poor compliance and retention in study II may be due to several reasons, all online modules were accessible at first login, but the information on how to use them was portioned out for 10 consecutive weeks via email. This may not be optimal; a better strategy may be to provide information on how to use the different modules at first login. Another reason may be that many users started the program just to see what the program was about. An evaluation of a smoking cessation intervention gives us some clues, 37% never logged in to the program and most of those users were not motivated to change their smoking habits at the current time point (McClure et al., 2013). Moreover, the intervention in study II was not developed in collaboration with its end users, this may also have affected compliance and retention negatively. Future self-directed programs should focus on being relevant for its end users by engaging them in all development phases; from idea to prototype and finished product.

In study III, the loss to follow-up at the 12-week time-point was 47%. Compared with other helpline studies, the attrition level in study III was equivalent to Rodda et al. (2018), where 61% of the participants were lost to follow-up at 12-weeks, but higher compared to Abbott et al. (2018), where only 19% were lost to follow-up at 12-weeks. The explanation for these differences may be that web surveys were used in our study III and by Rodda et al. (2018), whereas Abbott et al. (2018) used telephone surveys in their study and had a dedicated administrator for the purpose, which may have increased retention in their study. It may be easier to discard an e-mail reminder than a telephone call. Moreover, psychiatric comorbidities were not addressed in our study III, and this may have affected the compliance and retention negatively.

Among those who did not fill out complete follow-up measurements at the 12-weeks follow-up in study III, most of them quit when they reached the TLFB diary. This indicate that this type of diary was difficult complete. A better way could be to ask about the aggregated losses per week for four consecutive weeks instead. Furthermore, in study III, there were five questionnaires asking about gambling problems, this may have been perceived as too extensive by the participants and may have contributed to the high attrition rates in that study. Finally, given the recruitment pace in study III with 2.15 randomized participants per week, it cannot be considered effective to recruit participants via an external webpage for a full-scale RCT. A better way would be to recruit participants directly via the helpline's web and telephone counselling.

5.4 EFFECTIVENESS OF STUDY II AND STUDY III

In study II, we found an initial decrease in gambling expenditures for those who logged their gambling habits for up to six months, but among those who logged for a longer period, the gambling expenditures increased compared to the baseline measure. The findings in study II

can be understood in the light of how the gambling log may have been used. Our analytic model suggests that those who used the log for a shorter period reached their set gambling goal (i.e., did not gamble at all) at an early stage, consequently, their motivation to continue logging gambling expenditures may therefore have been low. Those who logged for a longer period often returned to the log on an irregular basis, usually several months apart. This suggests that they may have returned to the log after a relapse in gambling and therefore reported higher gambling expenditures compared to a regular week. Given the high relapse rates among IGPs (Aragay et al., 2015; Ledgerwood & Petry, 2006), this may be a possible explanation. Given the low proportion of users that accessed the gambling log, it seems that gamblers who recognize that they have gambling problems are reluctant to log their gambling habits. There are, however, indications that the intervention in study II was helpful for some individuals. For instance, there was an increase of gambling log users who reached their set up expenditure goal or reported 0 SEK at the last log compared to the first.

In study III, we did not find any obvious benefits of being randomized to the CBT intervention compared to the control group. Both groups improved on all gambling related outcomes as well as depression and anxiety, and there were inconclusive results for all between groups comparisons. Both groups in study III recorded their weekly gambling losses. Keeping track of gambling losses could be considered an intervention *per se*. The result from study III is in line with several studies which have compared two different active interventions for IGPs. Carlbring et al. (2010) compared CBT to face-to-face MI and found all comparisons between the two groups to be inconclusive, Nilsson et al. (2020) found inconclusive results in the comparisons between ICBT and behavioral couples' therapy, and Casey et al. (2017) who did not find online CBT to be superior to a monitoring and feedback intervention with regards to gambling symptoms, amounts spent on gambling or gambling frequency.

Since study III was a pilot trial, we did not have enough participants to detect eventual differences between the groups. However, given the results, i.e., no indication of CBT being superior to just logging gambling habits, it does not seem reasonable to conduct a full-scale RCT.

5.5 FEMALES PREFER THE ONLINE ENVIRONMENT

In general, 20% of the Swedish helpline callers are females (Stöddlinjen, 2018; Stöddlinjen, 2019). In the helpline online screener (study I), 22% were females, in helpline's online self-help program without therapist support (study II), 32.7% were females, and among the participants in the brief ICBT program with therapist support (study III), 49% were females. This suggests that female IGPs prefer the online environment. Convenience and accessibility have been identified as reasons to choose web-based counselling over telephone counselling in an Australian study (Rodda & Lubman, 2014). Even though we did not ask the participants directly, the results from study II and study III indicate that females prefer the anonymity and accessibility of online interventions to a greater extent than males.

5.6 THE FUTURE OF GAMBLING HELPLINES

Gambling helplines play an important role as a first way of contact for many gamblers on all levels of the PG spectra. Data from the Swedish gambling helpline, show that almost 50% of the helpline callers report that they had not taken action to change their gambling habits prior to the helpline contact. After the helpline contact almost 40% planned to seek treatment (including contacting the helpline again) and 30% intended to limit the gambling on their own (Stockholm Center for Psychiatry Research, 2018). International studies show that up to 90% of all helpline callers plan to seek further help after the contact (Ledgerwood et al., 2012; Rodda et al., 2014; Stockholm Center for Psychiatry Research, 2018). These numbers highlight helplines' important role in society, both as facilitator of further help-seeking, and as a stand-alone service.

The services offered in a gambling helpline could be seen as a stepped-care model (Swan & Hodgins, 2015), ranging from primary to tertiary prevention (Dickson-Gillespie et al., 2008). The focus for gambling helplines should be building an ecosystem of help ranging from evidence-based information and self-help interventions for the great mass who visit the helpline's web page, to web and telephone counselling for those who need more support. If one level of support is not enough, it should be easy to move on the next level. For those who need extended support, recurring contact with a counsellor should be an option, either online or via telephone. This way a gambling helpline can be relevant for everyone.

Moreover, there are several advantages of the online environment, data on behaviors can be collected automatically, and different set-ups of information or interventions can be tested directly at the platform (so called A/B testing) to see which one works the best. Finally, based on the results from study II and III, online services offered in a gambling helpline setting should be brief, relevant, and developed in conjunction with its end users.

5.7 METHODOLOGICAL CONSIDERATIONS

In study I, we analyzed the involvement effect using two different approaches: a game-centered approach (regressing game type against PG-level while adjusting for involvement in more game types) and a person-centered approach (regressing PGA against PG-level). Both have their strengths and weaknesses. In the game-centered approach, the association between a game type and PG can be assessed while adjusting for involvement in other game types, however. However, an individual can be represented in more than one trajectory and thus making comparisons between trajectories impossible. The person-centered approach enables comparisons between PGAs, but the association between certain game types or the effect of increased gambling involvement cannot be measured directly.

In the person-centered approach in study I, an unsupervised machine learning algorithm was used to cluster gamblers into different PGA. One disadvantage of this method is that the clustering relies on a "black box" algorithm. It is not possible to evaluate how accurate the predictions from the algorithm are since there are no correct answers in advance on the cluster structure. Furthermore, the unique characteristics of each gambling market and the

resolution of game types (for instance online casino games constitute at least three game types, slots, table games and card games) added to the algorithm, affects the cluster structure. This makes replications of person-centered approaches difficult. However, these algorithms seem to capture latent patterns of gambling. Among the females in study I, 86% were online casino gamblers and a vast majority of these only gambled on this game type. In the cluster analysis, 76% of the female gamblers were classified as *online casino* gamblers, a PGA categorized by online casino gambling only. This agreement between descriptive data and the cluster constitution strengthens the person-centered approach in study I. The two approaches put together strengthen one another and provides a more robust result.

The hypothesized target population in study I were not gamblers from the general population, but individuals with severe gambling problems. This reduces the generalizability of the findings. Further, given the nature of the study, a minimum of background data was collected, and it is possible that unmeasured variables (confounding variables), such as various psychiatric comorbidities and impulsivity, are better predictors of PG than game type *per se*.

The PGSI was used in study I, III and IV to measure PG, the scale was originally developed to measure PG in the general population (Ferris & Wynne, 2001). It was translated into Swedish for swelogs study but has not been formally validated in a Swedish setting. Furthermore, in study I, we used a three-month time frame instead of the original one-year timeframe (the three-month time frame was used to better map past month gambling to current gambling problems). This reduce the generalizability of the findings in study I and IV. Moreover, most of the participants in study I scored above the threshold for PG, which is set to eight points. Little is known on how the PGSI discriminates among those scoring above the threshold for PG, a recent study suggests a 19-point cut-off for high problem severity (Merkouris et al., 2020). The 19-point cut-off, however, gives no clues on how different PGSI scores relate to one another, do the *online casino* gamblers (17.6 PGSI points) experience more gambling problems compared to the *horse/lottery* gamblers (12.6 PGSI points)? Both PGAs are on a low problem severity level according to the classification by Merkouris et al. (2020). It can be argued that scoring 17.6 on the PGSI indicate more harm from gambling compared to scoring 12.6 on the PGSI.

In study II, it was difficult to assess the actual number of logins per participants given how the data base was set up. Proper time stamps were only saved in the gambling log module and in the relapse prevention module. This leads to uncertainty regarding the actual behavior in the program. However, the existing data point in the direction that few users returned to the program over time. Moreover, since we did not have a control group, we could not evaluate the effect of the program.

In study III, the high attrition is an obvious limitation. Due to few participants and follow-up timepoints, no imputations were made. Consequently, the results in study III depend highly on those who provided data. Moreover, no conclusions on the efficacy of the ICBT intervention can be drawn due to the small sample size and lack of power calculation.

In study IV, it can be argued that there were not any qualitative differences between the first and second wave of the COVID-19 pandemic in Sweden, and that the Swedes did not experience the same kind of restrictions as the rest of Europe, and therefore, the effect of restrictions due to COVID-19 cannot be measured in a Swedish context. However, even though the Swedish government relied on soft recommendations on social distancing, most Swedes followed the recommendations, and tele data show a major decrease in travelling during the pandemic (Folkhälsomyndigheten, 2021). Also, during the second wave, to limit the spread of sars-cov2, the COVID-19 act (SFS 2021:4) was decided, which limited the number of visitors and opening hours for e.g., gyms, restaurants, bars, and public gatherings to a greater extent compared to the first wave. This suggests that the two different COVID-19 waves can be considered qualitatively different and analyzed as two separate time points. Furthermore, outcomes such as level of gambling problems and gambling frequency the previous month that were on an ordinal scale (Likert-scale) were analyzed with models that assume “count” outcome data. The definition of “count” data stipulates that data is discrete and does not contain negative values. Poisson regression models are usually used to analyze “count” data, but when the mean value and the variance is not the same, negative binominal regression models are recommended since they offer greater flexibility. That said, I believe that the data was analyzed in an established way in study IV.

5.8 CONCLUDING REMARKS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The results from this thesis showed that individuals who screened their gambling habits at the Swedish gambling helpline mainly engaged in online casino games and that this game type was associated with the highest PG severity levels. This highlights the importance of effective regulation of the gambling market to mitigate negative consequences from gambling, especially harm from online casino games. Future research should focus on longitudinal research designs that clarify the temporal relationship between engagement in various game types and subsequent gambling problems.

Brief online interventions seem to be a viable option for IGPs. Although the results from this thesis showed that few remained in the self-directed intervention for more than one week, the proportion of gambling log users who reached their set up gambling goal or did not gamble at all increased from first to last log. This suggests that the intervention was helpful for those individuals. Moreover, it cannot be considered effective to recruit IGPs for a full scale RCT in a gambling helpline via an external webpage, and it was uncertain if the CBT-intervention was superior to just monitoring gambling habits. Future studies in a gambling helpline should focus on:

- Which level of intervention and therapist support is necessary?
- Who are in need of a more extensive intervention?
- Which building blocks should an entire self-help intervention include?
- How should research studies in a helpline setting be designed to achieve high retention?

Finally, we did not find any support for migration from sports betting to online casino games, nor increased gambling problems during the COVID-19 pandemic. Coming studies on the effects of the COVID-19 pandemic should focus on those who started gambling on a high-risk game or experienced financial difficulties during to the pandemic to see how this affects future gambling problems.

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