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DEVELOPING NOVEL MEASURES AND TREATMENTS FOR GAMBLING DISORDER

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Developing Novel Measures and Treatments for Gambling Disorder
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By

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To Ruby and Erika

POPULAR SCIENCE SUMMARY OF THE THESIS

Gambling can take many forms. When associated with negative consequences, gambling can be problematic, commonly referred to as problem gambling. There is also a clinical diagnosis for gambling. In the latest diagnosis manual for psychiatric disorders, DSM-5, a decision was made to revise the earlier diagnosis of pathological gambling and call it Gambling Disorder. The number of diagnostic criteria was reduced from ten to nine. It was also decided that gambling should be seen as an addiction, in the same way as alcohol and drugs. Compared to many other psychiatric diagnoses, relatively little is known about Gambling Disorder. Knowledge is lacking about how common the Gambling Disorder diagnosis is. Much previous research is based on the term problem gambling and many different questionnaires have been used to measure this. But problem gambling is a broader term, including only one criterion of the diagnosis Gambling Disorder. However, it has also been difficult to measure problem gambling. Researchers have concluded that questionnaires do not include enough (or the right) questions to address necessary gambling-related aspects. The first-choice treatment for problem gambling is cognitive behavioral therapy. However, from a treatment perspective, knowledge is lacking on why problem gambling behavior persists, and how to best intervene to address this. Another problem is that few researched cognitive behavioral therapies reach patients in the healthcare system.

This thesis includes four studies. The studies were done to develop and evaluate measures and treatments for Gambling Disorder.

In the first study, gambling experts ($n = 61$) from ten countries were asked to prioritize among a set of gambling-related questions. These questions were then used to develop a new self-report questionnaire, called the Gambling Disorder Identification Test (GDIT). Feedback was also received from individuals with their own experiences of gambling, to ensure that the GDIT seemed adequate from a user perspective.

In the second study, the GDIT was tested among four different groups of gamblers (total $N = 603$). A sub-group of these participants ($n = 203$) were also interviewed to determine whether they fulfilled the diagnostic criteria for Gambling Disorder. The GDIT was then compared to the interviews and other gambling measures in analyses. The second study showed that the GDIT had good measurement qualities and that it was possible to measure Gambling Disorder according to the DSM-5 criteria, via a self-report questionnaire.

In the third study, patients with Gambling Disorder and other comorbid psychiatric diagnoses ($n = 6$) were interviewed. The focus of the study was to explore Gambling Disorder from a treatment perspective - what types of behaviors do patients engage in which could be relevant to address in treatment? The third study suggested that sudden access to money, such as receiving salary, clearly triggered gambling. Also, access to money was related to feelings of expectancy, anticipation or excitement, where the possibility to gamble was seen in a favorable way. Furthermore, a common pleasant experience during gambling was increased focus (i.e., entering a gambling "bubble" or "zone"), which was associated with a feeling of escaping reality, tunnel vision or lost perception of time. Finally, gambling was associated with chasing behaviors, such as chasing losses or wins, meaning that participants continued to gamble either to recoup losses - or to extend winnings.

The findings from the third study were combined with existing basic research on gambling behavior, and a new internet-delivered cognitive behavioral therapy for problem gambling and GD (iCBTG) was developed.

In the fourth study, the newly developed iCBTG program was uploaded to the national Support and Treatment (ST) platform for interned-delivered treatments, which made the iCBTG accessible to patients in the Swedish healthcare system. We conducted a first evaluation of the iCBTG ($n = 23$), while the treatment was introduced among patients at an addiction eClinic. The fourth study showed that the patients who participated in the study used the iCBTG in similar ways to participants in studies of internet-delivered treatments for problem gambling in non-healthcare settings. The patients reported that they perceived the iCBTG as a credible treatment which they were also satisfied with. Gambling symptoms also decreased during treatment (within-group effect size d = 1.05 at post-treatment follow-up). But the way the ST platform handled self-report questionnaires was problematic from a research perspective. It led to missing data and reduced the extent to which conclusions on treatment feasibility and potential treatment effects could be drawn.

In sum, the studies in the thesis yielded a novel measure and a novel treatment for problem gambling and Gambling Disorder. The GDIT includes questions corresponding to previous recommendations from gambling researchers. The GDIT questions were perceived as acceptable among gambling experts and individuals with their own gambling experience. The GDIT showed good measurement qualities. A specific important benefit of the GDIT is that it enables reliable and valid screening for the diagnosis of Gambling Disorder. Future studies should test additional measurement qualities of the GDIT with analyses in item response theory (i.e., statistical methods that enable testing of individual questions), or through international evaluations among different gambling groups. The development process for the iCBTG program increased knowledge about gambling behavior from a theoretical and clinical perspective. Some initial results suggest that iCBTG is a treatment that patients find acceptable and that iCBTG might be effective to reduce gambling symptoms. The iCBTG is currently available as a treatment in routine addiction care. Future randomized controlled studies should evaluate whether the iCBTG is effective in relation to other treatment options, and also evaluate whether the iCBTG is effective for treating Gambling Disorder with additional psychiatric comorbidities.

POPULÄRVETENSKAPLIG SAMMANFATTNING

Spel om pengar, också kallat hasardspel, kan ske på många olika sätt. När hasardspelande leder till negativa konsekvenser, brukar det kallas spelproblem. Det finns också en psykiatrisk diagnos för "spelberoende". I den senaste versionen av diagnosmanualen DSM-5 gjordes ett beslut att ändra den tidigare speldiagnosen från patologiskt spelande, till Hasardspelsyndrom (Gambling Disorder på engelska). Man beslutade att minska antalet diagnoskriterier från tio till nio. Man bestämde också att spel om pengar skulle ses som ett beroende på samma sätt som alkohol och droger, i stället för att kategorisera spel om pengar som en impulsstörning som tidigare. Jämfört med andra psykiatriska diagnoser är kunskapen om Hasardspelsyndrom förhållandevis liten. Man vet exempelvis inte hur vanlig diagnosen är. Mycket av spelforskningen har utgått från termen spelproblem och många olika frågeformulär har använts för att mäta det. Men spelproblem är en bredare term som bara omfattar en mindre del av diagnosen Hasardspelsyndrom. Det har också funnits svårigheter med att mäta spelproblem. Forskare har dragit slutsatsen att de frågeformulär som finns inte innehåller tillräckligt många (eller rätt typ av) frågor för att kunna mäta det som behövs för hasardspel. Förstahandsvalet för behandling av spelproblem är kognitiv beteendeterapi (KBT). Men utifrån ett behandlingsperspektiv så saknas kunskap om problematiska spelbeteenden och vad man ska göra för att kunna behandla dem på bästa sätt. Ett annat problem är att se till att KBT behandlingar blir tillgängliga för patienter i den vanliga hälso- och sjukvården.

Avhandlingen innehåller fyra studier som gjordes för att utveckla och utvärdera mätmetoder och behandlingar för Hasardspelsyndrom.

I den första studien ombads experter och forskare ($n = 61$) från tio olika länder, att prioritera bland en uppsättning frågor om hasardspelande. Frågorna användes sen för att utveckla ett nytt frågeformulär, the Gambling Disorder Identification Test (GDIT). Synpunkter på GDIT inhämtade också från personer med egen erfarenhet av spelproblem och Hasardspelsyndrom, för att öka trovärdigheten för frågeformuläret bland dem som ska använda det.

I den andra studien utvärderades GDIT bland olika grupper av spelare (totalt $N = 603$). En del av spelarna ($n = 203$) intervjuades också för att undersöka om de uppfyllde kriterierna för diagnosen Hasardspelsyndrom eller inte. Sedan jämfördes GDIT med intervjuerna och andra frågeformulär i olika statistiska analyser. Studien visade att GDIT hade goda mätegenskaper och att det var möjligt att screena diagnosen Hasardspelsyndrom med ett frågeformulär.

Den tredje studien fokuserade på Hasardspelsyndrom utifrån ett KBT behandlingsperspektiv – vilka beteenden hos patienter är vanliga i samband med spelande, som kan vara relevanta att förhålla sig till i behandling? Detta undersöktes genom att patienter med Hasardspelsyndrom och olika andra psykiatriska diagnoser ($n = 6$) intervjuades. Studien visade att tillgång till pengar, exempelvis att få lön, tydligt var kopplat till hasardspelande. Tillgång till pengar var också kopplat till en känsla av förväntan, som gjorde att hasardspelande sågs som något potentiellt positivt och åtråvärt. En vanlig känslomässigt positiv upplevelse under själva spelandet var också ökad fokus och koncentration (att komma in i en "spelbubbla" eller "zon"), som var kopplat till känslor av verklighetsflykt, tunnelseende, eller förlorad tidsuppfattning. Hasardspelandet var också kopplat till olika "jaktbeteenden" för fortsatt spelande, som exempelvis handlade om att vinna tillbaka förlorade pengar, eller vinna nya pengar.

Utifrån resultaten från den tredje studien och tidigare grundforskning om spelbeteenden, utvecklades sedan en ny internetförmedlad kognitiv beteendeterapeutisk behandling för spelproblem och Hasardspelsyndrom (iCBTG).

I den fjärde studien implementerades iCBTG i nationella Stöd och behandlingsplattformen för internetbehandling, vilket gjorde att behandlingen blev tillgänglig för patienter inom den svenska hälso-och sjukvården. En första preliminär utvärdering av behandlingen gjordes också, samtidigt som den introducerades på eStöd mottagningen - en klinik för internetförmedlad behandling inom Beroendecentrum Stockholm. Studien visade att patienterna använde iCBTG i ungefär samma utsträckning som i andra internetförmedlade KBT studier. Patienterna uppgav att de uppfattade iCBTG som en trovärdig behandling som de var nöjda med. Spelsymptom minskade också under behandlingens gång (inomgrupps effektstorlek d = 1.05 vid uppföljning efter behandling). Men problem identifierades också med hur Stöd och behandlingsplattformen hanterade frågeformulär utifrån ett forskningsperspektiv. De problemen ledde till förlust av data och minskad vetenskaplig kvalité för den fjärde studien.

Sammanfattningsvis så ledde avhandlingens studier till ett nytt frågeformulär och en ny behandling för problemspelande och Hasardspelsyndrom. The Gambling Disorder Identification Test (GDIT) uppvisade goda mätegenskaper, men har också andra fördelar. En viktig sådan är att det nu är det möjligt att tillförlitligt uppskatta diagnosen Hasardspelsyndrom via frågeformulär. Den nya internetförmedlade kognitiv beteendeterapeutiska behandlingen för spelproblem och Hasardspelsyndrom (iCBTG), utvecklades för att förbättra kunskapen om spelbeteenden utifrån ett kliniskt och teoretiskt perspektiv. Preliminära resultat visar att patienter uppfattar iCBTG som en trovärdig behandling som de är nöjda med, och att iCBTG potentiellt kan minska spelsymptom. iCBTG är för närvarande tillgänglig för patienter inom reguljär beroendevård, men fler studier behövs för att kunna säkerställa att iCBTG är en effektiv behandling.

ABSTRACT

Background:

While gambling is an activity that seems to have entertained humanity for millennia, it is less clear why problematic gambling behavior may persist despite obvious negative consequences, from a research and clinical perspective. With the introduction of the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM–5), gambling was equated with alcohol and drug use and labeled an addictive disorder, Gambling Disorder (GD). Problem gambling is associated with destroyed careers, broken marriages, financial ruin, and psychiatric comorbidities. Still, research on gambling can be described as a field still in its infancy, with a need to conduct further gambling research on measurement and treatment procedures.

Aims:

The overall aim for the thesis was to develop and evaluate measures and treatments for Gambling Disorder.

- The aims of Study I were to reach a consensus regarding a specific set of potential new measurement items, to yield a testable draft version of a new gambling measure, and to establish preliminary construct and face validity for this novel gambling measure, the Gambling Disorder Identification Test (GDIT).
- The aim of Study II was to evaluate psychometric properties (e.g., internal consistency and test-retest reliability, factor structure, convergent and discriminant validity, as well as diagnostic accuracy) of the GDIT, among treatment- and support-seeking samples ($n = 79$ and $n = 185$), self-help groups ($n = 47$), and a population sample ($n = 292$).
- The aim of Study III was to formulate hypotheses on the maintenance of GD by identifying clinically relevant behaviors at an individual level, among six treatment-seeking participants with GD. This qualitative study was conducted as a preparatory step to develop the iCBTG (see Study IV).
- The aim of Study IV was to evaluate acceptability and clinical effectiveness of the newly developed iCBTG, among treatment seeking-patients with GD ($n = 23$) in routine care. A further aim was to evaluate research feasibility of using existing healthcare infrastructure to deliver the iCBTG program.

Methods:

In Study I, gambling experts from ten countries rated 30 items proposed for inclusion in the GDIT, in a two-round Delphi ($n = 61$; $n = 30$). Three following consensus meetings including gambling researchers and clinicians ($n = 10$; $n = 4$; $n = 3$), were held to solve item-related issues and establish a GDIT draft version. To evaluate face validity, the GDIT draft version was presented to individuals with experience of problem gambling ($n = 12$) and to treatment-seeker participants with Gambling Disorder ($n = 8$).

In Study II, the psychometric properties of the GDIT were evaluated among gamblers ($N = 603$), recruited from treatment- and support-seeking contexts ($n = 79$; $n = 185$), self-help groups ($n = 47$), and a population sample ($n = 292$). The participants completed self-report measures, a GDIT retest ($n = 499$) and a diagnostic semi- structured interview assessing GD ($n = 203$).

In Study III, treatment-seeking patients with GD and various additional psychiatric symptom profiles ($n = 6$), were interviewed using an in-depth semi-structured functional interview. Participants also completed self-report measures assessing gambling behavior. A qualitative thematic analysis was performed using functional analysis as a theoretical framework. Following completion of Study III, the results were synthesized with existing

experimental evidence on gambling behavior and used to develop the novel treatment model and internet-delivered treatment evaluated in Study IV, i.e., the iCBTG.

In Study IV, a non-randomized preliminary evaluation of the novel iCBTG was conducted in parallel with implementation into routine addiction care, through the Support and Treatment platform (*Stöd och behandlingsplattformen*; ST platform). Feasibility was evaluated among a sample of treatment-seeking patients ($N = 23$), in terms of iCBTG adherence, acceptability and clinical effectiveness, and feasibility of using existing healthcare infrastructure for clinical delivery as well as research purposes.

Results:
Study I established preliminary face validity for the GDIT, as well as construct validity in relation to a researcher agreement from 2006 on measuring problem gambling, known as the Banff consensus.

Study II showed excellent internal consistency reliability ($\alpha = .94$) and test–retest reliability (6-16 days, intraclass correlation coefficient = 0.93) for the GDIT. Confirmatory factor analysis yielded factor loadings supporting the three proposed GDIT domains of gambling behavior, gambling symptoms, and negative consequences. Receiver operating characteristic curves (ROC) and clinical significance estimates were used to establish GDIT cut-off scores for recreational gambling (<15), problem gambling (15-19), and GD (any ≥20; mild 20-24; moderate 25-29; and severe ≥30).

Study III yielded several functional categories for gambling behavior, as well as four main processes potentially important for treatment, i.e., access to money, anticipation, selective attention (focus) and chasing behaviors.

Study IV showed that patient engagement in the iCBTG modules was comparable to previous internet-delivered cognitive behavioral treatment trials in the general population. The iCBTG was rated satisfactory in treatment credibility, expectancy, and satisfaction. Mixed effects modeling revealed a significant decrease in gambling symptoms during treatment (within-group effect size d=1.05 at follow-up), which correlated with changes in loss of control (in the expected direction of increased control). However, measurement issues related to the ST platform were also identified, which led to significant attrition in several measures.

Conclusions:
GDIT is a reliable and valid measure to assess GD and problem gambling. In addition, GDIT demonstrates high content validity relation to the Banff consensus.

The iCBTG was developed to achieve a theoretically grounded and meaningful treatment model for GD. Preliminary estimates support acceptability and clinical effectiveness in "real world" settings, but further randomized controlled studies are warranted to ensure treatment efficacy.

LIST OF SCIENTIFIC PAPERS

1. Molander, O., Volberg, R., Månsson, V., Sundqvist, K., Wennberg, P., & Berman, A. H. (2021). Development of the Gambling Disorder Identification Test: Results from an international Delphi and consensus process. *International Journal of Methods in Psychiatric Research*, *30*(2), e1865.
   doi: https://doi.org/10.1002/mpr.1865

2. Molander, O., Wennberg, P., & Berman, A. H. (2021). The Gambling Disorders Identification Test (GDIT): Psychometric Evaluation of a New Comprehensive Measure for Gambling Disorder and Problem Gambling. *Assessment.*
   doi: https://doi.org/10.1177/10731911211046045

3. Molander, O., Ramnerö, J, Bjureberg, J. & Berman, A. H. (2021). What to Target in Cognitive Behavioral Treatment for Gambling Disorder - A Qualitative Study of Clinically Relevant Behaviors [Manuscript submitted for publication]. Department of Clinical Neuroscience, Karolinska Institutet.

4. Molander, O., Berman, A. H., Jakobson, M., Gajecki, M., Hällström, H., Ramnerö, J., Bjureberg, J., Carlbring, P. & Lindner, P. Implementation of internet-based cognitive behavior therapy for problem gambling in routine addiction care: A feasibility study [Manuscript in preparation]. Department of Clinical Neuroscience, Karolinska Institutet.

SCIENTIFIC PAPERS NOT INCLUDED IN THE THESIS

- Molander, O., Volberg, R., Sundqvist, K., Wennberg, P., Månsson, V. & Berman, A. H. (2019). Development of the gambling disorder identification test (G-DIT): protocol for a Delphi method study. *JMIR research protocols*, *8*(1).
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- Ramnerö, J., Molander, O., Lindner, P. & Carlbring, P. (2019). What can be learned about gambling from a learning perspective? A narrative review. *Nordic Psychology*, *71*(4), 303-322.
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- Molander, O., Lindner, P., Ramnerö, J., Bjureberg, J., Carlbring, P. & Berman, A. H. (2020). Internet-based cognitive behavior therapy for problem gambling in routine care: protocol for a non-randomized pilot and feasibility trial. *Pilot and feasibility studies*, *6*(1), 1-11.
  doi: https://doi.org/10.1186/s40814-020-00647-5

CONTENTS

LIST OF ABBREVIATIONS

α	Cronbach's Alpha
ASRS	The Adult Attention-Deficit/Hyperactivity Disorder Self-Reporting Rating Scale
AUD	Alcohol Use Disorder
AUDIT	The Alcohol Use Disorders Identification Test
CBT	Cognitive Behavioral Therapy
CFI	Confirmatory Fit Index
DSM-5	The 5th edition of the Diagnostic and Statistical Manual of Mental Disorders
DSM-IV	The 4th edition of the Diagnostic and Statistical Manual of Mental Disorders
DUDIT	The Drug Use Disorders Identification Test
G-SAS	The Gambling Symptom Assessment Scale
GD	Gambling Disorder
GDIT	The Gambling Disorder Identification Test
iCBT	Internet-delivered Cognitive Behavioral Therapy
iCBTG	Internet-delivered Cognitive Behavioral Therapy for problem gambling and Gambling Disorder
MDQ	The Mood Disorder Questionnaire
NODS	The NORC Diagnostic Screen for Gambling Problems
PGSI	The Problem Gambling Severity Index
PPGM	The Problem and Pathological Gambling Measure
RCT	Randomized Controlled Trial
RMSEA	Root Mean Square Error of Approximation
ROC	Receiver Operator Characteristic curve
SCI-GD	The Structured Clinical Interview for Gambling
SOGS	The South Oaks Gambling Screen
ST platform	The Support and Treatment platform
SUD	Substance Use Disorder
TLFB-G	The TimeLine Follow-Back for Gambling
TLI	Tucker–Lewis Index
VGS	The Victorian Gambling Screen
WHOQOL-BREF	The World Health Organization Quality of Life, 26-item version

1 INTRODUCTION

The first psychology course I took at Stockholm University 2007 was a revolutionary experience for me. Together with fellow psychology students, I co-authored an essay, *The cards on the table – a literature study of pathological gambling* (Lepisk et al., 2007), where we criticized the 4th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994) for lacking a contextual perspective. We also identified maintaining factors for gambling and proposed three types of problematic gamblers.

Many years later, as a clinical psychologist who had learned to appreciate behavioral analysis and psychological treatments (and their development), I found myself returning to the scientific study of gambling again, in a doctoral project at the Center for Psychiatry Research, Karolinska Institutet. This time, I had the utmost privilege of collaborating with some of the most foremost gambling researchers across the world.

The overall aim of this thesis is to develop measures and treatments for Gambling Disorder. The thesis includes studies within two main tracks. The first track describes the development and psychometric evaluation of a novel gambling measure, the Gambling Disorder Identification Test (GDIT). The second track describes the development and dissemination of a novel cognitive behavioral treatment delivered via internet (iCBTG), which is now accessible in routine care for treatment-seeking patients throughout Sweden. The rest follows.

Olof Molander, Skarpnäck, Stockholm, February 2022.

2 BACKGROUND

2.1 GAMBLING

Gambling, "where something of value is risked on the outcome of an event when the probability of winning or losing is less than certain" (Shaffer & Martin, 2011, p.484), is an activity that can take multiple forms. Noteworthy examples throughout history include dice boards in Mexico among the Tarahumara people in the year 3000 BC (Voorhies, 2015), lotteries in China and the Roman empire, respectively (Schwartz, 2006), as well as roulette in Russia during the mid-19th century (Dostoyevsky, 1986). Involvement in more contemporary gambling types, for instance poker, casino, slots or betting (accessible online or in venues), are for some individuals associated with destroyed careers, broken marriages, financial ruin (Blaszczynski & Nower, 2002), or even suicide (Black et al., 2015; Newman & Thompson, 2003).

While gambling is an activity that seems to have entertained humanity for millennia, it is less clear why problematic gambling behavior may persist despite obvious negative consequences, from a research-based and clinical perspective. Research on gambling can be described as a field still in its infancy, and has been depicted as being 20-30 years behind that of substance use (Gooding & Tarrier, 2009). This emphasizes the need to conduct gambling research, in terms of both measurement and treatment procedures.

2.2 DIAGNOSIS AND CLASSIFICATION

With the introduction of the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM–5; American Psychiatric Association, 2013), gambling was equated with alcohol and drug use and labeled an addictive disorder, instead of an impulsive disorder, pathological gambling, in the precursor DSM-IV (American Psychiatric Association, 1994). Gambling was thereby the first "pure" diagnosis of a behavioral addiction, without involvement of any psychoactive agents (Lyons, 2006). One previous DSM-IV criterion, illegal acts to finance gambling (American Psychiatric Association, 1994), was removed in DSM-5 (American Psychiatric Association, 2013). The revised diagnosis, Gambling Disorder (GD), consists of nine criteria. Some GD criteria shares diagnostic similarities with alcohol use disorder (AUD) and substance use disorder (SUD), for instance *withdrawal* i.e., restlessness or irritable when attempting to control or decrease gambling, *tolerance* i.e., needing to gamble with larger amounts to achieve excitement, repeated *unsuccessful attempts* to control or quit gambling, or gambling-related *negative consequences* for significant relationships. Other GD criteria define unique characteristics, such *chasing losses* i.e., gambling to win back money previously lost, or *relying on others* to provide money for continuous gambling or handling gambling-related financial hardships. Furthermore, an assessment of GD symptom severity was introduced in the DSM-5, also in similarity with AUD and SUD. To fulfill GD, a minimum of 4 criteria must be met during the past 12-month period. If fulfilling 4 or 5 criteria GD is labeled mild, if fulfilling 6 to 7 criteria GD is labeled moderate, while fulfillment of 8 to 9 criteria results in a severe GD diagnosis. Most diagnostic research on gambling has been conducted using the clinical criteria of pathological gambling in DSM-IV. Throughout the rest of this thesis the term GD will be used, sometimes alluding to pathological gambling according to DSM-IV, and sometimes to GD according to DSM-5.

Problematic gambling behavior can also be categorized using a more broadly public health-based term, i.e., problem gambling, which refers to various gambling-related problems, for instance defined as "excessive gambling behavior that creates negative consequences for

the gambler, others in his/her social network, and for the community" (Blaszczynski & Nower, 2002).

2.3 PREVALENCE

Research on gambling prevalence has, in general, emanated from the term problem gambling. The Swedish problem gambling population prevalence has been estimated to 2.1% (Abbott et al., 2018). Estimates among clinical samples indicate higher problem gambling prevalence, for instance in primary care (6%; Nehlin et al., 2016), social services (19%; Dahlberg & Anderberg, 2015), or among individuals that are seeking treatment for substance use (23%; Cowlishaw et al., 2014). Prevalence of GD is less explored than problem gambling, particularly since the recent introduction of the revised GD criteria in the DSM-5 (American Psychiatric Association, 2013).

2.4 ETIOLOGY AND EPIDEMIOLOGY

2.4.1 The Biopsychosocial model

Although a variety of experimental, clinical, and epidemiological attempts have been made to explain problem gambling and GD, the etiology remains unclear. The highly esteemed pioneer of behavior therapy in Sweden, Professor Sten Rönnberg, described a Biopsychosocial model for gambling (Ajdahi & Wolgast, 2008). The Biopsychosocial model summarizes a range of factors shown to be associated with problem gambling (e.g., genetics, deviations in brain functioning, psychiatric comorbidity, alcohol use, socioeconomic factors, access to money and gambling, personality traits, properties of gambling types, antecedents for and consequences of gambling, cognitive distortions, and self-efficacy); and how these factors interact to generate and maintain problematic gambling behavior. However, the research-based Biopsychosocial model is too general to give any clinical guidance for treatment, and the vast number of included variables may reflect a lack of knowledge about the etiology, rather than the opposite. From a cognitive behavioral therapy perspective, the purpose of clinical interventions is to reverse empirically validated maintaining factors, such as disorder-related behavioral or thought patterns (Clark, 2004; Cooper, 2007). If too large a number of diverse general factors is included in a clinical model of a disorder, it might lead to a confusion as to what to prioritize in treatment, thus making desired clinical outcomes, such as behavioral change, less likely to occur (see below under 2.6.1 Models for development of cognitive behavioral therapy, for further discussion).

2.4.2 Psychiatric comorbidity

From an epidemiological perspective, it is worth mentioning that gambling seldom occurs as an isolated problem. In an epidemiological study in the general population, Konkoly Thege, Hodgins and Wild (2016) examined the prevalence of substance use and behavioral addictions, such as excessive eating, working or sex. The result indicated that gambling never occurred as a single problem, but was associated with substance use, usually alcohol. Furthermore, psychiatric comorbidities are common. In a meta-analysis of gambling prevalence in the general population Lorains et al. (2011), concluded that multiple comorbid diagnoses were associated with problem gambling and GD, where the most common were nicotine dependence (60.1%), substance use disorders (57.5%), mood disorders (37.9%), and anxiety disorders (37.4%). A similar meta-analysis (Dowling et al., 2015), examined the prevalence of psychiatric comorbidities among treatment-seeking samples with problem gambling. The results indicated that mood disorders (23.1%), and alcohol use disorders (21.2%) were the most common psychiatric comorbidities, followed by anxiety disorders (17.6%), attention deficit hyperactivity disorder (9.3%), and substance (non-alcohol) use disorders (7.0%).

4

2.4.3 The Pathways model

In an effort to explain how psychiatric comorbidity is linked to problem gambling, Blaszczynski and Nower (2002), formulated the etiological Pathways model. Briefly, the Pathways model suggests three gambling subtypes, which manifest impaired control over problematic gambling behavior in distinct ways: (1) Behaviorally conditioned gamblers, who gamble due to learning processes such as conditioning and habit formation; (2) emotionally vulnerable gamblers, who in addition gamble to relieve aversive experiences; and (3) impulsive/antisocial gamblers, who in addition gamble due to impulsive traits, substance use and antisocial behavioral tendencies. The Pathways model has gained increased empirical validity in the gambling research field (e.g., Allami et al., 2017; Ledgerwood & Petry, 2010; Turner et al., 2008; Valleur et al., 2016). The Pathways model also suggests possible targets for treatment, but research has not yet shown whether the proposed subtypes manifest different clinically relevant behaviors.

2.5 MEASUREMENT ISSUES OF PROBLEM GAMBLING AND GAMBLING DISORDER

The research field of gambling and problem gambling has in general been characterized by a wide range of measures, targeting a multitude of gambling-related and non-gambling-related constructs (Caler et al., 2016; Dowling et al., 2017; Molander et al., 2019; Otto et al., 2020; Pallesen et al., 2005; Pickering et al., 2017; Toneatto & Ladouceur, 2003; Williams et al., 2012), which is problematic. For instance, Williams, Volberg and Stevens (2012) compared 202 studies conducted between 1975 and 2012, in an effort to examine the global population prevalence of problem gambling across countries and time. The standardized past year prevalence of problem gambling ranged from 0.5% to 7.6% internationally over time, with an average across all countries of 2.3%. The authors noted several methodological issues that affected problem gambling prevalence rates and made comparisons between studies difficult, for instance variability in measures used to assess problem gambling, differences in problem gambling scoring thresholds used for the same gambling measure, or various time frames used to assess problem gambling. In another study, a comprehensive content analysis of 47 gambling existing measures, Molander et al. (2019), found that items within the measures targeted a wide range of constructs, such as self-reported gambling behavior (e.g., gambling frequency), gambling-related symptoms (e.g., urges or emotional distress/abstinence), gambling-related monetary aspects, negative consequences, cognitive distortions, self-efficacy or motivation. See below under 2.5.1 The Banff consensus agreement (Walker et al., 2006), for a proposed framework of these constructs.

As a diagnosis, GD can be established by using semi-structured diagnostic interviews (e.g., the Structured Clinical Interview for Gambling Disorder [SCI-GD]; Grant et al., 2004), or through self-report measures. However, the relationship between existing gambling measures and GD remains indeterminate. A recent systematic review of gambling measures (Otto et al., 2020), concluded that there was a lack of diagnostic evidence for these measures, in relation to the DSM-5 GD diagnosis. Thirty-one measures from 60 studies were identified. Only one measure, the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987), had been validated against a reference standard semi-structured interview based on the DSM-5 criteria of GD, although no cut-off scores for GD severity (i.e., mild, modest, or severe) were established for the SOGS (Goodie et al., 2013). An obvious further drawback of the SOGS is that the measure could be considered obsolete, as it is based on the clinical criteria of pathological gambling in the 3rd revised edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1987).

A final measurement issue concerns gambling types. Existing gambling measures less frequently include assessment of participation in specific gambling types (see Williams et al., 2017, for a detailed discussion). This is problematic, as different gambling types, e.g., online casino compared to lotteries, might be associated with varying levels of problem gambling and GD severity (see for example Wall et al., 2021).

2.5.1 The Banff consensus agreement

To address issues of variations in gambling outcome measures, an expert panel of gambling researchers convened at the Alberta Gambling Research Institute's 3rd Annual Conference (Walker et al., 2006). A consensus-based framework known as the Banff consensus was formulated, which specified a set of minimal features of gambling outcome measures within three domains: (1) Gambling behavior (net expenditures per month, frequency of gambling in days per month, time spent thinking about or engaged in the pursuit of gambling per month); (2) problems caused by gambling (health, relationships, financial and legal[1]); and (3) treatment-specific measures of proposed mechanisms of change.

Ever since its formulation, the Banff consensus has been influential as a proposed core set for reporting standards in gambling treatment studies, even though it is unclear whether studies have adhered to these recommendations. Although detailed reviews examining the relation between content of gambling measures and the Banff consensus seem to be lacking, both Pickering et al. (2017) and Molander et al. (2019) commented that most existing gambling measures appeared to fail to fulfill the measurement guidelines outlined by Walker et al. (2006). In contrast to the Banff consensus domains 1 (gambling behavior) and 2 (problems caused by gambling), it is not feasible to include domain 3 (treatment-specific measures of proposed mechanisms of change) in a single measure, as domain 3 depends on treatment-specific assumptions, resulting in a range of conceivable theoretical constructs. Using domains 1 and 2 of the Banff consensus as a basis, Study II analyzed the content of six frequently used gambling outcome measures[2] identified in a systematic review (Pickering et al., 2017), as well as the frequently used public health-based measure, the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001) (see Table 1). The results indicated construct underrepresentation (Spurgeon, 2017); i.e., no individual measure, nor any combination of the measures analyzed, seemed to fulfill all the features of the Banff consensus. The measures analyzed commonly included items targeting financial or relationship problems due to gambling but assessed gambling-related health problems or gambling behavior less frequently. Furthermore, to fulfill the Banff consensus features within domain 1 (gambling behavior), measures need to include time-based item response alternatives. Most measures, such as the SOGS (Lesieur & Blume, 1987) or the NORC Diagnostic Screen for Gambling Problems (NODS; Wickwire et al., 2008) use dichotomous

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[1] The Banff consensus was made before the revised clinical criteria in DSM-5, where illegal acts to finance gambling was removed.

[2] The gambling outcome measures were the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987), symptoms according to the diagnostic criteria pathological gambling in DSM-IV (American Psychiatric Association, 1994), the NORC Diagnostic Screen for Gambling Problems (NODS; Wickwire et al., 2008); the Victorian Gambling Screen (VGS; Tolchard & Battersby, 2010), the Gambling Symptom Assessment Scale (G-SAS; Kim et al., 2009) and the Timeline follow-back for gambling (TLFB-G; Hodgins & Makarchuk, 2003).

"Yes" or "No" item responses, or, such as in the PGSI (Ferris & Wynne, 2001), vague verbal responses, e.g., "Never", "Sometimes", "Most of the time", or "Almost always".

Table 1
Content validity of frequently used gambling measures in relation to the recommended features of the Banff consensus agreement

Measures[a]	SOGS	DSM-IV	NODS	VGS	G-SAS	TLFB-G	PGSI
Gambling-related content of measure	Symptoms, DSM-III criteria	Symptoms, DSM-IV criteria	Symptoms, DSM-IV criteria	Harms, enjoy-ment	Urges, thoughts, behaviors	Behaviors, time, expenditures	Symptoms, DSM-III criteria
Includes items assessing feature of the Banff consensus agreement							
Gambling behavior per month							
Net expenditures	No	No	No	No	No	Yes	No
Day's gambling	No	No	No	No	Partially	Yes	No
Time pre-occupation	No	No	No	No	Partially	No	No
Problems caused by gambling							
Health	No	No	No	No	Yes	No	Yes
Relationships	Yes	Yes	Yes	Yes	Yes	No	No
Financial	Yes	Yes	Yes	Yes	Yes	No	Yes
Legal[b]	No	Yes	No	No	Yes	No	No

Note. [a]All measures, except the PGSI, were used in 9% or more of the gambling studies identified in a systematic review by Pickering et al. (2017).

[b]The Banff consensus agreement was published before illegal activities to finance gambling were removed from the GD diagnosis, in the revised DSM-5 criteria (American Psychiatric Association, 2013).

SOGS = The South Oaks Gambling Screen (Lesieur & Blume, 1987); DSM-IV = The criteria for pathological gambling according to DSM-IV (American Psychiatric Association, 1994); GD = The diagnostic criteria for Gambling Disorder according to DSM-5 (American Psychiatric Association, 2013); NODS = The NORC Diagnostic Screen for Gambling Problems (Wickwire et al., 2008); VGS = The Victorian Gambling Screen (Tolchard & Battersby, 2010); G-SAS = The Gambling Symptom Assessment Scale (Kim et al., 2009); TLFB-G = The TimeLine Follow-Back for Gambling (Hodgins & Makarchuk, 2003a; Weinstock et al., 2004); PGSI = The Problem Gambling Severity Index (Ferris & Wynne, 2001).

Table adapted from Molander et al. (2021), with permission from the publisher through the Creative Commons Attribution License 4.0.

2.5.2 Development of the Gambling Disorder Identification Test

As a response to the measurement issues described above, a process was initiated to develop the Gambling Disorder Identification Test (GDIT), as a DSM-5 based gambling measure, analogous to the Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993) and the Drug Use Disorders Identification Test (DUDIT; Berman et al., 2005). The Banff consensus (Walker et al., 2006) was used as an overall benchmark throughout the GDIT development process.

In the first step (see Molander et al., 2019), four gambling researchers participated in content analysis and categorization of 583 unique items from 47 existing gambling measures, which resulted in the selection of 30 candidate items for the GDIT. In the second step (Study I) a draft version of the GDIT was formulated, through international researcher consensus processes, and feedback from stakeholders with their own experiences of problem gambling and GD. In the third step (Study II), psychometric properties of the GDIT were evaluated among four cohorts of gamblers, including validation in relation to the DSM-5 criteria of GD.

The final GDIT measure consisted of 14 items within three domains (gambling behavior, gambling symptoms, and negative consequences). In addition, gambling expenditures and involvement in gambling types are assessed in a separate appendix page. In similarity with the AUDIT and the DUDIT, GDIT items are assessed using frequency and time-based multiple choice response alternatives. The GDIT is in the public domain and is available at https://gditscale.com/. See Figure 1 for an overview of the GDIT.

Figure 1
Overview of the Gambling Disorder Identification Test (GDIT)

GDIT Gambling Disorder Identification Test

Here are a few questions on gambling. We thank you for responding as correctly and honestly as possible by indicating the response that is right for you.

	☐ Man ☐ Woman ☐ Other alternative			Age _____			
1. How often do you gamble?	Never ☐	Monthly or less ☐	2-4 times a month ☐	2-3 times a week ☐	4 or more times a week ☐	Daily ☐	Several times a day ☐
2. How much time do you spend gambling on a typical day?	No time ☐	Less than an hour ☐	1-2 hours ☐	3-4 hours ☐	5-6 hours ☐	7-9 hours ☐	10-24 hours ☐
3. How much time do you spend thinking about gambling on a typical day?	No time ☐	Less than an hour ☐	1-2 hours ☐	3-4 hours ☐	5-6 hours ☐	7-9 hours ☐	10-24 hours ☐

	Never	Less often than monthly	Monthly	Weekly	Daily or almost daily
4. How often have you tried to control, cut down or stop your gambling, in the past 12 months?	☐	☐	☐	☐	☐
5. How often have you gambled to win back money you lost on gambling, in the past 12 months?	☐	☐	☐	☐	☐
6. How often, in the past 12 months, have you gambled more than you planned (more occasions, longer time or larger sums)?	☐	☐	☐	☐	☐
7. How often have you lied to others about your gambling, in the past 12 months?	☐	☐	☐	☐	☐
8. How often have you borrowed money or sold something to obtain money for gambling, in the past 12 months?	☐	☐	☐	☐	☐
9. How often have you gambled as a way of escaping problems or relieving negative feelings, in the past 12 months?	☐	☐	☐	☐	☐
10. How often have you gambled with larger sums to get the same feeling of excitement as before, in the past 12 months?	☐	☐	☐	☐	☐

	No	Yes, but not in the past year	Yes, in the past year
11. Have you or anyone close to you experienced financial problems due to your gambling?	☐	☐	☐
12. Has your gambling worsened your mental health?	☐	☐	☐
13. Have you experienced serious problems in any important relationship because of your gambling?	☐	☐	☐
14. Have you experienced serious problems at work or in school because of your gambling?	☐	☐	☐

Turn page

Figure 1 (continued)

Appendix: Expenditures and gambling types

Think back to last month (e.g., if it is now May, think back to April). Try to estimate the quantity you spent in US $ as accurately as possible.

What was your **income** after tax last month (including salary and grants)? $

How much money did you **wager** last month on gambling? $

How much money did you **win** last month by gambling? $

How much money did you **lose** last month by gambling? $

If some gambling types have led to negative consequences for you (for example in your finances, health, relationships, work or studies), please indicate which ones apply for you.

	Gambling machines/ slots	Poker	Casino	Sports betting	Horse betting	Bingo	Lotteries	Instant lotteries	Other types of gambling
Internet/ online	☐	☐	☐	☐	☐	☐	☐	☐	☐
Physcial venue	☐	☐	☐	☐	☐	☐	☐	☐	☐

GAMBLING TYPES (EXAMPLES)

Gambling machines/slots	Poker	Casino table games	Sports betting	Horse betting
Electronic gambling machines (EGMs) Video lottery terminals (VLTs) Slot machines Poker machines Any other form of gambling in which a physical or virtual machine rapidly display results and instantly accepts new wagers.	Texas hold'em Any other kind of poker game against other players (not a casino croupier)	Roulette Black Jack Sic Bo Craps Baccarat Caribbean Stud Poker (and similar casino poker games played against a casino croupier) Any other casino game with cards, wheels or dice.	Betting on any kind of sports event In-game betting (during a sports event) Spread betting Esports betting Fantasy sports betting	Any form of betting on horses

Bingo	Lotteries	Instant lotteries	Other types of gambling
Any form of bingo, regardless of how numbers are drawn and displayed.	Lottery tickets Lotto Keno Any other type of lottery of the traditional type.	Instant lottery tickets Scratch cards, either physical or online	Speculative financial activities (e.g., buying penny stocks, non-professional day trading) Televised guessing games Illegal gambling in a physical venue Specify – not listed above _____

10

2.6 COGNITIVE BEHAVIORAL THERAPY FOR PROBLEM GAMBLING AND GAMBLING DISORDER

CBT is first-choice treatment for problem gambling and GD (The Swedish National Board of Health and Welfare, 2017). CBT for problem gambling and GD has been delivered in a broad range of settings, as traditional face-to-face (Petry et al., 2006), as group therapy (Oei et al., 2010) as well as in different online self-help programs with or without the support of a therapist (iCBT; Carlbring & Smit, 2008). Meta-analyses and reviews have concluded that CBT for problem gambling and GD is effective for reducing gambling behavior and related problems (Cowlishaw et al., 2012; Pallesen et al., 2005). For example, Pallesen et al. (2005) found that the overall between-group (treatment versus no treatment) effect size was 1.59 (p<.01) at follow-up (averaging 17 months).

With regard to treatment content, CBT for problem gambling and GD have mainly included adaptations of interventions found to be effective for other conditions or disorders. Few existing CBT protocols for problem gambling and GD are based on a thorough functional analysis of why problematic gambling behavior persists, even though these phenomena have generated basic research on the learning processes involved (Ramnerö et al., 2019). Some CBT programs for problem gambling and GD have been delivered as "broad spectrum antibiotics", offering a wide range of general CBT interventions (see Gooding & Tarrier, 2009, for a review of treatment intervention content for problem gambling), while interventions targeting key gambling behaviors such as "chasing losses" or "loss of control" have been lacking (Molander et al., 2020). This can be problematic in several regards, for example on what to prioritize in treatment, or for measurement of proposed mechanisms of change in clinical trials.

2.6.1 Models for development of cognitive behavioral therapy

Models for development of CBT have often emphasize a bottom-up approach. Cooper (2007) described an iterative model for behavioral treatment development. In the first step, information is gathered using indirect and descriptive assessment (e.g., semi-structured interviews). During the second step, the information is interpreted, and hypotheses regarding onset and maintenance of problem behaviors are formulated. In the third step, the hypotheses are tested using behavioral analysis. As a fourth and final step, specific interventions are developed based on the function of the problem behavior.

Clark (2004) recommends a similar model for development in cognitive therapy. In the first step, interviews and cognitive assessment instruments are used to identify hypotheses on problematic cognitions and behaviors. During the second step, a simple clinical model is framed, which explains how problematic cognitions and behaviors are maintained. In the third step of the treatment development, the hypotheses are tested in laboratory experimental studies. In the fourth step, specific interventions to target and reverse the identified problematic cognitions and behaviors, are selected, or developed, and formulated as treatment protocols. In the fifth step, treatment is evaluated in clinical trials. In the sixth and final step, treatment is made broadly available through dissemination.

2.6.2 Development and dissemination of a novel cognitive behavioral treatment for Gambling Disorder

A novel cognitive behavioral treatment for GD was developed, using bottom-up methods inspired by Clark's (2004) and Cooper's (2007) treatment development models. In the first step of the treatment development process, a review of experimental evidence on experimentally verified behavioral processes was conducted (Ramnerö et al., 2019). The results indicated that several learning principles had been experimentally verified, for instance delay and probability discounting, reinforcement without actual winning, and rule

governed behavior, and that gambling treatment should include interventions that enhance extinction learning. In the second step, a qualitative study was conducted (see Study III). The study formulated hypotheses on the maintenance of GD, by identifying clinically relevant behaviors at an individual level among six treatment-seeking participants with GD. Building upon the first and second steps, a clinical model of psychological processes involved in GD was developed (see Figure 2), as well as corresponding cognitive behavioral interventions. In the third step, the novel treatment content was framed in an internet-delivered treatment protocol, and disseminated into routine addiction care, through the nationally available ST platform for internet-based treatments within the Swedish health-care system. A simultaneous feasibility study (see Study IV and the research protocol described in Molander et al., 2020) evaluated treatment acceptability and safety, recruitment and measurement procedures, and potential effectiveness.

2.6.3 A clinical model for Gambling Disorder

The clinical model for GD (Molander, 2022, unpublished manuscript) emanates from gambling-related loss of control, in similarity with the Pathways model (Blaszczynski & Nower, 2002). Briefly, the clinical model for GD (see Figure 2) states the most common stimuli or triggers lies in the situations that offer an opportunity to gamble, of which access to money is the most notable antecedent (see Study III). Furthermore, when faced with an opportunity to gamble, individuals with GD experience a state of reward expectancy, where gambling immediately is perceived as favorable, regardless of previous experience, for example regarding gambling-related negative consequences. The gambling situation is, in several ways, a rigged stimulus array (Ramnerö et al., 2019) designed to produce continuous betting, no matter what the outcome. On a superficial level, placing a bet is an exciting activity (see Study III). Winning is associated with a kick and euphoria, as well as a desire for winning more. Losing is associated with anxiety and a desire for revenge to win back the money lost. Gambling is also an activity associated with a state of dark flow, which sets the stage for continuous autopilot play during gambling, as well as onset of future gambling behavior. Finally, between-gambling session chasing behaviors, such as chasing losses, money, or further opportunities to gamble, increase the likelihood of future gambling episodes among individuals with GD.

Figure 2
A clinical model for Gambling Disorder
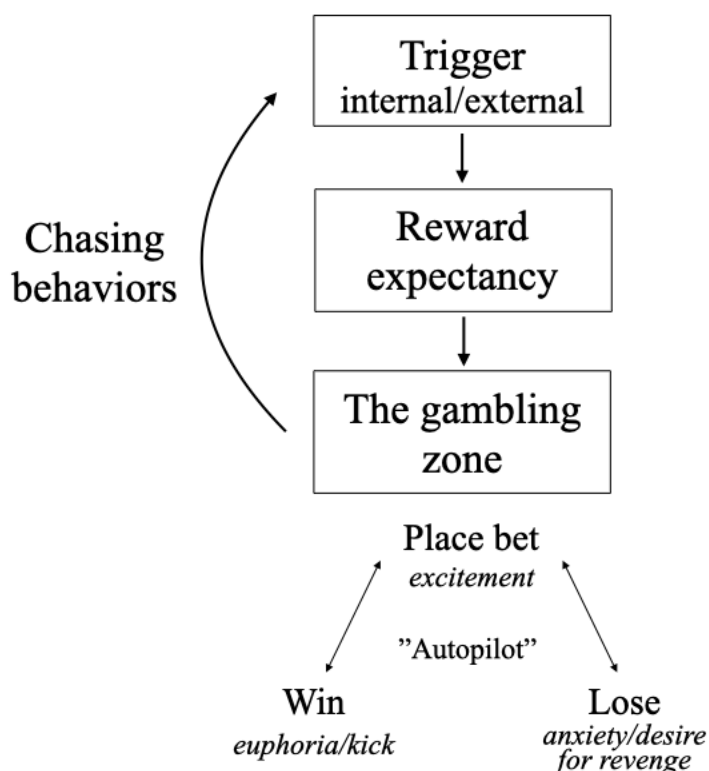
2.6.4 Hypotheses of the clinical model for Gambling Disorder
The clinical model for GD emanates from loss of control over gambling behavior, based upon the following hypotheses:

1. Commonplace stimuli, such as access to money, may trigger gambling episodes in individuals with GD.
2. Circumstances that activate reward expectancy will produce increased gambling behavior among individuals with GD.
3. Individuals with GD who experience a state of dark flow during gambling, are more likely both to prolong gambling behavior and to gamble again.
4. Various kinds of chasing behaviors, between gambling episodes, increase the likelihood to initiate further gambling episodes, among individuals with GD.

Below, each hypothesis of the clinical model for GD (Molander, 2022, unpublished manuscript) is discussed.

2.6.4.1 *Hypothesis 1: Commonplace stimuli, such as access to money, may trigger gambling episodes in individuals with GD.*
When we investigated the context of gambling behavior in Study III, a striking feature was that study participants reported commonplace antecedents, such as being alone, time of the day (e.g., evenings), and being at home. Furthermore, all described that having access to money, such as receiving salary or having money in their bank, or gambling accounts, clearly triggered their gambling. For example, one of the participants described a monthly pattern where he gambled using all his salary as soon as the amount was transferred to his

bank account. From there on, he lived without money for a couple of weeks, often thinking that he did not want to gamble again. However, as soon as the new salary was transferred to his bank account, he started to gamble online again until the salary was gone, often gambling the whole night through.

Arguably, access to money as an antecedent to gambling behavior is not a novel hypothesis (see for example Ajdahi & Wolgast, 2008). Ever since Hodgins and El-Guebaly's classic qualitative study (2000), where participants with GD, who had been able to recover on their own, described that various ways of limiting themselves from being able to gamble had been helpful for them, stimulus control strategies such as reducing gamblers' access to money by handing over control of bank accounts to significant others, have been commonly emphasized in CBT protocols for GD (see Gooding & Tarrier, 2009). Furthermore, building on the same principles, a national online self-exclusion service from licensed gambling providers called Gambling pause (*Spelpaus.se*, 2021), was introduced in Sweden in 2019.

Experimental evidence supporting a relationship between access to money and gambling behavior seems scarce. However, in this context it might be worth mentioning some important experimental research conducted on gambling behavior and delay discounting. Briefly, delay discounting is a process where long-term consequences are discounted (depreciated) in relation to smaller, more immediate rewards. From a behavioral analytical perspective, discounting has been proposed as a key feature of gambling behavior (Ramnerö et al., 2019). Experimental studies have shown that individuals with GD discount long term rewards (see for example Dixon et al., 2003; Petry, 2012), although direct comparisons between individuals with GD and recreational gamblers seem scarce. Furthermore, delay discounting has also been shown to be susceptible to manipulation by external stimuli. Dixon et al. (2006) conducted an experiment where participants with GD completed a delay discounting task in two conditions: in a gambling context, a betting facility where the participants regularly gambled, compared to a non-gambling context, for example in coffee shops or restaurants. Sixteen of the 20 participants discounted delayed rewards more in the gambling context, indicating that differences in context (external stimuli) might change the subjective valuation of delayed rewards among individuals with GD.

The recent rapid development of online gambling, offering continuous possibilities to gamble e.g., via smartphones, has increased the accessibility of gambling opportunities beyond geographic gambling facilities or opening hours. For example, only one participant in Study III described a specific time as a terminating event for gambling. This participant was the only one who only gambled on the stock market (day trading), which – compared to other gambling types played online by the other participants in the study – was not accessible around the clock. As such, it might be argued that access to money serves as the main contemporary discriminative stimuli for discounting processes and possible subsequent gambling behavior among individuals with GD, and that other external stimuli might be less important.

In sum, the qualitative finding that commonplace stimuli, such as access to money, may trigger gambling episodes in individuals with GD, is a plausible hypothesis. Previous research has shown that delay discounting is an important gambling-related process which is susceptible to contextual manipulation. Access to money might be one contextual antecedent (i.e., external trigger), which remains to be investigated in experimental studies.

*2.6.4.2 Hypothesis 2: Circumstances that activate reward expectancy will produce
increased gambling behavior among individuals with GD.*

All treatment-seeking participants with GD in Study III described that they experienced expectancy of rewards before they started to gamble. This state, expressed as "anticipation", "excitement", or "exhilaration", was often experienced in relation to gaining access to money, for example receiving a salary.

Expectancy of rewards is a psychological process which has been investigated in previous research. For instance, in a video lottery experimental study Ladouceur et al. (2003), showed that gamblers exposed to high versus low gambling expectation conditions experienced a faster heart rate antecedent to, and during gambling. Self-reports indicated that it was the expectancy of winning money that was more exciting, compared to playing the game in itself. Individuals fulfilling the criteria for GD have also been shown to have abnormal neural responses associated with monetary wins. van Holst et al. (2012), investigated neural responsiveness during reward and loss expectation among patients with GD compared to a control group of healthy subjects, in a functional magnetic resonance image study. The results showed that the patients with GD had higher activity in the reward system during reward expectation, while no group differences in the loss value system were observed; indicating abnormally increased reward expectancy coding among individuals with GD, thus rendering them overoptimistic to potential gambling outcomes.

Furthermore, gambling-related physiological arousal and subjective excitement have been investigated in several studies, both during and as antecedents to gambling behavior. For example, Meyer et al. (2000) conducted an experiment where gamblers played blackjack for their own money, compared to accumulation of points. Both heart rate and salivary cortisol were elevated for the participants in the experimental money-betting condition, indicating that gambling-related behavior increased cardiovascular activity. Leary and Dickerson (1985), compared low-, and high-frequency gamblers who, prior to gambling on a poker machine using their own money, were presented with gambling stimuli compared to neutral stimuli. Neither of the stimuli conditions resulted in increased arousal, as measured by heart rate and subjective arousal. However, poker machine gambling increased arousal in both groups, with significant greater arousal demonstrated in the high frequency players. Diskin and Hodgins (2003) compared participants with and without GD, who gambled at a video lottery terminal. In contrast to the study by Leary and Dickerson (1985), both groups experienced similar levels of increased physiological arousal, as measured by electromyographic activity, skin conductance level and heart rate. However, the group with GD rated their levels of subjective excitement higher than the group without GD, indicating that individuals with GD might perceive their responses to gambling-related situations differently than those without GD.

In sum, evidence of gambling-related reward expectancy and physiological arousal has been provided in previous experimental studies. Whether reward expectancy also produces increased gambling behavior among individuals with GD, seems to remain to be studied further.

2.6.4.3 *Hypothesis 3: Individuals with GD who experience a state of dark flow during
gambling, are more likely both to prolong gambling behavior and to gamble
again.*

All treatment-seeking participants with GD in study III stated that they experienced a positive state of increased focus, while they gambled. This state, categorized as the "zone" in the above-mentioned qualitative study, was described by the participants as "focus", "concentration", "entering a bubble", or "all thoughts on gambling", and was often

associated with a feeling of escaping reality (sometimes also avoiding negative thoughts or feelings), tunnel vision, lost perception of time, as well as continuing gambling until all money were gone.

Interestingly, this gambling zone is not novel finding. The anthropologist Schull (2005) describes a similar "slot machine zone", where everything outside the gambling experience becomes irrelevant to gamblers, as they become completely absorbed by the game. This "slot machine zone" also results in negative consequences, for example avoidance of symptoms of anxiety and depression among emotionally vulnerable gamblers, as proposed by the Pathways model (Blaszczynski & Nower, 2002). Furthermore, Dixon et al. (2018) coined the expression "dark flow", a flow-like state associated with multiline slot gambling (i.e., slot games with several reels) and GD. In an experimental study, Dixon et al. (2018) investigated the relationship between dark flow, depression, and multi-line slot gambling. Casino visiting gamblers were assessed with self-report measures and played a slot machine simulator with a force transducer that measured how hard players pressed the spin button after different outcomes (i.e., a behavioral measure for arousal), in two conditions: single-, versus multi line slots play. The result showed that expectancy, depression, and dark flow correlated in the multiline condition. The participants experienced more positive affect playing the multi-line slots, which they also preferred, compared to the control single line slot condition. Finally, self-reported problem gambling scores were correlated with dark flow in both conditions but showed a stronger relationship for the multi-line slots play. Subsequent experimental studies have replicated and expanded these findings (Dixon et al., 2019, 2019; Kruger et al., 2021).

In sum, it has been suggested that emotional experiences associated with a "slot machine zone", can be potent reinforcers for gambling behavior, aside from monetary aspects, such as wins and losses. Experimental evidence of a similar "dark flow" term, has been provided for recreational slot gamblers. The hypothesis that individuals with GD who experience dark flow are more likely to prolong gambling behavior and to gamble again, is plausible, but remains to be studied further. Also, the relationship between dark flow and gambling types other than slots, needs to be investigated in further studies.

2.6.4.4   *Hypothesis 4: Various kinds of chasing behaviors between-gambling episodes, increase the likelihood to initiate further gambling episodes, among individuals with GD*

Several chasing behaviors after a gambling episode had ended, were described by the treatment-seeking participants with GD in Study III. The participants described that they were engaged in a range of behaviors to be able to gamble again, for example waiting for salary, taking loans, selling possessions, gambling for smaller sums to increase gambling time, lying to others about gambling to be able to continue gambling, planning gambling strategies, or preparing for gambling by visiting online forums. Furthermore, some, but not all participants described in general that they "chased losses", i.e., gambled again to win back previous gambling-related monetary losses. Two participants described that "chasing wins" or "chasing missing wins" was an important motive for them to continue to gamble.

While some of the above described between-gambling episode chasing behaviors might have been less discussed in gambling research, chasing of both wins and losses during gambling is consistent with the theoretical Pathways model (Blaszczynski & Nower, 2002). In similar, chasing losses has been proposed as a key criterion of GD (Breen & Zuckerman, 1999). In a functional magnetic resonance imaging study Campbell-Meiklejohn et al. (2008) examined neural activity among healthy participants who, in a loss-chasing game, decided to chase losses or quit gambling to prevent further losses. The results indicated that

chasing losses was associated with increased activity in neural areas linked to motivation and expectancy for reward, while quitting gambling to prevent further losses, was associated with cortical areas linked to anxiety. Losing money has also been investigated as a reinforcer influencing aversive learning (Delgado et al., 2006). Overall though, experimental studies on loss chasing (both during, and between gambling episodes) seem surprisingly rare (Ramnerö et al., 2019).

In sum, chasing behaviors during gambling have been suggested as key features of GD in previous theoretical and brain imaging studies. However, the hypothesis that chasing behaviors between-gambling episodes, increase the likelihood to initiate further gambling episodes among individuals with GD, remain to be investigated.

2.6.5 Internet-delivered cognitive behavioral treatment for problem gambling and Gambling Disorder

Based on the clinical model for GD, a cognitive behavioral therapy protocol was developed, aligning interventions for the respective psychological processes in the model. The treatment protocol was adapted to an internet-delivered format (the iCBTG) and consisted of one assessment module and nine subsequent treatment modules. Initially during the treatment, psychoeducation (information) was presented on psychological processes involved in problem gambling/GD. Discrimination training, i.e., registration of individual gambling-related situations, was also included (see Table 2). Thereafter, a treatment rationale was presented, to increase voluntary control over gambling behavior (or other gambling-related issues) in gambling-related situations, through completion of continuous behavioral exercises. The instructions of the behavioral exercises were to seek out individual gambling-related situations and act differently than before, e.g., have access to a small amount of money on a bank account and use it for other things than gambling (see Table 2 below, for some more examples of iCBTG behavioral exercises). Various such behavioral exercises were also rated in a Difficulty rating task. During the rest of the treatment protocol, performance of repeated individual behavioral exercises with increasing difficulty was emphasized, in relation to the processes in the clinical model for GD. The treatment ended with a treatment summary and a maintenance plan. See Table 2 for detailed content of the iCBTG, and Figure 3 for some examples of iCBTG behavioral exercises for different clinical processes.

Table 2

Overview of iCBTG treatment components

Module	Brief description	Content and exercises
0	Introduction to online treatment and collection of pre-measures	-
1	Why problem gambling persists Presentation of clinical model	Discrimination training[a] A first step towards behavior change
2	Loss of control in gambling situations Strategies and loss of control	Identify strategies Discrimination training[a]
3	Behavioral exercises	Difficulty rating of gambling situations Discrimination training[a] Behavioral exercises targeting loss of control
4	How thoughts are affected by gambling: 'Chasing' and 'autopilot' gambling	Discrimination training[a] Behavioral exercises targeting loss of control
5	Why gambling situations continue to be challenging: Reward expectancy before gambling	Discrimination training[a] Behavioral exercises targeting loss of control
6	What happens while gambling: Common reactions, 'the zone'	Discrimination training[a] Behavioral exercises targeting loss of control
7	What happens while gambling: Other reactions facilitating continuous gambling behavior	Discrimination training[a] Behavioral exercises targeting loss of control
8	Further behavioral exercises	Discrimination training[a] Behavioral exercises targeting loss of control
9	Further behavioral exercises	Discrimination training[a] Behavioral exercises targeting loss of control
10	Treatment summary Maintenance plan Collection of post-measures	Individual evaluation and treatment summary Continuous behavioral exercises

Note. Reprinted table from Molander et al. (Molander et al., 2020), with permission from the publisher through the Creative Commons Attribution License 4.0.

[a]Discrimination training refers to the deliberate observation of one's own responses in the context where these responses are emitted, and the observation of contextual factors that may influence these responses.

iCBTG = Internet-delivered Cognitive Behavioral Therapy for problem gambling and Gambling Disorder

Figure 3

Examples of behavioral exercises for different processes of the clinical model for Gambling Disorder

Access to money

During the treatment program, Per has practiced being able to manage his economy, as well as telling the truth to his partner. Per uses *Spelpaus* but has been gambling anyway a few times lately. Per cannot really explain how this has happened; he has started to gamble almost automatically. After talking to his partner, Per decides to discuss this with his psychologist.

Per's psychologist was glad that Per dared to share what has happened, as they had an opportunity to work on increasing Per's control. They plan the following behavioral exercise. Per will log in to a webpage he gambles at, once a day. Immediately after that, he will shut down the page and do something else. Per is not going to gamble. The first times Per does the exercise, he will have his partner with him. Depending on how difficult the exercise is, Per can go on to do the exercise himself, or do the exercise several times a day.
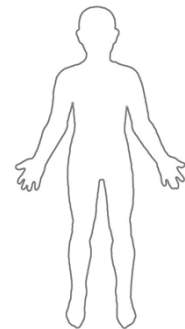
PER

Reward expectancy

For Anne, life works quite well if she has no opportunities to play. But every time Anne gets money deposited in her bank account (usually salary), she automatically ends up in "gambling mode". Suddenly it feels like a good idea to gamble, which Anne usually does, often all night until the money runs out.

Together with her partner Anne plans an exercise she will practice for several weeks to come. Anne's partner (who has taken over Anne's economy) will periodically deposit small sums into Anne's account for a period of three weeks. Anne will log in to the account and experience the feeling of anticipation/expectancy, and then practice breaking her habit of using the money to gamble. Anne will say to herself "now I'm in gambling mode" and then try to do other things than gambling, for instance buy something else for the money, leave the money on the account or do something completely different. Anne and her partner also agree not to quarrel or interrupt the exercise if Anne "fails" and uses the money to gamble at some point.
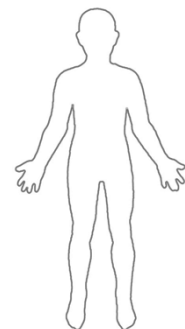
ANNE

The gambling zone

Jonas wants to work on increasing his control over his gambling. Jonas identified with the treatment text about "the zone", but he is not sure why he continues to place bets when he gambles. Jonas therefore plans to do a behavioral exercise where he will gamble without betting real money and notice what happens.

Jonas will log in to a webpage that offers gambling without placing bets using real money. Jonas will do the exercise every day at 14.00 and "gamble" for 10 minutes, then he will close the webpage for the day. While Jonas is playing, he will carefully notice how it feels when he plays, if, when and why he wants to bet money.
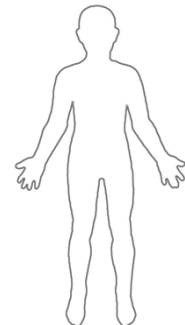
JONAS

Chasing behaviors

Sten often struggles with thoughts of winning money back, to get rid of his gambling debts. Together with a friend who is an economist, Sten plans a behavioral exercise, were Sten will practice for several weeks to come. First, Sten and his friend estimate how long he's been thinking about and gambling to chase losses (about 3 years). Next, they go through Sten's bank account history. They estimate if Sten's gambling losses have decreased or increased during the last three years and summarize the result on a piece of paper. At the bottom, Sten writes in big black letters DO NOT GAMBLE IN THE FUTURE TO WIN BACK MONEY. IT DESTROYS MY ECONOMY AND MY LIFE.

Every time Sten thinks about chasing losses during the next three weeks, he will say to himself "now I'm in gambling mode trying to chase losses". Then Sten will apply a rule (like when Sten is being very careful to put on his seatbelt when he drives a car). Sten will pick up the paper with the bank account result from his rucksack and read it. When Sten is done, he will do something else, preferably some activity that Sten likes.
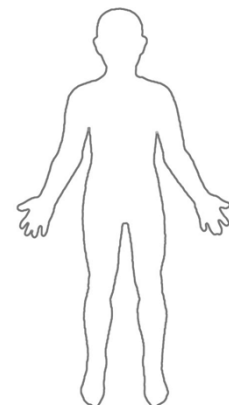
STEN

3 RESEARCH AIMS

The overall objective of the thesis was to develop and evaluate novel measures and treatments for GD. Specific aims for the studies are describes below.

3.1 STUDY I

The aims of Study I were to reach a consensus regarding a specific set of potential new measurement items, to yield a testable draft version of a new gambling measure, and to establish preliminary construct and face validity for this novel gambling measure, the Gambling Disorder Identification Test (GDIT).

3.2 STUDY II

The aim of Study II was to evaluate psychometric properties (e.g., internal consistency and test-retest reliability, factor structure, convergent and discriminant validity, as well as diagnostic accuracy) of the GDIT, among treatment- and support-seeking samples ($n = 79$ and $n = 185$), self-help groups ($n = 47$), and a population sample ($n = 292$).

3.3 STUDY III

The aim of Study III was to formulate hypotheses on the maintenance of GD by identifying clinically relevant behaviors at an individual level, among six treatment-seeking participants with GD. This qualitative study was conducted as a preparatory step to develop the iCBTG (see Study IV).

3.4 STUDY IV

The aim of Study IV was to evaluate acceptability and clinical effectiveness of the newly developed iCBTG, among treatment seeking-patients with GD ($n = 23$) in routine care. A further aim was to evaluate research feasibility of using existing healthcare infrastructure to deliver the iCBTG program.

4 EMPIRICAL STUDIES

4.1 STUDY I: DEVELOPMENT OF THE GAMBLING DISORDER IDENTIFICATION TEST (G-DIT): RESULTS FROM AN INTERNATIONAL DELPHI AND CONSENSUS PROCESS.

Aim

The aims were to reach a consensus regarding a specific set of items, to yield a testable draft version, and to establish preliminary construct and face validity of the Gambling Disorder Identification Test (GDIT).

Methods

Gambling experts from 10 countries participated in an international two round Delphi ($n = 61$, and $n = 30$), rating 30 items proposed for inclusion in the GDIT. Gambling researchers and clinicians from several countries participated in three consensus meetings ($n = 10$; $n = 4$; $n = 3$). User feedback was obtained from individuals with experience of problem gambling ($n = 12$) and from treatment-seekers with GD ($n = 8$).

Main Results

Ten items fulfilled Delphi consensus criteria for inclusion in the GDIT (M $\geq$ 7 on a scale of 1–9 in the second round). The consensus meetings addressed item-related issues, such as double- or triple-barreled phrasing. Also, four more items were added to conform to the Banff agreement recommendations, yielding a final draft version of the GDIT with 14 items in three domains: gambling behavior, gambling symptoms and negative consequences. Some additional adjustments in the draft version were made for response alternatives in the gambling behavior domain and in the expenditures appendix, after feedback from stakeholders with their own gambling experience, which yielded a final testable GDIT version.

4.2 STUDY II: THE GAMBLING DISORDERS IDENTIFICATION TEST (GDIT): PSYCHOMETRIC EVALUATION OF A NEW COMPREHENSIVE MEASURE FOR GAMBLING DISORDER AND PROBLEM GAMBLING.

Aim
The study aim was to evaluate psychometric properties (e.g., internal consistency and test-retest reliability, factor structure, convergent and discriminant validity, as well as diagnostic accuracy) of the GDIT, among treatment- and support-seeking samples (n = 79 and n = 185), self-help groups (n = 47), and a population sample (n = 292), (total N = 603).

Methods
Participants (n = 603) completed online self-report measures, a GDIT retest (n = 499), as well as diagnostic semi structured interviews assessing GD (n = 203).

Main Results
The GDIT showed excellent internal consistency reliability (α = .94) and test–retest reliability (6-16 days, intraclass correlation coefficient = 0.93). Confirmatory factor analysis yielded factor loadings supporting the three proposed GDIT domains of gambling behavior, gambling symptoms, and negative consequences. Measurement invariance analyses showed that the GDIT factor structure was largely consistent across gender, and that the weakest item was $GDIT_{item}14$. Regarding age, the differences in factor structure between young adults (18-30 years old) and older participants were attributable to items within the GDIT negative consequences domain, which might be explained by the fact that gambling-related negative consequences presumably affect younger and older individuals differently due to disparate life circumstances. The GDIT correlated positively with existing gambling measures, i.e., the widely used PGSI (Ferris & Wynne, 2001) and the PPGM (Williams & Volberg, 2013) (r = .90 and r = .89, respectively), supporting convergent validity with these measures. In terms of convergent validity, the GDIT also correlated positively with having gambling debts (r = .68). The GDIT score showed smaller positive correlations with measures assessing attention deficit hyperactivity disorder (the Adult Attention-Deficit/Hyperactivity Disorder Self-Reporting Rating Scale [ASRS; Kessler et al., 2005] ; r = .37) and bipolar disorder (the Mood Disorder Questionnaire [MDQ; Hirschfeld et al., 2000]; r = .34), as well as negative correlations with various domains related to quality of life (the World Health Organization Quality of Life, 26-item version [WHOQOL-BREF; Skevington et al., 2004]; r = −.40 to −.30), which indicated discriminant validity. Finally, receiver operating characteristic curves and clinical significance indicators were used to estimate GDIT cut-off scores in relation to recreational (<15) and problem gambling (15-19), any GD (≥20), mild GD (20-24), moderate GD (25-29), and severe GD (≥30).

4.3 STUDY III: WHAT TO TARGET IN COGNITIVE BEHAVIORAL TREATMENT FOR GAMBLING DISORDER - A QUALITATIVE STUDY OF CLINICALLY RELEVANT BEHAVIORS

Aim

The aim was to formulate hypotheses on the maintenance of GD by identifying clinically relevant behaviors at an individual level, as a preparatory step for developing a novel internet-delivered cognitive behavioral treatment.

Methods

Six individuals with GD and diverse symptom profiles of psychiatric comorbidity (corresponding to the Pathways subtypes) were interviewed using an in-depth semi-structured functional interview; they also completed self-report measures assessing gambling behavior.

Main Results

Functional analysis was used as a theoretical framework for a thematic analysis, which yielded the following categories: 1) antecedents that may increase or decrease gambling; 2) experiences accompanying gambling; 3) control strategies; 4) consequences of gambling behavior; and 5) events terminating gambling behavior. The results indicated that positive and negative emotions could be both antecedents and functions of gambling behavior. Avoidance-based strategies were commonly used to control gambling. One drawback with such strategies may be that individuals fails to learn control of behavior in the presence of the antecedents that tend to result in gambling behavior. Some potential reinforcers were identified, which could be addressed in new developments in cognitive behavioral treatment for GD. Sudden access to money, such as receiving salary, clearly triggered gambling. Also, access to money was related to feelings of expectancy, anticipation or excitement, where the possibility to gamble was seen in a favorable way. Furthermore, a common pleasant experience during gambling was increased focus (i.e., entering a gambling "bubble" or a "zone"), which was associated a feeling of escaping reality, tunnel vision or lost perception of time. Finally, gambling involved chasing behaviors, such as chasing losses or wins, meaning that participants continued to gamble to either recoup losses or extend winnings. Overall, few Pathway subtype differences were identified in terms of clinically relevant behaviors.

4.4 STUDY IV: IMPLEMENTATION OF INTERNET-BASED COGNITIVE BEHAVIOR THERAPY FOR PROBLEM GAMBLING IN ROUTINE ADDICTION CARE: A FEASIBILITY STUDY

Aim

The aim of this non-randomized study was to evaluate treatment feasibility and clinical effectiveness of the newly developed iCBTG within routine addiction care, as well as research feasibility of using existing healthcare infrastructure.

Methods

The iCBTG, packaged into ten modules, was delivered through the ST platform, with four clinical psychologists at the Stockholm Addiction eClinic providing guidance. Treatment acceptability measures were included. Self-rated gambling symptoms served as the primary outcome, and were measured weekly, along with process measures.

Main Results

Twenty-three treatment-seeking patients consented to participation (i.e., data sharing for research purposes). The study provided initial support for treatment feasibility and clinical effectiveness. On average, patients started roughly four of the ten iCBTG modules during a mean treatment duration of 156 days (Sd = 68). Treatment was rated satisfactory in terms of treatment credibility, expectancy, and satisfaction. Mixed effects modeling revealed a significant decrease in gambling symptoms during treatment (within-group effect size d=1.05 at follow-up), which correlated with decreases in several process measures. In terms of research feasibility, several ST platform-related measurement issues were identified, suggesting that alternative measurement designs for clinical studies in routine addiction care may need to be considered.

5 ETHICAL CONSIDERATIONS

Ethical approval was granted for all studies in the thesis (Studies I-IV, reference numbers 2017/1479-31/1, and 2019-05479).

The studies in the thesis comprise the following elements: (1) Asking individuals who gamble to answer questionnaires online; (2) interviewing individuals who gamble, either face-to face or by telephone; (3) asking gambling researchers to give their view on self-report items; (4) offer treatment-seeking patients internet-delivered cognitive behavioral treatment for problem gambling/GD (i.e., an evidence-based treatment that was recommended, but prior to the study, not accessible) in routine addiction care. As all the studies in the thesis involve human participants, careful considerations were made to fulfill the ethical principles of the Helsinki declaration (World Medical Association Declaration of Helsinki Ethical Principles for Medical Research Involving Human Subjects, 2013). Also, practical research procedures were planned to ensure the participants' autonomy, integrity, and protection (e.g., gathering informed consent prior to inclusion in the studies, ensuring confidentiality, using secure data handling procedures, or informing participants that their participation is voluntary and that they can withdraw their participation any time). Finally, as the studies involved participants from vulnerable gambling populations, several safety measures were taken, such as offering participants optional guidance for gambling problems or help to access treatment in Study I, II, and III, or offering patients the opportunity to receive treatment even if they do not wish to participate in research in Study IV. To ensure participant integrity in Study III, characteristics were presented on an aggregate-level, as suggested in a preliminary review by the Ph.D. Examination Board. Some additional ethical treatment-related considerations were made for Study IV. See below under 6.2.5 Limitations and points of perspective, for a discussion on these.

From a wider perspective, it is paramount that all research adheres to rules based on ethical principles, regardless of research participants. The studies in the current thesis have not included non-human participants, but gambling studies occasionally involve animal experimentation (see Nautiyal et al., 2017, for a review). Animal research can be criticized for methodological issues, such as lacking external validity or inadequate statistical methods (e.g., insufficient power). In contrast to research involving humans, which is strictly regulated by rule (i.e., deontological) ethics paradigms, such as the Helsinki declaration, research on animals lacks such strict ethical regulations. Instead, animal experiments have been approved by ethics committees on the basis of vague utilitarianism arguments, despite the fact that utilitarianism ethic have dismissed animal experimentation (see for example Foëx, 2007; Singer, 1996). As such, many cruel and unnecessary animal experiments have been performed at Karolinska Institutet, as well as at other research facilities. Introduction of a rule-based ethical framework for animal research, similar to the Helsinki declaration, might be to strategy to address this.

6 DISCUSSION

The overall aim of this thesis was to develop novel measures and treatments for Gambling Disorder. The thesis contains studies within two tracks: the development and evaluation of the measure GDIT, and the development and initial evaluation of a treatment, the iCBTG. Each track is discussed below, in addition to clinical implications.

6.1 IS THE GAMBLING DISORDER IDENTIFICATION TEST A VALID AND RELIABLE MEASURE?

6.1.1 Content and face validity

The GDIT was developed with an aim to develop a gambling measure which increased content validity in relation to a previous researcher-based agreement on gambling measures, known as the Banff consensus (Walker et al., 2006). Furthermore, the GDIT project aimed to establish norms in relation to the revised DSM-5 diagnosis of GD (American Psychiatric Association, 2013), and to develop a gambling measure analogous to the alcohol and drug use disorder measures AUDIT and DUDIT (Berman et al., 2005; Saunders et al., 1993).

Initially, a protocol for measure development study was conducted (Molander et al., 2019), in which four gambling researchers analyzed content of all unique items ($n = 583$) in 47 existing gambling measures, in relation to the recommendations featured in the Baff consensus. From this analysis, 30 candidate items were selected for possible inclusion in the GDIT. To further evaluate content validity of these 30 items, international and Swedish gambling researchers and experts participated in a two round online Delphi ($n = 61$; $n = 30$; Study I). Here, the Delphi stakeholders were presented with the 30 candidate items along with a rationale featuring the item-related recommendation of the Baff consensus; they then rated each item regarding importance of inclusion and also reported any potential item-related measurement issues.

The results of the Delphi were presented in three subsequent consensus meetings where gambling researchers and clinicians participated ($n = 10$; $n = 4$; $n = 3$), which yielded a draft version of the GDIT. During these meetings, the Delphi items were reviewed in detail and revised, based on consensus-based discussions on e.g., relevance, phrasing, or response alternatives. For instance, a common measurement issue that was addressed in relation to the Baff consensus, was that several of the Delphi items (originally retrieved from existing gambling measures) had double- or triple-barreled formulations, i.e., asking about several different things simultaneously.

Finally, to evaluate face validity, the draft version of the GDIT was presented to participants with their own experiences of problem gambling and GD. This resulted in further revisions of GDIT response alternatives and appendix assessment of expenditures. The GDIT draft version had the same time- and frequency-based response alternatives as the AUDIT and the DUDIT (Berman et al., 2005; Saunders et al., 1993), which corresponded to the Banff consensus recommendation that measurement of gambling behavior should be assessed in time units per month. However, the participants expressed that GD individuals gambled more frequently than "4 times a week or more often", which resulted in a revised expansion of response alternatives in the GDIT gambling behavior domain. Also, participants expressed doubts regarding the expenditure assessment of the GDIT draft version, which was addressed by a revision using items from the TimeLine Follow-Back for Gambling (TLFB-G; Hodgins & Makarchuk, 2003a; Weinstock et al., 2004).

In sum, several documented and interdependent methods were used to evaluate and ensure content and face validity of the GDIT during development process, which yielded a testable version (see Study I).

6.1.2 Reliability, factor structure, convergent and discriminant validity

Using classical test theory, a psychometric evaluation of the GDIT (Study II) was conducted in a sample of Swedish gamblers ($N = 603$). Regarding reliability, evidence of excellent internal consistency reliability (Cronbach's alpha [α] = .94) and test–retest reliability (6-16 days, intraclass correlation coefficient = 0.93) was provided.

Confirmatory factor analysis provided a good fit, $\chi 2(74) = 176.436$, $p < .05$; RMSEA (root mean square error of approximation) = 0.048; CFI (confirmatory fit index) = 0.975; TLI (Tucker–Lewis index) = 0.969, indicating support for the three proposed theoretical GDIT domains of gambling behavior ($GDIT_{items\ 1-3}$), gambling symptoms ($GDIT_{items\ 4-10}$), and negative consequences ($GDIT_{items\ 11-14}$). Regarding individual items, excellent to very good factor loadings were shown, except for two items ($GDIT_{item\ 11}$ and $GDIT_{item\ 14}$). Complementary analyses of measurement invariance indicated that the GDIT factor structure mainly was consistent across gender, but not for age. A difference in factor structure was shown between young adults (18-30 years) and older gamblers, inferable specifically to items within the negative consequences domains ($GDIT_{items\ 11-14}$); which might be explained by the fact that gambling-related negative consequences presumably affect younger and older individuals differently due to disparate life circumstances.

Regarding convergent validity, the GDIT showed expected positive correlations in relation to the gambling measures PGSI (Ferris & Wynne, 2001) and PPGM (Williams & Volberg, 2013), and with having gambling debts ($r = .68$; Study II). Evidence of discriminant validity was also provided for the GDIT, in relation to measures assessing attention deficit hyperactivity disorder (ASRS; Kessler et al., 2005), bipolar disorder (MDQ; Hirschfeld et al., 2000) and various domains related to quality of life (WHOQOL-BREF; Skevington et al., 2004).

In sum, the psychometric evaluation of the GDIT (Study II) provided evidence for several reliability and validity estimates within classical test theory. Regarding specific items, some estimates indicated possible construct irrelevance (Spurgeon, 2017), suggesting that some items could be removed to improve overall psychometric performance. Specifically, $GDIT_{item\ 14,}$ measuring gambling-related problems at work or school, showed lower performance in relation to the other GDIT items. However, a decision was made to retain the GDIT item structure, prioritizing content validity over performance. See below under 6.1.4 Limitations and points of perspective, for further discussion.

6.1.3 Diagnostic accuracy

Within classical test theory there are two main methods to establish cut-offs for measures in relation to diagnostic terms. In the first, gold standard method for psychiatric disorders (Comrey & Lee, 2016), cut-offs are estimated in relation to diagnostic semi-structured interviews, based on e.g., the DSM-5 (American Psychiatric Association, 2013). In the second, perhaps most widely used in evaluation of gambling measures, cut-off scores are estimated in relation to a specific population or populations. This method thus relies on an assumption that most individuals in a selected population (e.g., recreational, support-seeking, or treatment-seeking gamblers), do or do not fulfill a certain condition (e.g., no gambling-related problems, problem gambling or GD).

The psychometric evaluation of the GDIT (Study II), included gamblers from four different populations, i.e., treatment- and support-seeking gamblers (n = 79 and n = 185), gamblers participating in self-help groups (n = 47), and gamblers within the general population (n = 292). Also, semi-structured diagnostic interviews assessing GD (SCI-GD; Grant et al., 2004b), were conducted among a subsample (n = 203) of the participants. Comparisons in relation to these diagnostic interviews enabled ROC estimation of GDIT cut-off scores for GD, also including severity levels. In addition to standard considerations of sensitivity, specificity and area under the curve, establishment of GDIT cut-off scores also included estimations of Youden's index (i.e., a summary measure for ROC which defines an optimal threshold value or cutoff point).

A GDIT cut-off score for problem gambling was estimated by synthesizing results of GDIT ROC comparisons between the cut-off scores for problem gambling assessed by the PGSI (Ferris & Wynne, 2001) and the PPGM (Williams & Volberg, 2013), as well as estimation of the clinical significance cut-off point c (Jacobson & Truax, 1992), between recreational (norm population) and help-seeking samples (support seeking, self-help groups and treatment-seeking gamblers collapsed into one group). The GDIT cut-off score for at-risk gambling was estimated solely by using the ROC of cut-off scores for at-risk gambling assessed by the PGSI (Ferris & Wynne, 2001) and the PPGM (Williams & Volberg, 2013)

In sum, Study II provided evidence for GDIT diagnostic accuracy in relation to GD, problem and at-risk gambling, aiming to use the best available research methods within classical test theory for establishing cut-off scores.

6.1.4 Limitations and points of perspective

The development and evaluation process of the GDIT included some limitations, which could be explored in future studies.

The Delphi study (Study I) only included two rounds. If more Delphi rounds had been included, a better outcome in terms of consensus among the Delphi stakeholders might have been achieved. However, this was not possible due to time limits.

The psychometric evaluation of the GDIT (Study II) did not include the appendix, i.e., assessment of expenditures and gambling types. Future validation studies could evaluate GDIT assessment of gambling types in relation to the total GDIT score, based on previous research showing that certain gambling types (e.g., slots or poker) are more associated with problem gambling than others (Binde et al., 2017). Perhaps more urgently needed, are studies evaluating the GDIT assessment of expenditures. Previous research on self-reported gambling expenditures is mixed, indicating both acceptable (Hodgins & Makarchuk, 2003b) and poor recall accuracy (Heirene et al., 2021). The GDIT items assessing expenditures were problematized by the Delphi participants and the participants with their own experience of problem gambling and GD, and were therefore revised (Study I). As such, future studies need to evaluate the accuracy of the GDIT assessment of gambling expenditures in relation to objective data, such as bank or gambling accounts.

The development and evaluation process of the GDIT included several decisions that involved tradeoffs between theoretical content and empirical/statistical validity. First, during the Delphi (Study I) some items assessing recommended features of the Banff consensus (Walker et al., 2006), were rated low for inclusion in the GDIT by the expert stakeholders. Here, we chose to include these items anyway, prioritizing content validity in relation to the Banff consensus. Second, in the psychometric evaluation (Study II), $GDIT_{item\ 14}$, performed lower than other items for several psychometric estimates. $GDIT_{item}$

measures gambling-related school or work problems, which is a recommended feature of the Banff consensus (Walker et al., 2006). As noted before, we chose to keep GDIT$_{item 14,}$ prioritizing content validity. However, it should be noted that GDIT$_{item 14}$ was revised during the consensus meetings (Study I). The original item formulation was double-barreled, asking about gambling-related school/work and relationship problems, simultaneously. This particular double-barreled formulation was commonly observed among previous gambling measures in the GDIT item selection (Molander et al., 2019), indicating similarities with the formulation of the current and previous DSM diagnostic criteria (American Psychiatric Association, 1994, 2013). When we revised GDIT$_{item 14,}$ thereby assessing gambling-related school/work and relationships problems separately, school or work showed lower performance (Studies I and II). In the sample of Study II, participants spontaneously reported that they prioritized their work, as this was their income source which enabled them to continue to gamble. As such, it might be that gambling-related school or work problems have been overestimated in previous research, including the Banff consensus (Walker et al., 2006). This potential issue is a topic for future studies to investigate. Third, we did not to include psychometric estimates within item response theory (Wilson, 2004) in the development and evaluation process of the GDIT. Item response theory is suitable for measure construction, giving estimates both on poorly performing items and suggested item scoring. However, the GDIT psychometric evaluation did not include a large pool of potential items to consider as candidates, using only empirical/statistical validity as a determinator. At such, we were conservative in revising the GDIT draft version, as the items and response alternatives/scoring, were chosen in relation to content theoretical validity in terms of the Banff consensus (Walker et al., 2006) as well as the consensus meetings in the Delphi study (Study I). Still, future studies should evaluate and report psychometric properties of the GDIT using item response theory. These studies should consider potential estimates indicating construct irrelevance (Spurgeon, 2017), such as GDIT$_{item 14}$, in relation to theoretical content validity.

Future GDIT psychometric studies should include international evaluations among different gambling groups. Finally, validating the GDIT as an outcome measure could be considered. Such evaluations, preferably conducted in treatment study settings, could investigate clinical change of the GDIT in relation to validated outcome gambling measures, e.g., the Gambling Symptom Assessment Scale (G-SAS; Kim et al., 2009).

6.2   IS THE INTERNET-DELIVERED COGNITIVE BEHAVIORAL TREATMENT FOR PROBLEM GAMBLING AND GAMBLING DISORDER A VALID AND ACCEPTABLE TREATMENT?

6.2.1   Development of the clinical model for Gambling Disorder

The iCBTG was developed aiming to achieve a theoretically grounded and meaningful treatment model for GD. To achieve this, bottom-up methods inspired by previous treatment development models (Clark, 2004; Cooper, 2007), were used. Naturally, building experimental and clinical evidence this way, is a time-consuming and continuous process (see Clark, 1996), which would not be feasible to encompass in a single thesis. Below, the development process of the iCBTG is discussed, in relation to Clark's development model (Clark, 2004).

Clark's development model initially states that clinical hypotheses on psychological maintenance of disorders are identified through interviews with patients or clients, which later are formulated into a simple clinical model. The hypotheses of the clinical model are then validated in experimental laboratory studies. The advantage of using clinical behavioral analysis to develop a simple clinical model, where the main processes are

expressed in everyday language instead of precise technical terms, is that it becomes clear which the proposed mechanisms of behavior maintenance are, as well as which subsequent interventions to align with the model. The disadvantage is that it can be hard to test the model, as difficulties might arise regarding how to operationalize the everyday terms, and to measure and manipulate them in experimental studies (Clark, 1996)

We used a different order of the steps than that presented by Clark (2004). As a first step, we reviewed the experimental evidence of learning processes involved in gambling behavior (Ramnerö et al., 2019). As a second step, we conducted a qualitative study among treatment-seeking individuals with GD (Study III). Thereafter, a simple clinical model was constructed (see Figure 2), synthesizing the findings from the previous steps. Using this alternative approach yielded some advantages. We were able to exploit and incorporate experimental evidence of learning processes established in previous studies. Also, we were able to "translate" technical terms for processes investigated in experimental research on gambling behavior (e.g., discounting), into everyday clinical language (e.g., reward expectancy, access to money).

In sum, in terms of validity, the clinical model for GD is grounded in both experimental evidence and qualitative findings of gambling behavior. As discussed previously (see 2.6.4 Hypotheses of the clinical model for Gambling Disorder), some hypotheses of the clinical model for GD have been validated to some extent, while others remain to be investigated in further experimental studies.

6.2.2 Treatment rationale and interventions of the internet-delivered cognitive behavioral treatment for problem gambling and Gambling Disorder

After a simple clinical model has been formulated and verified, Clark (2004), recommends that specific interventions be selected or developed, with the aim of reversing the maintaining psychological processes of the model.

We choose to use a single recurrent intervention with increasing difficulty (i.e., behavioral exercises) throughout the iCBTG. This clinical setup seemingly resembles behavioral or cognitive therapies for anxiety disorders, such as exposure or behavioral experiments (see for example Dugas & Robichaud, 2007; Foa, 2011). Previous gambling CBT protocols have used similar conceptualizations, e.g., exposure and response prevention, aiming to extinguish gambling cravings (see for example Riley et al., 2011). However, the iCBTG treatment rationale does not include gambling cravings per definition. Instead, the iCBTG is based on the processes of the clinical model for GD, with the overall assumption of loss of control as a maintaining factor. The rationale for the iCBTG behavioral exercises is to continuously increase voluntary control over gambling behavior or other gambling-related problematic behavior (e.g., lying or handling money), in various gambling-related situations. Clinically, loss of control was operationalized as a single response (gamble) given a certain stimulus (e.g., access to money). Gaining access to an expanded behavioral repertoire (i.e., several potential responses) through behavioral exercises, is proposed to decrease loss of control as it increases the possibility for the patients to choose whether to gamble or not when facing gambling-related situations. The iCBTG treatment rationale thus differs from exposure-based rationales targeting cravings, but also from the rationale of controlled drinking, i.e., to achieve a drinking pattern within low-risk consumption (see for example Henssler et al., 2021).

6.2.3 Acceptability of the internet-delivered cognitive behavioral treatment for problem gambling and Gambling Disorder

After developing a treatment protocol, Clark (2004) recommends that treatment efficacy is evaluated in clinical trials, and finally made broadly available into healthcare through dissemination studies.

At the time when the iCBTG was being developed, iCBT was already a recommended treatment for problem gambling (The Swedish National Board of Health and Welfare, 2017). Several randomized trials (RCT) had been conducted in the general population (see van der Maas et al., 2019, for a review), but iCBT for problem gambling was not accessible for treatment-seeking gambling patients in routine addiction care. Therefore, we opted to meet a current clinical need, and conducted an initial feasibility study which evaluated the iCBTG in parallel with implementation into routine addiction care (Study IV). By doing so, we exploited the recent availability of technical infrastructure for dissemination of internet-based treatments within the Swedish healthcare system, i.e., the ST platform. Study IV was conducted in preparation for a pending RCT within routine addiction care, included 23 treatment seeking patients, and evaluated several pre-defined acceptability measures (see Molander et al., 2020). Evaluation of iCBTG adherence indicated results roughly equal to other iCBT trials for problem gambling conducted in the general population (Dowling et al., 2021; Magnusson et al., 2019). The patients started approximately four of ten iCBTG modules. About one third of the patients started at least half of the treatment modules and 9% started all iCBTG modules. Furthermore, iCBTG credibility, expectancy, and satisfaction were rated satisfactory by the patients. However, measurement issues within the ST platform resulted in attrition for several measures, and the study failed to evaluate acceptability in terms of working alliance and potential negative effects (see below under 6.2.5 Limitations and points of perspective, for further discussion).

In sum, Study IV indicated preliminary acceptability of the iCBTG, although several outcome and feasibility measures remain to be investigated. Future evaluation of potential treatment-related negative effects is warranted and urgent, since the iCBTG is implemented into routine addiction care.

6.2.4 Potential effectiveness and processes of change of the internet-delivered cognitive behavioral treatment for problem gambling and Gambling Disorder

Study IV evaluated potential effectiveness of gambling symptoms as a primary outcome, measured weekly by the G-SAS (Kim et al., 2009). The results showed a significant G-SAS decrease during treatment, corresponding to -1.52 points (95% CI:-2.23, -0.84, p=.0035) per module, with a within-group effect size of d=1.05 at follow-up.

Potential effectiveness in terms of secondary outcomes (i.e., symptoms of depression, anxiety, alcohol, and drug use, as well as quality of life), could not be estimated due to the previously described ST platform measurement issues (see below under 6.2.5 Limitations and points of perspective, for further discussion).

The Banff consensus (Walker et al., 2006) states that problem gambling treatment studies should report measures of processes of change. This measurement recommendation can be a challenge. Knowledge regarding how CBT for problem gambling works has been lacking (Tolchard, 2017), and many existing CBT protocols offer a range of interventions with diverse treatment rationales, according to a smorgasbord principle (Gooding & Tarrier, 2009; Molander et al., 2020). An advantage of the iCBTG is that the proposed processes of change are comparatively clear and defined. In Study IV several process measures were

piloted (e.g., loss of control in gambling situations, and problematic gambling-related thinking), but none of these changed significantly over time. The iCBTG treatment rationale was partly supported by results showing that reduced experiences of loss of control correlated with gambling symptom reduction. Overall, though, the theoretical foundations of the iCBTG need to be investigated in future treatment studies with fewer measurement issues and attrition than Study IV. Also, these studies should include better statistical analysis methods such as mediation analysis (Hesser, 2015) and modern cross-lagged panel models (Mund & Nestler, 2019) to formally examine dynamic temporal associations in samples of sufficient size; and preferably include iCBTG treatment-specific process measures such as access to money, reward expectancy, dark flow and chasing behaviors.

In sum, Study IV indicated preliminary effectiveness of the iCBTG for the primary outcome gambling symptoms. Although Study IV had attrition, the within-group effect size of d=1.05 of the primary measure at follow up, can be compared to the overall between-group effect size of d=1.59 identified by Pallesen et al. (2005), which motivates a future RCT for the iCBTG. Secondary measures and processes of change, remain to be investigated in future studies with fewer measurement issues and improved methodology than Study IV.

6.2.5 Limitations and points of perspective

The development and evaluation process of the iCBTG includes some limitations, which should be addressed in future studies.

First and foremost, the iCBTG development process so far has not included a RCT. Although several previous RCT:s have evaluated treatment effects of iCBT for problem gambling (van der Maas et al., 2019), formal investigations of efficacy for the iCBTG program in relation to other treatment options are lacking. In Study IV, feasibility of the iCBTG was evaluated among treatment-seeking patients in routine addiction care, as a first preparatory step for a pending RCT. An optional research approach would have been to follow Clark's development model (2004) more strictly, launching an RCT with samples recruited elsewhere (e.g., the general population), prior to treatment dissemination in "real" clinical settings. However, this route could be related to other potential drawbacks, such as less clinical value or issues regarding external validity. In cases where treatment options do not exist in routine care, it could be argued that evaluations of novel treatments simultaneous to dissemination into regular care, can constitute strengths. Such setups enable several advantageous bottom-up based procedures, previously not described by treatment development models (Clark, 2004; Cooper, 2007). Examples of such procedures includes early detection of important treatment-relevant issues via input from expert stakeholders (i.e., clinical psychologists), or fine-tuning of interventions directly in relation to the intended target population (i.e., patients) or other current treatment-related aspects (see the discussion regarding *Spelpaus* below, for an example).

The above remarks are research considerations for development of internet-delivered treatments in relation to healthcare, with no clear answers. Hopefully, these and other aspects will be debated to a larger extent in research in a future healthcare iCBT era. Nonetheless, as the iCBTG currently is being offered as a standard health care intervention, it is vital to emphasize that future RCT:s are crucial to ensure treatment acceptability and effectiveness.

In terms of qualitative limitations, particularly in Study III, we did not validate the results and conclusions made regarding GD, by reporting them back to the participants. Also, no

predefined method was used to determine if saturation was reached. In part, these limitations of Study III were addressed later in the development process, by considering iCBTG-related issues in Study IV via input from treating clinical psychologists at the Stockholm Addiction eClinic. Also, each iCBTG module included a patient evaluation section. These evaluations have not been reported as results in a formal study so far but, anecdotally, patients mainly reported that they identified with the iCBTG treatment content and felt that it applied to their situation.

Regarding Study IV, an initial concern was slow clinical (patient) recruitment. However, this was unwarranted, especially once national self-referral to the iCBTG was introduced. In addition to evaluation of recruitment rates, iCBTG acceptability and potential effectiveness, Study IV also aimed to evaluate research feasibility in terms of measurement procedures within routine healthcare infrastructure, i.e., the ST platform (Molander et al., 2020). Several issues were identified which constituted limitations. Measures were administered within the ST platform in relation to the iCBTG treatment modules, which was problematic as few patients completed the whole iCBTG program. Also, at the time of Study IV clinical praxis at the eClinic did not allow using the ST platform to deliver follow-up measures. To address this, we used an external research platform (also including a separate informed consent) for follow-up measures. However, only a minority of the patients clicked on the link to the platform and gave informed consent to this procedure. These measurement administration issues resulted in attrition in, e.g., secondary outcomes, acceptability and follow up measures. Furthermore, at the time of Study IV new data regulations were being implemented in the Swedish healthcare systems which resulted in prolonged efforts to obtain permission to extract data from the ST platform, although all patients who participated in Study IV had given informed consent. Also, we were only able to extract anonymous data, which was lacking information on, e.g., recruitment path (clinical referral or self-referral).

Although Study IV was an initial feasibility study, the above-mentioned crucial limitations raise questions regarding relevance from a scientific perspective. Also, in terms of lacking evidence for treatment efficacy, considerations were made about whether the iCBTG should be withdrawn from routine addiction care. However, given that the research field of iCBT for problem gambling and GD is relatively novel and few treatment alternatives exist, we decided to retain the iCBTG within the ST platform, also enabling possibilities for further studies to evaluate the iCBTG. Whether this discussion was adequate or not is a question for scientific debate. On a wider scope, more than 500 different ST platform units (e.g., internet-delivered treatments and support programs, self-report assessments, treatment plans or health care information), have so far been distributed to >180 000 patients in the Swedish health care system (Inera, 2021). The evidence base for these offered interventions remains unclear. We are not aware of any previous published study on ST platform data. Study IV thus offers some important clues on how to evaluate internet-delivered treatments within existing health-care structures. Future clinical studies using the ST platform should consider administering measurement via external research platforms, or use existing non-self-report outcomes, such as registry data.

In terms of feasibility, Study IV also identified some content-related issues for the iCBTG. The most notable was that patient and psychologist treatment evaluations indicated that several patients had trouble performing the behavioral exercises described in the iCBTG, as they were using *Spelpaus* (Gambling paus). *Spelpaus* is a national online self-exclusion service from licensed gambling, which was introduced in Sweden about the time Study IV started. The aim of the iCBTG, to increase patients' voluntary control over gambling behavior in gambling-related situations might introduce conflicting rationales in relation to

the simultaneous use of *Spelpaus*. On the other hand, it could be argued that the iCBTG rationale aims the spotlights at a long-lasting, yet unresolved, treatment-related issue for problem gambling. Stimulus-control techniques similar to *Spelpaus*, such as blocking the possibility to gamble via various technical aids or handing over control of bank accounts to someone else, have typically been emphasized as a first "emergency" step in CBT protocols. The idea behind this setup has sometimes been to gradually replace the use of stimulus-control techniques with other CBT coping skills. However, the clinical transition between stimulus-control techniques and other interventions has typically been poorly defined, resulting in a risk for continuous use of stimulus-control techniques throughout the treatment. From a clinical CBT perspective stimulus-control techniques also can be seen as a double-edged sword; they are effective in the short term, but they are also avoidance-based techniques which might impede long term behavior change (Study III). This raises questions whether clinical interventions presented after stimulus-control techniques in CBT protocols, have the potential to add any treatment effect.

The introduction of *Spelpaus* was partly an anticipated issue in relation to the iCBTG. We were not able to exclude patients using *Spelpaus* in Study IV, as it would have been unethical to exclude patients from routine care. During the development process, different ideas were discussed, such as having a separate treatment track (i.e., relapse prevention) for patients using *Spelpaus.* However, this too might have been unethical, as it would have withheld information from these patients about how gambling behavior is maintained and can be addressed in the long term. Another circumstance is worth mentioning in this context. To our knowledge, the effects of *Spelpaus* have never been evaluated in formal RCT:s. But preliminary studies indicate that relatively large proportions (38-61%) of those who use *Spelpaus* gamble anyway, for instance via unlicensed online casinos (Håkansson & Widinghoff, 2020; Månsson et al., 2021). As such, the potential conflicting rationales between the iCBTG and *Spelpaus* might be less of a problem than anticipated. However, to increase face validity and transparency of the iCBTG, we chose to revise the treatment content after the completion of Study IV. This revision included information on *Spelpaus* and its relation to the iCBTG rationale. We also added several examples of behavioral exercises that were possible to perform while using *Spelpaus* (see Figure 3 for one example).

A final point of perspective concerns potential iCBTG treatment adaptations in relation to psychiatric comorbidities. The etiological Pathways model includes three comorbidity subtypes, .i.e., conditioned, emotional vulnerable and impulsive gamblers, who gamble due to different reasons (Blaszczynski & Nower, 2002), which suggests that treatment interventions might need to be tailored. In Study III, few Pathway subtype differences were identified in terms of clinically relevant behaviors. On a wider scope, research on treatment for problem gambling and psychiatric comorbidities has shown mixed results. In a mini-review, Dowling et al. (2016) analyzed 21 treatment studies that had reported the influence of psychiatric comorbidities on treatment outcomes. The results indicated that although gambling participants had various psychiatric comorbidities, these comorbidities mainly did not affect participant outcomes in terms of gambling treatment. A complementary perspective was presented in a study by Ledgerwood and Petry (2010). Here, the Pathways subtypes were identified among a sample of treatment-seeking problem gamblers. The results indicated that all subtypes demonstrated similar patterns of treatment response, although emotional and impulsive gamblers overall had a higher gambling severity than conditioned gamblers. In sum, the research field of treatment for problem gambling and psychiatric comorbidities is relatively small, and some previous results indicate that tailored treatment adaptations are not necessary. However, most previous research has evaluated only gambling-related outcomes, such as gambling severity. A logical next step would be to

conduct an RCT where effectiveness of tailored versus non-tailored interventions are evaluated among Pathway subtypes, also including secondary outcomes related to psychiatric comorbidity.

7   CLINICAL IMPLICATIONS

7.1   THE GAMBLING DISORDER IDENTIFICATION TEST

The development and evaluation of the GDIT yields several clinical implications, mainly in relation to diagnostic accuracy and content validity. First and foremost, the GDIT enables reliable and valid screening of GD (including severity levels), an addictive disorder for which self-reported diagnostic accuracy has been lacking (Otto et al., 2020). Measuring GD is a prioritized endeavor, both in clinical practice and research. Most gambling research, including treatment studies, has targeted problem gambling, which is a broader public health-based term. For instance, the iCBTG was originally developed for GD (see Study III), but at the time when Study IV commenced, the GDIT was not yet completely evaluated. We were thus not able to screen reliably for GD and had to label the treatment iCBT for problem gambling and GD, although the study was conducted in healthcare settings where diagnoses are important to establish. Furthermore, it should be noted that problem gambling, defined as "excessive gambling behavior that creates negative consequences for the gambler, others in his/her social network, and for the community" (Blaszczynski & Nower, 2002), only includes one out of nine GD criteria (i.e., gambling-related negative consequences), and that the diagnostic cut-off for mild GD is at least 4 criteria. Nonetheless, problem gambling is sometimes used as a proxy or umbrella term, sometimes including GD or *spelberoende* (a Swedish folksy term equivalent to "gambling addiction"). As such, it could be argued that the lack of measures assessing GD has led to an unfortunate confusion of theoretical constructs, including in this thesis. It is also possible that estimates of *spelberoende* have been overestimated in relation to GD. Hopefully, the GDIT will enable more precise measurement procedures in this regard.

Additional clinical implications of the GDIT includes strengthening content validity in relation to the Banff consensus (Walker et al., 2006), an agreement which was settled among gambling researchers to resolve long-lasting measurement issues within the gambling research field. Given the span of time that has elapsed since the Banff consensus agreement and the development of the GDIT, an additional clinical implication could include international dissemination of the GDIT, where it could compensate for the current lack of screening instruments that reliably indicate probable DSM-5 based GD diagnoses. Also, the GDIT includes time and frequency-based response alternatives, which enables clearer measurement procedures, facilitating for example future establishment of levels of problematic gambling behavior, or comparisons between substance use and gambling behavior. A final clinical implication of the GDIT, which was developed analogously to the widely used alcohol and drug use measures AUDIT and DUDIT (Berman et al., 2005; Saunders et al., 1993), is that the DSM-5 addictive disorders can be assessed using similar methods, which also might facilitate introduction of measurement procedures for GD in routine healthcare settings.

7.2   THE INTERNET-DELIVERED COGNITIVE BEHAVIORAL TREATMENT FOR PROBLEM GAMBLING AND GAMBLING DISORDER

The development and initial evaluation of the iCBTG includes several clinical implications, mainly in relation to theoretical treatment validity and patient availability.

The iCBTG was developed aiming to achieve a theoretically grounded and meaningful treatment model for GD. Aside from the fact that evaluations of efficacy through RCT designs have not yet been conducted, the iCBTG development process described in this thesis included studies and procedures targeting several steps of bottom-up based CBT development models (Clark, 2004; Cooper, 2007). This is rare in terms of development for CBT models and protocols. The term treatment gap (Kohn et al., 2004) is often used to

problematize that large proportions of individuals with psychiatric disorders remain untreated despite the fact that effective treatments exist. However, this definition only includes the last step (i.e., dissemination) of CBT development models such as Clark's (2004). In our preparatory review (Ramnerö et al., 2019), we concluded that several behavioral processes for gambling had been experimentally verified, but that few of these findings had been incorporated into CBT protocols. In Study III, qualitative findings identified additional clinical processes related to GD. Some of these had been studied under experimental conditions, but few had resulted in development of clinical interventions. As such, in addition to dissemination, we were able to bridge "gaps" throughout multiple levels of existing empirical evidence related to gambling behavior.

The iCBTG included a novel treatment model and rationale, based on a predefined and clear idea on why gambling behavior persists despite negative consequences. The iCBTG thus challenges current ideas on what CBT for problem gambling or GD should target, including the relation to stimulus control techniques such as *Spelpaus*. Although alternative research designs might have been considered, such as conducting pilot or RCT studies in the general population as a first step, our decision to evaluate the iCBTG directly among patients in routine healthcare (Study IV) also resulted in immediate clinical implications. From a research-based perspective, vital measurement issues were identified within existing health-care infrastructure for iCBT (i.e., the ST platform), which need to be considered to ensure quality of future clinical trials. However, from a perspective of clinical dissemination, the ST platform proved a feasible medium to make iCBT available to patients within the health care system. At the time of writing this thesis, more than 200 patients have started the iCBTG as a standard healthcare intervention, since the treatment was introduced in October 2019 (see Figure 4; Inera, 2021). It is also important to emphasize that patients are given access to the iCBTG regardless of where they live in Sweden, and that they are not excluded from treatment due to psychiatric comorbidities.

Figure 4
Implementation

Total number of patients starting iCBTG in the ST platform
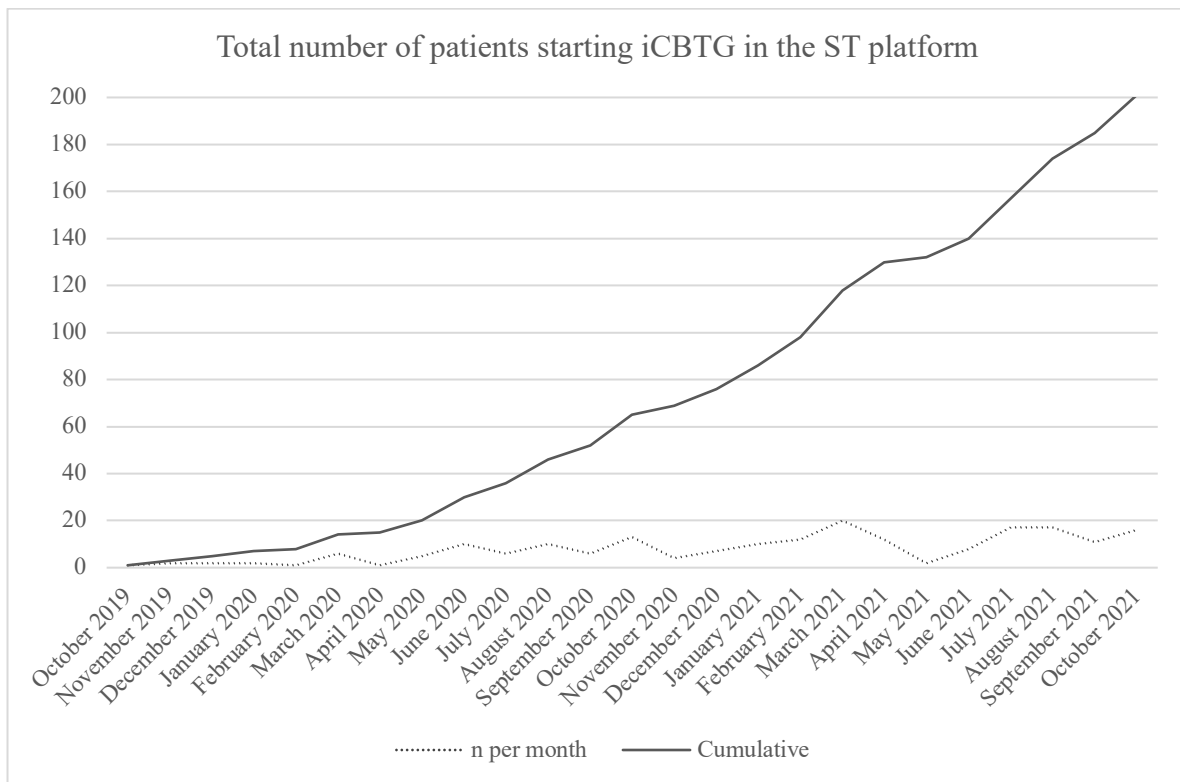
Note. Total number of patients starting iCBTG in the ST platform, *n* per month and cumulative. The presented time series do not constitute personal data, were not used for research, and are publicly available (see Inera, 2021).

iCBTG = Internet-delivered Cognitive Behavioral Treatment for problem gambling and Gambling Disorder

ST platform = the Support and Treatment platform

8 CONCLUSIONS

The newly developed measure GDIT is a reliable and valid self-report measure for assessing Gambling Disorder and problem gambling. In addition, GDIT increases content validity in relation to a previous researcher agreement on gambling measures, known as the Banff consensus (Walker et al., 2006).

The iCBTG was developed to achieve a theoretically grounded and meaningful treatment model for GD. Feasibility of the iCBTG was evaluated in parallel with treatment implementation in routine addiction care. Preliminary estimates support acceptability and clinical effectiveness, but further studies are warranted to ensure treatment efficacy.

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