

Disordered Gambling Among Finnish Adolescents and Emerging Adults

**A comprehensive cross-sectional examination of the correlates of
disordered gambling.**

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Tiivistelmä – Abstrakt – Abstract <i>Objectives:</i> This thesis examined the relationship between disordered gambling (DG) with mental health, loneliness, perceived general health, risky alcohol consumption, tobacco smoking and computer gaming frequency by age and gender among adolescents and emerging adults. Gambling types were also examined for their association to DG, mental health, loneliness, perceived health, risky alcohol consumption and tobacco smoking. DG is conceptualized as a behavioural addiction, and its development is influenced by the availability of gambling opportunities, prevalence of other addictive behaviours, and psychological well-being. Previous studies have indicated that specific types of gambling are more strongly associated to DG than others. The purpose of the present study was to identify the strength of the various risk factors of disordered gambling, examine whether specific risk factors are associated to certain gambling types and if there are age and gender related differences in regards to the associations between disordered gambling and its risk factors. <i>Methods:</i> A cross-sectional population based random sample (n = 822, 49.3 % female) of individuals aged 15 to 28 from the self-reported Finnish Gambling Survey 2011 was utilized. DG was assessed with the Problem Gambling Severity Index, such that a score of 2 or more indicated DG. Mental health was measured with the five item Mental Health Inventory and risky alcohol consumption was assessed with the Alcohol Use Disorders Identification Test -Consumption. The remainder of examined variables were assessed with single Likert-scaled items. The correlates of DG and gambling types were examined with logistic regression models. <i>Results and conclusions:</i> Male gender, risky alcohol consumption, tobacco smoking, and frequently feeling lonely were significantly associated to DG. Slot machine gambling, online gambling other than poker, private betting, and casino betting were strongly associated to DG. The aforementioned gambling types were strongly associated to risky alcohol consumption and tobacco smoking along with sports betting. Feeling lonely was associated to online poker, casino betting and private betting. There were indications of gender differences in regards to the gambling types associated to feeling lonely. Risky alcohol consumption seemed to be a stronger risk factor for DG among males, and tobacco smoking stronger among females. Current findings warrant further investigation of DG in regards to loneliness, and reconsideration of national gambling policies.	
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Tiivistelmä – Abstrakt – Abstract Tavoitteet: Tutkimuksessa tarkasteltiin ongelmallisen rahapelaamisen yhteyttä mielenterveyteen, yksinäisyyteen, koettuun terveyteen, alkoholin riskikäyttöön, tupakointiin ja tietokonepelaamisen iän ja sukupuolen suhteen nuorilla ja nuorilla aikuisilla. Myös rahapelien yhteys ongelmalliseen rahapelaamiseen, ja muihin edellä esitettyihin muuttujiin (lukuunottamatta tietokonepelaamista) tutkittiin. Ongelmallinen rahapelaaminen ymmärretään käyttäytymisen riippuvuutena, jonka kehitykseen vaikuttaa rahapelaamisen saatavuus, muiden riippuvuuksien samanaikainen esiintyvyys ja psyykinen hyvinvointi. Edelliset tutkimukset ovat osoittaneet, että tietyt rahapelit ovat muita voimakkaammin yhteydessä ongelmalliseen rahapelaamiseen. Tutkimuksen tavoitteena oli selvittää riskitekijöiden yhteyksien voimakkuutta ongelmalliseen rahapelaamiseen, tarkastella onko riskitekijät yhteydessä tiettyihin rahapeleihin ja esiintyykö ikä ja sukupuoli eroja riskitekijöiden ja ongelmallisen rahapelaamisen yhteyksien välillä. Menetelmät: Suomalaisten rahapelaamisen 2011 väestökyselyn itseraportoidun aineiston otos oli satunnainen ja koostui 15–28 vuotiaista (n = 822, 49.3 % naisia). Problem Gambling Severity Index (PGSI) mittaria käytettiin ongelmallisen rahapelaamisen arviointiin. Ongelmapelaamisen raja-arvo oli ≥ 2 PGSI:llä. Mielenterveys arvioitiin viisi osioisella Mental Health Index mittarilla ja alkoholin riskikäyttö mitattiin Alcohol Use Disorder Identification Test–Consumption mittarilla. Loput muuttujista mitattiin yksittäisillä Likert-asteikollisilla kysymyksillä. Ongelmallisen rahapelaamisen korrelaattit tutkittiin logistisella regressioanalyysillä. Tulokset ja johtopäätökset: Sukupuoli (mies), alkoholin riskikäyttö, tupakan poltto, ja yksinäisyyden tunteminen usein olivat merkittävästi yhteydessä ongelmalliseen rahapelaamiseen. Rahapeliautomaatit, nettirahapelaaminen (muu kuin pokeri), yksityinen vedonlyönti, ja vedonlyönti kasinolla olivat voimakkaasti yhteydessä ongelmalliseen rahapelaamiseen. Edellä mainitut rahapelit olivat urheiluviedonlyönnin lisäksi yhteydessä alkoholin riskikäyttöön ja tupakan polttamiseen. Yksinäisyys oli yhteydessä nettipokeriin, vedonlyöntiin kasinolla ja yksityiseen vedonlyöntiin. Sukupuoli eroja oli havaittavissa yksinäisyyden ja rahapelien yhteyksien välillä. Alkoholin riskikäyttö vaikutti olevan suurempi riskitekijä miehillä, ja vastaavasti tupakan poltto suurempi naisilla. Jatkossa on syytä tutkia ongelmallista rahapelaamista ja yksinäisyyttä enemmän, ja muuttaa lainsäädäntöä liittyen rahapeleihin.	
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1. Introduction

In the present thesis, a subset data from the 2011 population survey about Finnish gambling and health concerning individuals aged 15–28 was analysed with an emphasis on disordered gambling. Specifically gambling problems were inspected for their association to mental health, loneliness, perceived health, risky alcohol consumption, tobacco use and computer gaming frequency. The relationship between specific types of gambling and indicators of health and well-being were also investigated. This research topic is paramount, because results may provide valuable information from a public health standpoint on the co-occurrence of mental health issues, risky alcohol consumption and tobacco smoking with gambling problems among adolescents and emerging adults.

Though previous studies have analysed the data from the 2011 population survey concerning gambling and its correlates (e.g. Castrén et al. 2013a, b), no studies have been conducted focussing exclusively on an adolescent and young adult subsample, nor has computer gaming frequency been inspected as a correlate of gambling problems. Analyses regarding gambling types are also unique compared to previous research utilizing this survey sample. Differences between gambling types have previously been noted, such as gender specific preferences of gambling types and the strength of association to disordered gambling (Castrén et al 2013a, b). With the current focus, associations between disordered gambling and gambling types with the indicators of health and well-being may be identified specifically for the current age group.

New knowledge in this domain can be applied to enhance the efficiency of interventions and preventive programs for this age group, and may provide insight about markers for detecting individuals at risk of developing gambling problems. There are multiple reasons why gambling problems may develop, inclining that a comprehensive understanding of the phenomenon is required. As theorized by Blaszczynski and Nower (2002) problem and pathological gambling may arise from 3 possible pathways: either as a behavioural adaptation in the absence of mental health issues (1), as a result of dealing with adverse emotional states (2) or resulting from biological vulnerability (3).

1.1 Gambling

Gambling refers to the act of placing a monetary stake on an outcome, in which an individual takes the risk of losing his or her initial investment in exchange for the opportunity to win a

sum larger than the initial investment. Disordered gambling on the other hand, is defined as gambling that has some form of negative consequence(s) for the gambler. In Finland the opportunities to gamble are widespread (Jaakkola, Murto & Pajula, 2012). This is highlighted by the fact that around 20,000 slot machines were dispersed nationwide in Finland in 2011 (excluding slot machines in casinos and gambling venues) (THL, 2013). Consequently, it is understandable that a large part of the population have engaged in some form of gambling. In the 2011 population survey about gambling, 93 % of participants reported having gambled during their lifetime, and 78 % having gambled within the past year (Turja, Halme, Mervola, Järvinen-Tassopoulos & Ronkainen, 2012).

The prevalence of gambling in Finland is highest among 25-34 year olds, who also report engaging in the largest amount of gambling types, and report the highest rates of online gambling (Turja et al. 2012). Gambling is noticeable among young people as well. In a population based Finnish sample of 12-18 year olds, over 40 % reported having gambled within the past 6 months, out of which about 12 % gambled at least a couple times per week within the past 6 months (Raisamo, Halme, Murto & Lintonen, 2013).

It is clear that for some, gambling becomes problematic. Worldwide the prevalence of past year disordered gambling is about 2.3 %, ranging from 0.5 % to 7.6 % (Williams, Volberg & Stevens, 2012) with the prevalence in Finland being about 2.7 % (Turja et al. 2012). Within Finland individuals aged 25-34 displayed the highest rate of disordered gambling (Turja et al. 2012). Harms caused by gambling include feeling guilty about gambling, trying to win back lost money, the need to gamble with larger sums of money in order to experience the same feeling of excitement, economic difficulties, nervousness, anxiety and stress (Jaakkola et al. 2012; Turja et al. 2012).

Even though Gambling Disorder (GD) can be considered a somewhat rare occurrence, the population is broadly susceptible to the potential negative effects of gambling. Gambling problems are not limited to those with clinically significant Gambling Disorder. As Raisamo, Mäkelä, Salonen and Lintonen (2014) reported from the 2011 population survey sample, gambling harms are evident even among most low risk gamblers, advocating the need to also investigate gambling that is subclinical. According to survey responses, individuals who have experienced negative consequences from gambling have initially started gambling during adolescence (Turja et al. 2012). In addition, high frequency of gambling was associated with experiencing gambling related harms according to the results of Raisamo

and colleagues (2013). In this sample, the most common forms of harms experienced were feeling guilty, experiencing problems with relationships and disruptions of daily rhythm (Raisamo et al. 2013).

Studying gambling that causes even low levels of harm carries intrinsic value, as the knowledge gained can be utilized for the benefit of gambling individuals. Beyond this, experiencing some slight harms from gambling may eventually be followed by more severe problems related to gambling. In support of this notion, a recently completed 5 year longitudinal study concluded that at-risk gambling is a transient phase, as only 6.7 % remained as at-risk gamblers throughout the study, while 14.7 % of at-risk gamblers became GD gamblers. In this study for the most part, at-risk gamblers became non-problem gamblers (Williams et al. 2015). Here GD gambling was also found to be characterized by instability, as 80 % of GD gamblers experienced at least one year of remission (Williams et al. 2015). These findings further indicate that studying sub-clinical gambling is relevant.

1.1.1 Gambling terminology and diagnostic classification

A degree of variety in the terms used to describe gambling problems appears in the literature. This following section attempts to clarify the definitions of the terms commonly used, and simultaneously state the terms to be used throughout the present thesis. The diagnostic classification of Gambling Disorder is also described, in part to contribute to the understanding of the terminology.

Clinically significant gambling problems (i.e. diagnosis), is referred to as pathological gambling (PG) in the Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM-IV) (APA, 1994) and in the 10th revision of the International Classification of Disease (ICD-10) (WHO, 1993). In the DSM-IV and ICD-10 pathological gambling is classified dichotomously (DSM-IV, APA, 1994; ICD-10, WHO, 1993). In the Diagnostic and Statistical Manual of Mental Disorders fifth edition (DSM-5) the term Gambling Disorder (GD) is used (APA, 2013a). GD is defined as mild, moderate and severe, each requiring the fulfilment of 4-5, 6-7 and 8-9 (max. 9) diagnostic criteria, respectively (DSM-5, APA 2013; Castrén, Salonen, Alho & Lahti, 2014a,b). The diagnostic criteria for GD in the DSM-5 are the following: 1) The need to gamble with larger sums of money to achieve the same amount of satisfaction, 2) Attempts to reduce or quit gambling causes restlessness and agitation, 3) Failure to control, reduce or quit gambling, 4) Pre-occupation with gambling related thoughts, 5) Gambling in order to deal with adverse psychological states, 6) Gambling in

order to win back losses, 7) Lying about the extent of gambling habits, 8) Endangered or lost an important relationship, job or educational / career opportunity because of gambling, and 9) Sought help from others to deal with economical hardships caused by gambling (DSM-5, APA, 2013; Castrén et al. 2014a).

The term problem gambling is commonly used to refer to gambling, which is less severe than Gambling Disorder in prevalence studies as well as within the terminology of diagnostic instruments (Hodgins, Stea & Grant, 2011). Likewise, cases where some criteria are met, but not enough to be diagnosed are often referred to as at-risk gamblers (Hardoon, Gupta & Derevensky, 2004). Disordered gambling (DG), on the other hand refers to the full range of problematic gambling, encompassing gambling severity ranging from at-risk gambling to problem gambling and Gambling Disorder (NRC, 1999). The term at-risk/problem gambling (ARPG) is used in some instances, also referring to the entire spectrum of gambling. The term non-problem gambler refers to individuals who gamble, but do not manifest any diagnostic criteria (also referred to as social gamblers). Non-gamblers, on the other hand, refers to individuals who do not engage in gambling on any level.

In the present text, the term Gambling Disorder is employed when appropriate, in order to be in line with the most recent version of the DSM. Research results from this study are not referred to with Gambling Disorder, because diagnosis requires a clinical interview, which is not conducted in population surveys. The current thesis utilizes the term disordered gambling (DG) when referring to the full range of gambling problems. When citing research results on subclinical gamblers, who do not meet enough criteria to be diagnosed with GD the term at-risk gamblers is used. This thesis uses the terms non-problem gambler and non-gambler.

The publication of the DSM-5 was accompanied by changes pertaining to the classification and criteria related to Gambling Disorder (APA, 2013a). In DSM-5 Gambling Disorder is classified as a behavioural addiction within the novel category of substance-related and addictive disorders (DSM-5, APA 2013). This classification is in accordance with the research results suggesting GD and substance use disorders (SUDs) are analogous in several ways, including the expression within the brain's reward system activation, their recurrent nature, common comorbidity and treatment (DSM-5, APA 2013; APA, 2013a; Potenza, 2006).

In the current manual the criteria for GD includes 9 items (previously defined), and a positive diagnosis requires that 4 criteria are present in a 12 month period (DSM-5, APA 2013). GD diagnosis should not be given if the symptoms can be better explained by a manic episode (DSM-5, APA 2013). The item from DSM-IV referring to criminal activity has been removed from the criteria. The item related to legal problems was removed because it was considered difficult to apply on an international level due to cultural differences (APA, 2013a). Removing the item on illegal acts from the DSM-5 criteria has modestly improved the reliability of the criteria (Petry, Blanco, Stinchfield & Volberg 2013).

In DSM-5 recovery status is defined as either early remission, if an individual does not fulfil any criteria for 3-12 months, or sustained remission when no criteria are present for over 12 months. DSM-5 criteria are also to be specified on behalf of persistence, being either episodic (diagnostic criteria are met at numerous time points, with symptoms abating for at least several months) or persistent (diagnostic criteria are met uninterruptedly for numerous years) (DSM-5, APA 2013).

In DSM-IV Gambling Disorder (then termed Pathological Gambling) was classified as an Impulse Control Disorder (DSM-IV, APA, 1994). The threshold for diagnosis in the fifth edition of the DSM is lower compared to that of the DSM-IV (DSM-IV, APA 1994; DSM-5, APA, 2013). This means less is required in order to receive a positive diagnosis, which is relevant to keep in mind while comparing research results that have employed distinct editions of the DSM (Castrén et al. 2014a).

In the ICD-10 classification (WHO, 1993) pathological gambling is categorized as a Habit and Impulse disorder along with, kleptomania, pyromania and trichotillomania. The ICD-10 diagnostic criteria for pathological gambling include an intense urge to gamble and difficulty to withhold from gambling, and that gambling is continued although being detrimental for the individual. Despite ICD-10 (WHO, 1993) being the official diagnostics manual to be used in clinical work in Finland, the DSM is preferably used for research purposes.

1.1.2 Gambling types

Gambling types can be classified as being based entirely upon chance, or as being partly influenced by skill (Griffiths & Delfabbro, 2001; Stevens & Young, 2010). Gambling types are based on chance when the odds of winning do not improve with practice (Castrén, Murto & Salonen, 2014). Lotteries, scratch cards and slot machines are examples of chance based gambling types. Gambling with poker and sports betting can potentially be influenced by

element of skill, as statistics and prior knowledge can be utilized. Differences in gambling type preferences have been noted between females and males, which are discussed in more detail in section 1.4 on Disordered Gambling by gender.

Another noteworthy distinction between gambling types is whether the gambling takes place online or at a physical location providing gambling services. For example, lotteries, scratch cards, slot machines, poker and sports betting are all available at gambling websites (e.g. www.ray.fi or www.paf.com). Slot machine gambling on the internet has increased notably since 2011 (Jaakkola et al. 2012), and it is therefore important to study the harmfulness of this growing online tendency. The growing trend of online slot machine gambling is also elucidated by the fact that RAY's (Raha-automaattiyhdistys, Finnish gambling company with monopoly on slot machines) online sales of gambling grew from the year 2010 to 2011 by 1194 % (THL, 2013).

In the present thesis, the gambling types that are examined are grouped into the following categories: lottery, scratch cards, slot machine gambling, online poker, other online gambling, casino betting, sports betting and private betting. Here lottery represents the most common national daily and weekly lotteries. Other online gambling encompasses online gambling other than online poker, including for instance online slot machines. Casino betting covers betting that takes place within casino venues and betting that takes place within a venue other than a casino run by a coopier. Private betting refers to private card games and bets. The remainder of gambling type groups are self-explanatory by name (see Supplementary Table 8).

Gambling problems may be linked to certain gambling types. Gambling types based entirely on chance seemingly play role in the development of disordered gambling, as Rahman and colleagues (2012) reported that disordered gamblers who had started gambling at a young age, were more likely to have gambled with gambling types based on chance than disordered gamblers who started gambling at a later age. Slot machine gambling is a chance-based gambling type which has consistently been linked to DG. Gambling with slot machines has been internationally noted to be associated to gambling related harms (Parke & Griffiths, 2006). Furthermore, having gambled with slot machines in the past year was significantly associated with at-risk gambling and Gambling Disorder (Castrén et al. 2013b). Likewise, the most common form of harm causing gambling in Finland was reported to be slot machines, according to the annual report of the gambling helpline Peluuri (Jaakkola et al.

2012). Providing further evidence of the risks associated to slot machines, a longitudinal study concluded that living nearby a slot machine venue is a significant predictor of future disordered gambling (Williams et al. 2015). Note that within the literature, slot machines are often referred to as electronic gaming machines (EGMs) (e.g. Trevorrow & Moore, 1998) or fruit machines (e.g. Parke & Griffiths, 2006), but the term slot machines is used in the current thesis.

1.1.3 Theoretical framework of disordered gambling

The cause of origin of disordered gambling is best conceptualized within a biopsychosocial context where several determinants contribute to the outcome (Blaszczynski & Nower, 2002; Williams et al. 2015). Blaszczynski and Nower (2002) suggest in their Pathways Model theoretical framework that there are three developmental pathways leading to DG. The current thesis bears in mind the Pathways Model (Blaszczynski & Nower, 2002) when interpreting research results, although not equipped to test the assumptions of the theory. This theory is described below (see Figure 1.). According to the Pathways Model, all “developmental routes” of disordered gambling are influenced by the availability and accessibility to gamble (ecological factors), experiencing arousal and excitement from gambling (conditioning processes), irrational beliefs about gambling (cognitive representations), establishing a habit of gambling, and eventually losing control of money spent while gambling (e.g. chasing losses).

In pathway 1 disordered gambling is the result of behavioural conditioning, where gambling becomes a harmful habit. Disordered gambling that develops via pathway 1 is not accompanied by comorbid mental health issues or substance use. Pathway 2 is distinguished from pathway 1 by the prevalence of premorbid depression, anxiety, poor coping skills and stress. In effect a gambler of pathway 2 is partly motivated to gamble in order to modify feelings or satisfy psychological needs. As such, gambling may be a means of self-medication for an adverse emotional state, or turning attention away from something, avoiding boredom or seeking excitement. Pathway 2 gambling may be linked to increased alcohol consumption.

Gambling disorder that develops via pathway 3 is differentiated by the prevalence of impulsivity, antisocial behaviour and attention deficit. Pathway 3 is the least common etiological explanation for developing GD. Individuals who develop GD via pathway 3 are also plagued by the emotional vulnerability characteristic of pathway 2. Furthermore both

pathways 2 and 3 are characterized by biochemical abnormalities regarding serotonin, noradrenalin and dopamine (biological vulnerability).

The Pathways Model has been partially tested with adolescents in a cross-sectional study (Gupta et al. 2013). In this study latent class analysis (LCA) revealed 5 subtypes of at-risk and GD gamblers. 3 of these subtypes paralleled the theoretical framework: one group without simultaneous mental health issues, another group identified with past trauma, depression, self-hatred and family conflict, and one group characterized by impulsivity and antisocial tendencies. Of the two remaining subtypes identified in this study, one was characterized by depression alone and the other as expressing both depressive symptoms and simultaneously impulsivity and antisocial traits. (Gupta et al. 2013)

There is a substantial amount of evidence supporting the conceptualization of the Pathways Model (or parts of it). A literature review of studies on GD concluded that three subtypes of GD gamblers are identifiable, and these subtypes were parallel to the distinctions made in the Pathways Model (Milosevic & Ledgerwood, 2010). The biochemical component suggested by the Pathways Model (Blaszczynski & Nower, 2002) is partly supported by findings from neuroimaging research. Joutsa and colleagues (2012) found that dopamine was released in response to slot machine gambling, and that among GD gamblers dopamine release was associated to gambling symptom severity.

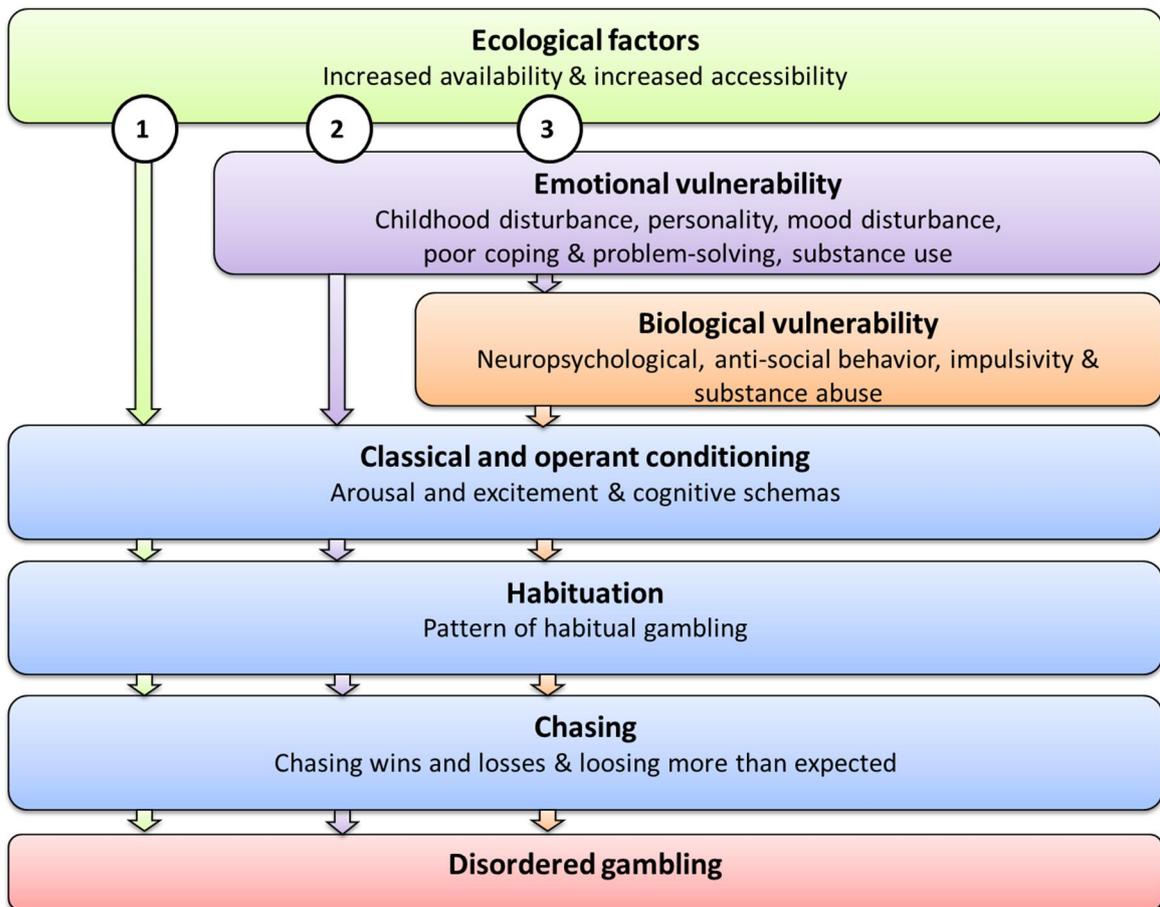


Figure 1. Diagram of the Pathways Model, modified from Alho, Heinälä, Kianmaa, Lahti & Murto (in press). The Pathways Model was originally presented by Blaszczynski and Nower (2002, p. 496). The arrow originating from the encircled number 1 represents Pathway 1. Likewise, the arrows originating from the encircled numbers 2 and 3 represent pathways 2 and 3, respectively.

1.2 Adolescence and emerging adulthood

The purpose of the youth law (Nuorisolaki 72/2006) in Finland is among other things to strengthen and enhance the growth of youth and their living conditions (1 §), and concerns individuals under the age of 29 (2. § 1. subsection). It is therefore warranted to examine the health related correlates of gambling for this specific age group, where new information can potentially be used to influence decision-making aimed at maintaining and enhancing the well-being of this population. Research related to addiction among adolescents and young adults has obvious societal importance. Identifying age specific subtypes of disordered gamblers would provide important information to be utilized in developing prevention and treatment programs (Gupta & Derevensky, 2011). Individuals within the age range of 15 to 28 are diverse in many senses. This diversity includes the maturity of the brain and body, as well as in terms of independence, both in an economic sense and in relation to authoritative figures. As such, the sample is likely to constitute of heterogeneous groups of gamblers.

The literature up to date indicates a heightened vulnerability of adolescents to take part in potentially addictive behaviour, and that this is linked to normative developmental changes. Common behavioural tendencies of adolescence include heightened interaction with peers, risk-taking behaviour and sexual behaviour (Spear, 2000; Steinberg 2005). The late part of adolescence, part of the transition to adulthood, is often manifested by experimentation (Arnett 2000; Staff et al. 2010). During this time the prevalence of substance use has been noted to reach its maximum (Stone, Becker, Huber & Catalano, 2012). This developmental period referred to as emerging adulthood by Arnett (2000) is observable in developed countries, and is marked by less involvement of authority figures such as guardians and school teachers, but without the duties related to adulthood, such as parenting and responsibilities of a work-career.

The rise in risk taking behaviour documented among adolescents may be partly the result of the development of the dopaminergic reward circuitry, as concluded by Blakemore and Robbins (2012) in their review. Risk taking among emerging adults may furthermore be influenced by the predominant life situation of an individual, as previously noted in reference to Arnett's theoretical framework. Obviously there are numerous possibilities to what leads an individual to engage in risk taking behaviour. Likewise risk taking behaviour itself can of course take many forms, and at least in western cultures may constitute experimentation with alcohol or other substances.

Intuitively gambling is a form of risk-taking, providing the thrill of possibly winning more money at the risk of losing the initial investment. Heightened risk taking behaviour is associated to the incentive to participate in novel experiences and intense stimuli (Arnett, 1994), which can logically be applied to the context of gambling. As gambling enthralls the player with a lot of sensory and mental arousing, being eager for new experiences and intense stimuli can place an individual at risk of developing problematic gambling (Nower, Derevensky & Gupta 2004).

Risk taking is influenced by numerous factors, as previously mentioned and subsequently elaborated upon. Personality traits have been linked to risk-taking behaviour. It is a well-accepted fact that sensation-seeking contributes to risk taking behaviour (Zuckerman, Eysenck & Eysenck 1978). This association has also been specifically identified among adolescents and emerging adults (Greene, Krcmar, Walters, Rubin & Hale, 2000). In addition, brain development that is characteristic of adolescence (areas associated to motivation, impulsivity and addiction) are likely to influence the well documented enhanced risk-taking behaviour occurring during adolescence (Chambers, Taylor & Potenza, 2003; Doremus-Fitzwater, Varlinskaya & Spear, 2010).

Concurrently, the decision to take part in any risk taking behaviour is partly aroused by affect and social influences (Steinberg, 2004). Hence, it is safe to say that many forces are at work and partially overlapping in determining causalities and correlations of risk-taking behaviour. It is not the intention to suggest that risk taking is synonymous with engaging in addictive behaviour, but risk-taking most likely plays a crucial role, as previous suggested.

1.3 Disordered gambling among adolescents and emerging adults

As previously cited, adolescence is a developmental time constituting heightened vulnerability for developing addictions due to greater motivational drive for novel experiences accompanied by an underdeveloped inhibitory control system of the prefrontal cortex (Chambers et al. 2003). In firm support of this, the risk of developing DG has numerously been shown to be highest among young individuals (about 18 to 25 years of age), and similarly that the prevalence of DG is higher among adolescents than among adults (Delfabbro, King & Griffiths, 2014; Haroon & Derevensky, 2001).

Though the risk of DG is highest during youth, the roots of developing disordered gambling may reach into childhood. Pagani, Derevensky and Japel (2009) found a causal link between kindergarten teacher-rated impulsivity and gambling 5 years later. Early age of gambling

onset has been linked to developing more severe gambling problems, compared to individuals who start gambling at an older age (Jiménez-Murcia et al. 2010). Adolescents who started gambling prior to age 12, were more likely to meet at least one DSM-IV criteria than later-onset gamblers (Rahman et al. 2012). In addition, a longitudinal study found that early onset of gambling was linked to higher levels of acting without thinking and sensation seeking (Betancourt et al. 2012). In this study it was concluded that Gambling Disorder is related to inadequate impulse control and alternations in areas of the brain responsible for reward and aggression (Betancourt et al. 2012). Put together, the evidence warrants further detailed studies on gambling at a young age. Despite the compelling amount of evidence linking young age and disordered gambling, Williams and colleagues (2015) could not replicate this finding in their longitudinal study.

The older half of the current sample (21 < years) can also be considered to be particularly vulnerable to the potential adverse effects of gambling, as previously suggested. Disordered gambling is likely to be associated to distinct cognitive characteristics among individuals of legal age, in a similar manner as formerly stated for adolescents. Deficits in cognitive control and reward processing have been identified among adult GD gamblers, indicative of frontal lobe dysfunction (Goudriaan, Oosterlaan, de Beurs & van den Brink, 2006).

In light of the framework of Arnett (2000) and the pathways model (Blaszczynski and Nower, 2002), behaviourally conditioned disordered gamblers may be represented among the older half of the current sample, due to heightened risk taking. In agreement with this, the largest proportion of problems gamblers in 2011 within the Finnish population was among 25 to 34 year olds, who also displayed the highest proportion of internet gambling and largest variety of different gambling types engaged in (Turja et al. 2012). In light of the findings of Turja and colleagues (2012) previously mentioned, it is hypothesized that within the current sample disordered gambling will be associated to older age. Considering that the late twenties – early thirties may be marked by a heightened susceptibility to develop disordered gambling, it is important to acknowledge that adolescents and are at the brink of reaching this age, while emerging adults are essentially of this age.

1.4 Disordered gambling by gender

Piccinelli and Wilkinson (2000) concluded in their review that depressive disorders are more common among females than males, and the explanation to this gender difference is multifaceted. Likewise men have been found to drink heavily at a higher rate than females

at an international level (Wilsnack, Vogeltanz, Wilsnack & Harris, 2000). In a similar manner, it is well documented within the literature that males and females differ from each other in their tendencies to develop disordered gambling, as reviewed next.

With a working-age sample (mean age 42.9), Castrén and colleagues (2013a) found that males were significantly more strongly represented than females at all levels of gambling, ranging from low-level to disordered gambling. Prevalence rates of at-risk gambling and GD have internationally been found to be higher amongst males than females (Williams et al. 2012), and males tend to start gambling at an earlier age (Tavares, Zilberman, Beites & Gentil, 2001). As such, it is hypothesized that male gender will be associated to disordered gambling.

Gender differences related to gambling are visible over time as well. From the year 1995 to 2011 the rate of school aged girls who gamble at least once per week has remained fairly stable (5-8 %). On the contrary, during this time the amount of at least weekly gambling has significantly increased among school aged boys from 36 % to 45 % (Järvinen-Tassopoulos & Raitasalo, 2015). The development of disordered gambling seemingly differs between the genders, as females tend to start gambling at a later age, but develop gambling related problems in a shorter time frame than what has been documented among males. The faster development of disordered gambling among females is referred to as telescoping phenomenon (Lesieur, Blume & Zoppa, 1986; Tavares et al. 2001).

Substance related gender differences are visible within the context of gambling as well. For example, Castrén and colleagues (2013a) detected a strong associating between male gender and risk-level alcohol consumption with low and moderate levels of gambling. Similarly, nicotine dependence was found to be a stronger risk factor associated with GD for females than males (Petry, Stinson & Grant, 2005). In light of the previously mentioned findings, it is possible that within the current sample males show a stronger association between risky alcohol consumption and disordered gambling than among females, and likewise that the association between tobacco smoking and gambling is stronger among females than males.

There seem to be gender specific motivations to gamble influencing gambling type preferences, as Trevorrow and Moore (1998) suggest loneliness and alienation may be associated to the choice to gamble with slot machines among women. In light of what Trevorrow and Moore (1998) suggested, playing slot machines is hypothesized to be

associated to feeling lonely in the current sample. Additionally this association is expected to be stronger among females.

Additional documented gender differences in gambling type preferences include the finding that scratch cards was the only form of gambling that was more popular among women than among men in a Finnish working-age sample (Castrén et al. 2013a). Males on the other hand preferred gambling forms such as sports betting, horse racing and internet poker, suggesting that gambling types with an element of skill may be preferred more strongly by males than females (Castrén et al. 2013a). This preferential difference for gambling types based on chance among women and (partly) skill based gambling types among men was also evident in Ladd and Petry's (2002) study. Also, among gambling helpline users females were more likely to report problems exclusively with gambling types based on chance (Potenza et al. 2001). In Finland gambling types run by a coopier (e.g. Black Jack) are available at venues where alcohol beverages are served (i.e. at Grand Casino Helsinki and at bars), for which reason this type of gambling (referred to as casino betting) is hypothesized to be associated to risky alcohol consumption. Risky alcohol use on the other hand is expected to be associated to disordered gambling (see section 1.5.3 on gambling, alcohol and tobacco).

Taken together, the findings presented warrant the investigation of possible gender differences in gambling, that are likely to be related to differences in the use of alcohol and tobacco, and psychological well-being and gambling type preferences in the current sample. Despite the available evidence about gender differences, limited information is available on the correlates of female gambling because of its infrequent occurrence (Derevensky & Gupta, 2004). This being the case, it is plausible that low occurrence of female gambling obstructs the current study's ability to identify gender specific associations of disordered gambling.

1.5 Disordered gambling and indicators of health and well-being

1.5.1 Disordered gambling, mental health and loneliness

Co-occurrence of mental health problems with at-risk gambling and GD is high, as highlighted by a systematic review reporting comorbid rates in population surveys of any mood disorder to be on average 37.9 % and any type of anxiety disorder to be 37.4 % (Lorains, Cowlishaw & Thomas, 2011). Similarly, GD gamblers were found to have psychosocial problems more often than at-risk gamblers, non-problem gamblers and non-

gamblers, with conduct problems having the highest prevalence, followed by family problems (Hardoon et al. 2004).

Further evidence in this domain stems from a comprehensive longitudinal study that reported having any mental health problem to be significantly associated to disordered gambling, where depression was the strongest predictor of the measured mental health problems (Williams et al. 2015). In this same study, lower levels of happiness and higher stress levels were significantly associated to disordered gambling (Williams et al. 2015). Depression has also been linked to disordered gambling specifically among adolescents (Molde, Pallesen, Bartone, Hystad & Johnsen, 2009). Based on the reviewed evidence it is hypothesized that poor mental health is associated to disordered gambling in the current sample.

There is reason to believe that loneliness can play a role in making the decision to gamble. At-risk gamblers were more likely to feel lonely than non-gamblers and GD gamblers, indicating that loneliness may be a risk factor for developing more severe disordered gambling (Castrén et al. 2013b). Perceived social support from peers may serve as a protective factor against developing disordered gambling, as Hardoon and colleagues (2004) found that non-problem gamblers perceived higher support from friends than at-risk gamblers reported. On the other hand gambling tendencies among peers has been found to be strongly correlated to disordered gambling (Castrén, Grainger, Lahti, Alho & Salonen, 2015). This being the case, having peer support in itself cannot be said to be a protective factor against DG.

1.5.2 Disordered gambling and perceived health

It is interesting to study perceived health as a correlate of disordered gambling, in the sense that it would be valuable to know whether gambling problems are associated to lower self-rated health. Previous studies have not reported findings for an association between perceived health and DG. The longitudinal study conducted by Williams and colleagues (2015) concluded that disordered gambling is significantly associated to life satisfaction and lower subjective well-being. Life satisfaction and subjective well-being are not identical to perceived general health, but intuitively both influence the perception of health. As such, it is possible that poor perceived health is associated to disordered gambling in the present sample.

1.5.3 Disordered gambling, alcohol and tobacco

There is substantial evidence that addictions are easily co-occurring (Hakkarainen, Järvinen-Tassopoulos & Metso, 2010; Sussman, Lisha & Griffiths, 2011), meaning that individuals diagnosed with one addiction commonly suffer from other addictions too. In line with this, within a larger sample from the same dataset as the current study, nicotine use was associated with all levels of gambling severity (Castrén et al. 2013a). Likewise, Lorains and colleagues (2011) concluded that comorbid nicotine dependence among at-risk and GD gamblers in population surveys is on average 60.1 %, and for substance use disorders 57.5 %. In the same manner, Haroon and colleagues (2004) reported substance use to rise significantly with gambling involvement. Williams and colleagues (2015) concluded from their longitudinal study, building upon the amounting evidence, that alcohol abuse was a predictor of disordered gambling. Also, a Norwegian study concluded that alcohol abuse was associated to at-risk gambling and Gambling Disorder among adolescents (Molde et al. 2009). Similarly among Finnish adolescents smoking tobacco and drinking alcohol for intoxication were associated to DG (Castrén et al. 2015).

The rate of abstinence among Finnish students had risen from 1995 to 2011 only among those students who gambled at a frequency of less than once per week (Järvinen-Tassopoulos & Raitasalo, 2015). During this time frame the rate of experimentation with cannabis had grown especially among students who gambled at least once per week for both boys and girls (Järvinen-Tassopoulos & Raitasalo, 2015). Here daily tobacco smoking and experimentation with snus (tobacco product) had risen particularly among female students who gambled at least once per week (Järvinen-Tassopoulos & Raitasalo, 2015). This finding lends further support to the notion that the association between tobacco smoking and disordered gambling may be stronger among females than among males in the current sample (discussed previously in section 1.4 on gambling and gender). Williams and colleagues (2015) also concluded in their longitudinal study that tobacco use was a consistent predictor of disordered gambling. It is therefore warranted to investigate the occurrence of alcohol and tobacco use among gamblers in the current sample.

1.6 Disordered gambling and computer gaming

Computer gaming is becoming increasingly popular among adolescents and young adults, and for some players computer gaming may become detrimental (Ferguson, Coulson & Barnett, 2011). Internet Gaming Disorder (IGD) can be viewed as a non-substance related addiction (or behavioural addiction), but is nonetheless included in the DSM-5 in the

research appendix Section 3 as a topic that requires further research before diagnostics can be defined (DSM-5, APA 2013). This placement is due to a lack of evidence and inconsistency in research methods related to Internet Gaming Disorder (Petry & O'Brien, 2013; Walther, Morgenstern & Hanewinkel, 2011). This being the case, the current research question concerning gaming as a predictor of disordered gambling is timely, as it contributes to this understudied topic. Previous research that has utilized the same population survey dataset from 2011 as in the current study, have not examined the variables pertaining to gaming. Here, gaming refers to computer, console and mobile games, which are not played for money. The term computer gaming will be used from here on out in reference to this topic.

If computer gaming is by nature to be considered as an addition, co-occurrence with other similar additions should be evident (Sim, Gentile, Bricolo, Serpelloni & Gulamoydeen, 2012). Along with GD, an extreme form of computer gaming (i.e. IGD) can be considered to be a behavioural addiction that is comparable particularly to gambling that takes place online. There is evidence that suggests computer gaming and gambling may co-occur to some extent. First, playing computer games frequently was associated to disordered gambling among Finnish adolescents (Castrén et al. 2015). Second, it has been documented that adolescents who are disorder gamblers are more likely to play computer games at a high frequency than adolescents who are non-problem gamblers or non-gamblers (Wood, Gupta, Derevensky & Griffiths, 2004). Third, Gaming correlated significantly albeit weakly with gambling in an adolescent and young adult sample (Walther et al. 2011). Similarly, increasing amount of online gambling was associated to higher frequency of online gaming (Floros, Siomos, Fisoun & Geroukalis, 2013). In line with previous findings, it is hypothesized that disordered gambling and computer gaming will co-occur at a modest rate.

1.7 Objectives and hypotheses

The objectives of this study are grouped into 3 sections. Results are addressed according to this same division. Hypotheses are presented where appropriate for each objective. Beyond the hypotheses defined subsequently additional associations are expected to arise, but are approached in an explorative manner. Results are interpreted in the light of the DSM-5 (APA, 2013) criteria for Gambling Disorder, viewing the disorder as a behavioural addiction.

1. Examine at-risk behaviours (disordered gambling, risky alcohol consumption, tobacco smoking, and high frequency computer gaming) by age and gender. The

function of this examination is to help make accurate judgements related to the correlates of disordered gambling, in addition to providing epidemiological rates.

2. Examine mental health, loneliness, perceived health, risky alcohol consumption, tobacco use and frequent computer gaming as predictors of disordered gambling while controlling for the effects age and gender. The likelihood of disordered gambling is hypothesized to increase with age. Likewise, it is hypothesized that male gender is a significant predictor of disordered gambling. Furthermore, it is hypothesized that poor mental health, loneliness risky alcohol consumption and tobacco smoking are all significant predictors of disordered gambling. Although not definitive hypotheses of the current study, it will be investigated whether the association between DG and the indicators of health and well-being differ between females and males. Specifically, it will be investigated whether the association between tobacco smoking and disordered gambling is stronger among females than males, and likewise whether the association between risky alcohol consumption and DG is stronger among males. It is hypothesized that high frequency computer gaming and disordered gambling will co-occur, but at a modest rate.
3. Examine the relationship between specific gambling types and DG, mental health, loneliness, perceived health, risky alcohol consumption, and tobacco use. Slot machine gambling is hypothesized to be a strong predictor of disordered gambling, and also associated to loneliness. Engagement in casino gambling is expected to be linked to risky alcohol consumption.

2. Methodology

2.1 Sampling procedure

The survey was planned by the National Institute for Health and Welfare (THL) and executed by the research firm Taloustutkimus Oy during the autumn and winter of 2011. The target group for the survey was 15-74 year olds, with the purpose of providing gambling and health related statistics. Participants spoke Finnish or Swedish as their mother tongue, and resided in the mainland of Finland. The initial random sample consisted of a registry of 16000 individuals. The final sample consisted of 4484 individuals. The survey questionnaire was structured and conducted by computer assisted telephone interviews. See Turja & Mervola (2012) and Turja and colleagues (2012) for more detailed reports of sampling procedures and sample characteristics.

2.2 Participants

The current sample (n = 822) age ranges from 15 to 28. All ages are well represented as 16.9 % are aged 15 to 17 years, 33.1 % are aged 18-21, 28.8 % are aged 22-25 and 21.2 % are aged 26-28. Roughly half (49.3 %) of the survey participants are female, and this ratio remains relatively unchanged between the previously defined age groups.

Results from the numerous instruments utilized will be examined for gender and age group differences. As previously specified, age will be categorized into 4 groups. Gender differences will be further investigated by re-running analyses for males and females separately, in addition to utilizing the entire sample. Additional demographics such as years of education, occupation and marital status will not be controlled for in analyses. This decision is based on the fact that a great deal of normative variation is expected for these measures with the current age range (Arnett, 2000). Information on background variables of the current sample are available in Supplementary Table 1.

2.3 Measures

2.3.1 Disordered gambling

The Problem Gambling Severity Index (PGSI) is a nine item instrument, in which past year probable gambling problems are measured by tapping into 2 constructs, gambling behaviour and gambling consequences (Ferris & Wynne, 2001). The responses on the 9 items are summed, reaching a maximum of 27 points. As originally intended, a sum score of 0 is indicative of non-problem gambling, 1-2 low level gambling with none or few negative consequences, 3-7 moderate gambling with some harmful consequences and $8 \leq$ problem gambling with several negative consequences.

In the present study a dichotomous categorization was employed for analyses, such that individuals scoring 0 to 1 on the PGSI are categorized as non-problem gamblers, and individuals scoring at least 2 are classified as disordered gamblers. This classification method is justified by the fact that Finnish adolescents who had experienced gambling related harms, experienced on average 2 forms of harm (Raisamo et al. 2013). It was initially intended to use the classification style suggested by Currie, Hodgins and Casey (2013) which was found to discriminate well among low and moderate gamblers on behalf of gambling type preferences. This classification style was discarded because of low rates of individuals in the moderate risk and problem gambler groups (see Supplementary Tables 5a-c).

The nine items of the PGSI

1. Have you bet more than you could afford to lose?
 2. Have you needed to gamble with larger amounts of money to get the same excitement?
 3. Have you gone back to try to win money you have lost?
 4. Have you borrowed money or sold anything to get money to gamble?
 5. Have you felt that you might have a problem with gambling?
 6. Have you felt that gambling has caused you any health problems, including stress or anxiety?
 7. Have you been criticized for your betting, or been told that you have a gambling problem whether or not you thought it is true?
 8. Have you felt that your gambling has caused financial problems for you or your household?
 9. Have you felt guilty about the way you gamble or what happens when you gamble?
-

The Canadian Problem Gambling Index (CPGI) from where PGSI is derived from, was developed to be used in the general population (Abbott & Volberg, 2006; Ferris & Wynne, 2001). The development of the CPGI was conducted with a large sample representative of the general population, and retested with subsamples and clinical interviews (Ferris & Wynne, 2001). The PGSI items were selected based on the fact that they were the most effective items at discriminating between non-gamblers, at-risk gamblers and GD gamblers. The PGSI is a reliable and valid instrument, displaying internal consistency, test-retest reliability and concurrent validity (Abbott & Volberg, 2006). The original categorical classifications of the PGSI correlated .302 with gambling frequency (Holtgraves, 2009) and .82 ($p < .001$) with self-rated perception of disordered gambling (McMillen & Wenzel, 2006). PGSI score correlated significantly ($r = .82$) with the DSM-IV (APA, 1994) score (Orford, Wardle, Griffiths, Sproston & Erens, 2010). The DSM-IV scale (APA, 1994) is intended to measure disordered gambling, while gambling frequency and self-perception of disordered gambling can be considered as external reference standards of disordered gambling. The correlations with gambling frequency, perceived problems and the DSM-IV lend evidence for the construct validity of the PGSI instrument. The intraclass correlation coefficient (ICC) of the PGSI score between 2 time points covering 14 months was 0.63 ($p < .001$), indicative of good agreement (Currie et al. 2013). Williams and Volberg (2014) concluded that the CPGI has high sensitivity (0.912) and specificity (0.855), but poor positive predictive power (0.494) resulting in higher prevalence rates of GD compared to prevalence rates based on clinical assessment.

2.3.2 Gambling types

Survey respondents were questioned whether they had engaged in 18 predefined gambling types, and about gambling frequency for each gambling type individually. Frequency was measured on a 7-point Likert scale: daily / almost daily, several times per week, once a week, 2-3 times per month, once per month, more seldom, cannot say. For analyses dealing with gambling types, 8 gambling type groups were formed. These 8 groups include all 18 gambling types that were inquired about in the survey questionnaire (see Supplementary Table 8). An individual was classified as a player of a specific gambling type if he or she played this form of gambling at least 2-3 times per month. As previously described (Section 1.1.2 Gambling types) gambling types were classified into the following groups: lottery, scratch cards, slot machine gambling, online poker, other online gambling, casino betting, sports betting, and private betting

2.3.3 Indicators of health and well-being

Mental health. Mental health is measured with the five item Mental Health Inventory (MHI-5) (Veit & Ware, 1983). MHI-5 items are scored on the range of 1-6 where high scores are indicative of good mental health. The 5 items inquire about feelings of nervousness, calmness, happiness and about feeling down and gloomy (2 items). Each item is answered in respect to the time frame of the past 4 weeks, and the meaning of the responses are as follows: all of the time (6), most of the time, a good bit of the time, some of the time, a little of the time, none of the time (1) (Ware & Gandek, 1998). The sum score of the instrument therefore ranges from 5 to 30. The sum score is linearly transformed to vary from 0 to 100. The lowest possible score represents “feels nervous and depressed all of the time”, while the highest possible score represents “feels peaceful, happy and calm all of the time” (Ware & Gandek, 1998).

In this study a cut-off score of 60 will be used to classify moderate to poor mental health. A cut-off score of 60 produces the smallest error rate, as defined by yielding the highest sensitivity and specificity rates (Kelly, Dunstan, Lloyd & Fone, 2008). This cut-off score has been previously used among adolescents (e.g. Theunissen, Jansen & van Gestel, 2011).

The MHI-5 is part of the SF-36 questionnaire, which measures general health with 8 separate scales, each measuring its own health related concept. These 8 scales are summed into 2 summary measures, physical health and mental health. In a study evaluating the factor structure of the SF-36 in 10 countries, the MHI-5 scale displayed high correlations with the

rotated mental health component (range 0.81-0.91), and low correlations with the physical health component (range 0.09-0.25) (Ware et al. 1998). The MHI-5 scale is among the most precise scales of the SF-36. The scales are considered suitable for telephone interview among individuals aged 14 years and older (Ware & Gandek, 1998). A strength of this instrument is that it has been widely used in population surveys of general health, not only within clinical populations (Strand, Dalgard, Tambs & Rognerud, 2003).

Previous studies have proven the instrument to be a valid screening tool for depressive and anxiety symptoms. MHI-5 displayed satisfactory validity for measuring mood disorders and anxiety disorders in a general population sample using DSM-IV criteria as a reference (Rumpf, Meyer, Hapke & John, 2001). The internal consistency of MHI-5 as measured by Cronbach's alpha is sufficient, receiving values above .80 and correlates significantly with GHQ-12 scores and SCL (5, 10 and 25) scores which are intended to measure the same constructs (McCabe, Thomas, Brazier & Coleman, 1996; Strand et al. 2003). In a previous study utilizing a larger subsample from the same dataset as the current study, Cronbach's alpha for MHI-5 was 0.77 (Castrén et al. 2013b).

Loneliness. Survey participants were inquired about the frequency of feeling lonely with a single item. Loneliness is rated on a 5 point Likert scale (1-5; high values represent feeling lonely often). Loneliness is compressed for analysis into 2 categories, 1) never, seldom, sometimes and 2) quite often, often. This 2-class categorization is applied for analyses in order to satisfy the requirements of statistical methods used (see section 2.4 for analytic procedures).

Perceived Health. Survey participants were inquired about their subjective perception of their general health with a single item. Perceived general health is scored on a 5 point Likert scale (1-5) where high values represent poor health. Scores are compressed to 2 categories for analyses, 1) good, somewhat good, average and 2) somewhat bad, bad. Again, this 2-class categorization serves to satisfy the requirements of statistical methods used, as previously also stated in regards to the measurement of loneliness.

Alcohol and Tobacco. Alcohol consumption was rated with the three item Alcohol Use Disorders Identification Test -Consumption (AUDIT-C) (Bush, Kivlahan, McDonell, Fihn & Bradley, 1998) screening tool. Each item is rated on a scale from 0 to 4 (sum score range 0-12), where higher scores indicate higher risk consumption. AUDIT-C is adequately

capable in detecting risk drinking in the general population (Dawson, Grant, Stinson & Zhou, 2005).

Risky alcohol consumption was defined as scoring at least 6 for males and at least 5 for females on the AUDIT-C. Cut scores are used to create a two class variable, making a distinction between risky consumption and non-risky / no consumption. These are the same cut-offs as employed by Castrén and colleagues (2013b), and these cut-offs were concluded to be optimal by Kaarne, Aalto, Kuokkanen and Seppä (2010). Optimal levels of sensitivity and specificity are reached when gender specific cut-offs are defined (Reinert & Allen, 2007). In further support of the current cut-off scores for the present sample, Dawson and colleagues (2005) concluded that a cut-off score of $5 \leq$ is best for detecting any alcohol use disorder (AUD) or risk drinking among 18–29 year olds, but here gender differences were not considered. In a previous study utilizing a larger subsample of the same dataset as the current study, the Cronbach's alpha of the AUDIT-C was 0.61 (Castrén et al. 2013b). This may seem as an alarmingly low value, but considering that the instrument has only 3 items, a low estimate of reliability is expected (Cronbach, 1951).

Tobacco use was measured with the single question “Have you smoked within the past 12 months?” Three predefined response choices are provided, “yes, daily”, “yes, occasionally” and “no”. Both positive responses are grouped together for analyses.

2.3.4 Computer gaming

The current survey inquired about the hours spent gaming in the past 7 days and within the past 30 days. Based on the reviewed literature on computer gaming studies, excessive computer gaming is defined as playing more than 5 hours a day (Grüsser, Thalemann & Griffiths, 2007). Respondent answers are converted for categorization as non-gaming, low frequency gaming (1-4 h / day) and high frequency gaming (≥ 5 h / day). For high frequency gaming classification, it is enough to exceed the threshold for either or both items (weekly and / or monthly time spent). It is noteworthy to mention that judgements about the prevalence of internet gaming disorder (IGD) (DSM-5, APA, 2013) cannot be made with the information at hand.

The current 5 hours per day threshold is well justified. First, it differentiates high frequency usage from average usage, which is estimated to be about 1 hour per day. Adolescent males spent on average about 1 hour gaming on weekdays and about 1 hour 40 minutes on weekends (Cummings & Vandewater 2007). The corresponding time spent for adolescent

girls was about $\frac{3}{4}$ of an hour on weekdays and 1 hour on weekends (Cummings & Vandewater 2007). Equivalent levels of average time spent gaming was found in a German sample: 1 hour daily for males and 40min daily for females (Festl, Scharkow & Quandt, 2012). Second, IGD gamers played on average 4.7 hours daily (SD=4.03), which differed significantly from non-IGD gamers (M=2.49, SD=2.22) (Grüsser et al. 2007). In Grüsser and colleagues' (2007) study IGD gaming was defined according to ICD-10 (WHO, 1993) dependence syndrome, requiring fulfilment of at least 3 out of 6 diagnostic criteria.

2.4 Analysis procedures

First, in order to address the research questions of the 1st objective, cross tabulations were conducted. Gender and age group specific frequencies of lifetime gambling prevalence, PGSI and MHI-5, AUDIT-C, tobacco smoking status and computer gaming frequency classifications were calculated.

The primary research questions (objectives 2 and 3) were addressed with binary logistic regression. Particular attention was paid to the odds ratio results. Odds ratios depict the multiplier by which the probability of belonging to a specific group of the dependent variable increases in relation to the predictors of the model. As such, the dichotomous classification of the PGSI score can straightforwardly be used as the dependent measure when addressing the research questions of objective no. 2. As part of addressing the research questions of objective no.3, the indicators of health and well-being that are primarily used as predictors of disordered gambling, are also used as dependent variables of logistic regression. Thus, in order to maintain comparability between regression results, all measurements of interest are utilized as nominal scale variables throughout analyses. The effects of age and gender will be accounted for in all logistic regression analyses. Logistic regression models (objectives 2 and 3) were additionally calculated for males and females separately to elucidate whether gender differences are evident within the current sample.

Logistic regression is frequently used within the scientific literature of gambling problems (e.g. Donati, Chiesi & Primi, 2013). Beyond conforming to the methods used in similar studies, the variables of interest are not normally distributed in the current sample (see supplementary Figures 1-7), further providing support for the use of logistic regression. While not placing assumptions for the normality of predictor variables (Peng, Lee & Ingersoll, 2002), logistic regression does assume that predictors do not correlate strongly with each other. In the present sample, correlations between variables are modest, for which

reason multicollinearity is not an issue (see Table 1). Correlations were additionally computed separately for males and females (see Supplementary Table 4). Gender specific correlations were also low, similarly to the correlations of the entire sample.

It is noteworthy to mention that non-gamblers have not completed the PGSI, but for analyses these individuals have been coded to score 0 (opposed to missing value). This ensures that analyses are representative of the entire population, and not only individuals who have gambled. Comparison of those who have never gambled (n = 92) and those who have (n = 728) revealed that non-gamblers were more likely to be females, under aged, drink less alcohol and less likely to smoke tobacco. Additionally, computer gaming was less common among non-gamblers than among gamblers.

Analyses were conducted with a weighted sample, in order to make the sample characteristics match the population by taking into account age, gender, and residential area (Southern, Western, Eastern and Northern Finland). In effect, this means that sample representativeness has been adjusted to characterize proportionately each gender-age-geographic area specific population size correctly. See Turja & Mervola (2012) for more detailed report of weighting procedures. Analyses were performed with SPSS (IBM SPSS Statistics 22).

Table 1. Pearson correlations of study variables (n = 822).

	Correlations							
	1.	2.	3.	4.	5.	6.	7.	8.
1. Age								
2. Gender ¹	.03							
3. PGSI sum score ²	-.02	.13**						
4. Smoking status ³	.11**	.03	.17**					
5. AUDIT-C sum score ⁴	.18**	.28**	.21**	.35**				
6. MHI-5 sum score ⁵	.00	.07*	-.16**	-.06	-.05			
7. Loneliness ⁶	.04	-.11**	.15**	.03	.01	-.46**		
8. Perceived health ⁷	.03	.02	.14**	.12**	.01	-.33**	-.18**	
9. Gaming ^{8†}	-.14**	.30**	.10**	-.01	.03	.00	.05	.05

Categorical codings for variables: ¹female = 0; ³Does not smoke = 0; ⁸no gaming = 0, 1-4 h/day = 1, ≥5 h/day = 2. High values for continuous variables represent: ²disordered gambling, ⁴risky alcohol consumption, ⁵good mental health, ⁶frequently feeling lonely, ⁷poor perceived health; † Spearman's correlations (n = 748); statistical significance ** p<0.01; *p<0.05 (2-tailed).

Missing values were present exclusively for variables concerned with computer gaming frequency. 9 % (n = 74) of respondents had missing values for both questions inquiring about computer gaming frequency. There were more females (n = 49) with missing values than males (n = 25). Underage respondents had the least missing values (n = 24) accounting for 11.5 % of individuals with missing values. Analogous percentages for the older age groups ranged from 26 to 34 %. There were proportionately fewer disordered gamblers among those with missing values for computer gaming frequency (6.8 %) than among those without missing values (9.6 %). Because missing values were relatively infrequent, no actions were taken to replace them. Analyses concerning computer gaming thus have a slightly different sample compared to all other analyses.

3. Results

3.1 Objective 1: Examination of at-risk behaviour by age group and gender

Tables 2 and 3 display the means for continuous measures and frequencies for categorical measures. The descriptive statistics of tables 2 and 3 display information both for the entire sample and for the two genders separately. These statistics are for the true (unweighted) sample. For comparison of the unweighted sample and weighted sample see Supplementary Tables 2 and 3.

Table 2. Descriptive statistics for continuous variables with unweighted sample.

	Females			Males			Total		
	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.
PGSI sum score	405	0.27	1.26	417	0.67	1.49	822	0.48	1.40
AUDIT-C sum score	405	3.28	2.20	417	4.71	2.82	822	4.01	2.63
MHI-5 sum score	405	78.47	12.76	417	80.48	13.21	822	79.49	13.02
Loneliness	405	1.97	0.82	417	1.79	0.80	822	1.88	0.81
Perceived health	405	1.35	0.63	417	1.37	0.65	822	1.36	0.64
Computer gaming (hrs/week)	277	2.21	5.49	337	6.82	10.40	614	4.74	8.84
Computer gaming (hrs/month)	353	5.94	19.22	384	20.18	27.32	737	13.36	24.81

Table 3. Classification frequencies for nominally coded variables with unweighted sample.

		Females		Males		Total	
		N	%	N	%	N	%
Life time gambling	No	62	15.3	32	7.7	94	11.4
	Yes	343	84.7	385	92.3	728	88.6
PGSI score	0-1	386	95.3	359	86.1	745	90.6
	≥2	19	4.7	58	13.9	77	9.4
Smoking	No	241	59.5	238	57.1	479	58.3
	Occasionaly / Daily	164	40.5	179	42.9	343	41.7
AUDIT-C score	Non-risky consumption	296	73.1	246	59.0	542	65.9
	Risky consumption	109	26.9	171	41.0	280	34.1
MHI-5 score	Normal mental health	381	94.1	394	94.5	775	94.3
	Poor mental health	24	5.9	23	5.5	47	5.7
Loneliness	High frequency	11	2.7	10	2.4	21	2.6
	Low frequency	394	97.3	407	97.6	801	97.4
Perceived health	Poor	24	5.9	34	8.2	58	7.1
	Good	381	94.1	383	91.8	764	92.9
Computer gaming frequency	None	144	35.6	53	12.7	197	26.3
	Low (1-4 h/day)	208	51.4	329	78.9	537	71.8
	High (≥5 h/day)	4	1	10	2.4	14	1.9

The research questions of the first objective are addressed in table 4, where age group and gender specific frequencies for gambling, risky alcohol consumption, tobacco smoking and computer gaming are presented. In the upcoming text, the differences between males and females are presented. Males were disordered gamblers more often than females ($X^2(1) = 22.55$, $p < .001$). Males consumed alcohol at a risky level more often than females ($X^2(1) = 23.22$, $p < .001$). Males were more likely than females to play computer games 1-4 hours per day compared to females, and likewise females were more likely to not play computer games at all ($X^2(2) = 77.89$, $p < .001$). Males and females did not differ in regards to high frequency computer gaming ($5 \leq h/day$). There was no gender difference in regards to tobacco smoking ($X^2(1) = 0.62$, $p = .469$).

Table 4. Frequencies of lifetime gambling, disordered gambling, risky alcohol consumption, tobacco smoking and computer gaming frequency (%) by age group and gender.

	Males					Females					Total				
	15-17	18-21	22-25	26-28		15-17	18-21	22-25	26-28		15-17	18-21	22-25	26-28	
Lifetime gambling															
No	16 (21.3)	10 (7.4)	2 (1.6)	4 (4.7)		25 (39.1)	18 (13.1)	15 (13.0)	4 (4.5)		41 (29.5)	28 (10.3)	17 (7.2)	8 (4.6)	
Yes	59 (78.7)	125 (92.6)	120 (98.4)	81 (95.3)		39 (60.9)	119 (86.9)	100 (87.0)	85 (95.5)		98 (70.5)	244 (89.7)	220 (92.8)	166 (95.4)	
PGSI dichotomous classification															
0-1 items endorsed	63 (84.0)	119 (88.1)	107 (87.7)	70 (82.4)		60 (93.8)	129 (94.2)	112 (97.4)	85 (95.5)		123 (88.5)	248 (91.2)	219 (92.4)	155 (89.1)	
≥2 items endorsed	12 (16.0)	16 (11.9)	15 (12.3)	15 (17.6)		4 (6.3)	8 (5.8)	3 (2.6)	4 (4.5)		16 (11.5)	24 (8.8)	18 (7.6)	19 (10.9)	
AUDIT-C classification															
Non-risky consumption ¹	57 (76.0)	78 (57.8)	72 (59.0)	39 (45.9)		55 (85.9)	90 (65.7)	83 (72.2)	68 (76.4)		112 (80.6)	168 (61.8)	155 (65.4)	107 (61.5)	
Risky consumption ²	18 (24.0)	57 (42.2)	50 (41.0)	46 (54.1)		9 (14.1)	47 (34.3)	32 (27.8)	21 (23.6)		27 (19.4)	104 (38.2)	82 (34.6)	67 (38.5)	
Tobacco consumption															
None	51 (68.0)	82 (60.7)	65 (53.3)	40 (47.1)		41 (64.1)	80 (58.4)	68 (59.1)	52 (58.4)		92 (66.2)	162 (59.6)	133 (56.1)	92 (52.9)	
Occasional / Daily	24 (32.0)	53 (39.3)	57 (46.7)	45 (52.9)		23 (35.9)	57 (41.6)	47 (40.9)	37 (41.6)		47 (33.8)	110 (40.4)	104 (43.9)	82 (47.1)	
Computer gaming frequency															
none	4 (5.4)	19 (15.1)	17 (14.7)	13 (17.1)		13 (21.7)	43 (35.8)	50 (48.5)	38 (52.1)		17 (12.7)	62 (25.2)	67 (30.6)	51 (34.2)	
1-4 h/day	66 (89.2)	105 (83.3)	97 (83.6)	61 (80.3)		46 (76.7)	75 (62.5)	52 (50.5)	35 (47.9)		112 (83.6)	180 (73.2)	149 (68.0)	96 (64.4)	
≥5 h/day	4 (5.4)	2 (1.6)	2 (1.7)	2 (2.6)		1 (1.7)	2 (1.7)	1 (1.0)	0 (0.0)		5 (3.7)	4 (1.6)	3 (1.4)	2 (1.3)	

¹score of 0-4 for females and 0-5 for males; ²score of 5-12 for females and 6-12 for males.

Subsequently, sample age group differences in regards to risk taking behaviours are highlighted. Risky consumption of alcohol was significantly lower among 15-17 year olds compared to all other age groups ($X^2(3) = 23.43, p < .001$). There was significantly less smokers among the youngest age group compared to the oldest age group ($X^2(3) = 10.74, p = .013$). There were significantly fewer non-gamers among 15-17 year olds compared to all other age groups, and individuals aged 15-21 were more likely to play computer games 1-4 hours per day than 22-28 year olds ($X^2(6) = 21.60, p = .001$). There were no age group differences in regards to high frequency computer gaming ($5 \leq h/day$). There was no age group differences in the prevalence of disordered gambling ($X^2(3) = 1.88, p = .60$)

3.2 Objective 2: Examination of indicators of health and well-being and computer gaming as correlates of disordered gambling

To begin with 7 logistic regression models controlling for age and gender were conducted (see Table 5.) to investigate to what extent the indicators of health and well-being and computer gaming frequency are capable of predicting disordered gambling. In line with the hypothesis, male gender was a significant predictor in all models, such that males were around 3 times as likely to be disordered gamblers as females. Contrary to the hypothesis, age was not a significant predictor. Using age groups as a categorical predictor brought no added value to the models, for which reason age was retained as a continuous independent variable throughout logistic regression analyses.

Model 1 shows that both risky alcohol consumption and tobacco smoking were significantly associated with higher risk of disordered gambling, confirming the hypothesis that these intoxicants were associated to disordered gambling. Models 2 and 3 illustrate that as separate predictors, poor mental health and feeling lonely significantly increased the risk of disordered gambling (Table 5). These findings support the hypotheses that loneliness and poor mental health increase the risk of disordered gambling. However, when these predictors were placed together (model 4) loneliness was significant and poor mental health was not.

Model 5 was most accurate in predicting disordered gambling, in comparison to the other models, explaining about 15 % of the variance (Nagelkerke $R^2 = .166$), and classifying 99.8 % of non-problem gamblers and non-gamblers correctly and 11.4 % of disordered gamblers correctly. The other models (models 1-4 and 6-7) were not as accurate in classifying cases correctly into the disordered gambling group. Models 3 and 4 were the only additional models that correctly classified disordered gamblers to any degree (8.6 % and 5.9 %, respectively).

respectively). Models that did not classify any cases in the disordered gambling group, classified all non-problem cases correctly.

Poor perceived health and high frequency computer gaming were not significant predictors (table 5, models 6 and 7). Even so, poor perception of health seemed to be linked to a heightened risk of disordered gambling. Since the confidence intervals of the odds ratios for computer gaming frequency extend to both sides of the value 1, judgements could not be made in regards to the potential relationship between gambling and computer gaming with the present regression results.

Logistic regression models equivalent to those of table 5 were additionally calculated separately for males and females. The gender specific regression models are available among the supplementary files (Supplementary Tables 6 and 7). The odds ratios (ORs) for the gender specific models were similar, such that all the confidence intervals (95 %) of all corresponding odds ratios overlapped. Some gender specific differences were nonetheless evident in the separate models for males and females. These differences are addressed subsequently.

The OR for tobacco smoking in model 1 was higher among females compared to males, and this association was statistically significant only among females. Likewise the OR for risky alcohol consumption in model 1 was higher among males compared to females, and additionally statistically significant only for males. Poor mental health in model 2 was more strongly associated to disordered gambling among males compared to females. Statistical significance was apparent for males but not for females for the association between disordered gambling and poor mental health (model 2). The OR for feeling lonely in model 3 was slightly higher among females (OR = 8.80) compared to males (OR = 7.81). The gender differences noted so far were also evident in model 5, which used all the predictors of models 1 to 4 simultaneously (Supplementary Tables 6 and 7). In model 5 the only statistically significant predictor among males was risky alcohol consumption. When limited to females, the only significant predictor in model 5 was tobacco smoking. Additionally the OR for poor perceived health in model 6 was approaching statistical significance exclusively among females ($p = .035$).

Table 5. Binary logistic regression models predicting disordered gambling behaviour presented as odds ratios (95 % confidence interval).

	Model 1: substance use	Model 2: Poor mental health	Model 3: Loneliness	Model 4: Models 2, and 3. combined	Model 5: Models 1, and 4. combined	Model 6: Perceived health	Model 7: Computer gaming
Gender [†]	2.88* (1.72, 4.83)	3.27* (1.97, 5.45)	3.40* (2.02, 5.70)	3.38* (2.02, 5.68)	3.13* (1.84, 5.34)	3.14* (1.89, 5.21)	2.94* (1.70, 5.11)
Age	0.96 (0.91, 1.02)	0.99 (0.93, 1.05)	0.99 (0.94, 1.05)	0.99 (0.94, 1.05)	0.96 (0.91, 1.02)	0.99 (0.93, 1.05)	0.99 (0.93, 1.05)
Risky alcohol consumption	2.21* (1.35, 3.61)				2.01* (1.21, 3.32)		
Tobacco smoking	2.27* (1.38, 3.75)				2.41* (1.44, 4.03)		
Poor mental health		3.44* (1.73, 6.84)		1.74 (0.74, 4.08)	1.87 (0.80, 4.36)		
Feeling lonely			8.57* (3.71, 19.81)	6.24* (2.34, 16.64)	5.45* (2.03, 14.62)	2.22 (1.14, 4.33)	
Poor perceived health							1.46 (0.75, 2.81)
Gaming [‡] 1-4 h/day							1.34 (0.27, 6.76)
Gaming ≥5 h/day							
Nagelkerke R ^{2†}	.123	.076	.100	.103	.166	.064	.056

reference groups: [†]females, [‡]no computer gaming[†] pseudo estimate of variance explained (%) for each regression model; statistical significance *p<.01

3.3 Objective 3: Examination of gambling types as predictors of disordered gambling and indicators of health and well-being

Subsequently logistic regression models were calculated that investigated the associations of specific gambling types and disordered gambling (Table 6). First each gambling type was placed as a separate predictor of disordered gambling, while controlling for the effects of age and gender (Table 6, models 1). Second, gambling types were all placed together as predictors while still controlling for the effects of age and gender (model 2) thus elucidating the unique effect for each gambling type. Finally, gambling types were entered as separate predictors while controlling for the effects of poor mental health, feeling lonely, poor perceived health, age and gender (models 3). Because an individual can engage in several gambling types, the individual gambling type predictors of models 1 (Table 6) are not independent from one another (see Supplementary Table 10 for how engagement in numerous gambling types is distributed by gambling type). In order to account for this, the mutually adjusted model 2 was calculated where the odds ratios represent solely the unique effect of each gambling type (Table 6).

Table 6. Binary logistic regression models predicting disordered gambling presented as odds ratios (95 % CI).

	Gambling type models 1	Mutually adjusted model 2	Gambling type models 3
Lottery	2.65* (1.62, 4.35)	1.30 (0.72, 2.35)	2.45* (1.47, 4.09)
Scratch cards	5.64* (2.89, 11.00)	0.98 (0.40, 2.43)	5.24* (2.63, 10.43)
Slot machine gambling	7.91* (4.75, 13.15)	5.89* (3.33, 10.41)	8.17* (4.84, 13.82)
Online poker	7.01* (2.74, 17.93)	1.42 (0.40, 5.10)	5.31* (2.00, 14.13)
Other online gambling†	21.35* (7.40, 61.61)	8.35* (2.28, 30.63)	20.28* (6.87, 59.81)
Casino betting	10.17* (3.79, 27.31)	3.34 (1.03, 10.78)	8.08* (2.91, 22.39)
Sports betting	4.19* (2.33, 7.54)	1.5 (0.72, 3.13)	4.27* (2.31, 7.88)
Private betting	11.87* (4.25, 33.20)	5.72* (1.57, 20.86)	9.68* (3.29, 28.49)

Models 1 display 8 regression models where each gambling type is used individually as a predictor. Model 2 is a mutually adjusted model where all gambling types are simultaneously used as predictors. Model 3 displays 8 regression models where mental health, loneliness and perceived health are controlled for while using each gambling type as an individual predictor. Age and gender are controlled for in all models; † Includes all gambling types other than online poker available at gambling websites (e.g. RAY, PAF, Centrebet, Ladbrokes & Unibet); statistical significance *p<.01

The gambling types that were the strongest predictors of disordered gambling that remained significant when controlling for the simultaneous effects of other gambling types (models 1 and 2) were slot machine gambling, other online gambling, and private betting. This confirms the hypothesis that slot machine gambling is a strong predictor of disordered gambling. Additionally gambling with lottery, scratch cards, online poker, casino betting and sport betting were significant predictors of disordered gambling when used as distinct predictors, but became insignificant in the mutually adjusted model (models 1 and 2). Within the mutually adjusted model, casino betting was nonetheless a near significant predictor ($p = .044$), giving slight support for the hypothesis that casino betting is associated to disordered gambling. By comparing the odds ratio for specific gambling types in models 1 and 3 of table 6, it can be seen that the strongest influence of the indicators of health controlled for is for playing online poker, casino betting and private betting (Table 6).

In order to support the interpretation of the gambling type regression models, a second set of gambling type related logistic regression models were conducted (Table 7). Here each gambling type serves a distinct predictor for the indicators of health and well-being. Non-gambling is also used as a predictor of the indicators of health and well-being. These analyses thus provide insight to how gamblers of specific gambling types differ from each other in regards to the indicators of health and well-being, as well as how non-gamblers differ in regards to the indicators of health and well-being.

Table 7. Binary logistic regression models predicting indicators of health and well-being with gambling types.

	Poor mental health	Feeling lonely	Poor perceived health	Risky alcohol consumption	Tobacco smoking
Lottery	1.48	3.48*	0.96	1.72*	1.75*
Scratch cards	1.97	4.23*	0.69	1.76	3.04*
Slot machine gambling	1.54	1.55	1.83	2.58*	3.88*
Online poker	2.63	9.35*	3.90*	1.79	2.20
Other online gambling	1.34	4.91	1.63	7.33*	5.41*
Casino betting	2.79	10.49*	1.86	24.37*	2.97
Sports betting	0.65	3.56	0.48	2.22*	2.42*
Private betting	1.07	16.08*	1.07	3.97*	1.61
Non-gambler	1.26	0.82	1.67	0.25*	0.48*

Columns represent outcome variables and rows represent the predictors (gambling types and non-gambling). Each cell thus represents an individual regression model in odds ratios. Age and gender are controlled for in all models; statistical significance $*p \leq .01$

Out of all gambling types, online poker, casino betting and private betting were the strongest predictors of feeling lonely compared to the other gambling types (Table 7). Contrary to the hypothesis, slot machine gambling was not associated to feeling lonely for the entire sample. In line with the hypothesis, casino betting is a strong predictor of risky alcohol consumption. Playing online poker is the only gambling type related to poor perception of health. Other online gambling was the second to most strong predictor of risky alcohol consumption, followed by private betting and gambling slot machines. Other online gambling was most strongly related to tobacco smoking out of all gambling types, followed by slot machine gambling and sports betting. As such, out of the investigated gambling types particularly slot machine gambling, other online gambling and sports betting seem to be linked to risky alcohol consumption and tobacco smoking. Non gamblers are significantly less likely to consume alcohol at a risky level and less likely to smoke tobacco compared to gamblers.

Gender specific examination of the research questions of objective 3 had limited success. Calculating gender specific regression models concerning gambling types was hindered by the fact that few females engaged in online poker, other online gambling, casino betting, sports betting and private betting (see Supplementary Table 9 for gender specific frequencies for gamblers of specific gambling types). Results from the regression models of Tables 6 and 7 concerning online poker, other online gambling, casino betting, sports betting and private betting are therefore mainly representative of the male sample.

Gender specific regression models for objective no. 3, dealing with gambling types were conceivable only for models concerning lottery, scratch cards, slot machines and non-gamblers. Gender specific regression models predicting disordered gambling with gambling types (Supplementary tables 11 and 12) revealed that the slot machine gambling ORs for predicting disordered gambling were significantly higher ($p < .05$) among females than males. This was the only statistically significant gender difference in the current sample, and was evident when slot machine gambling appeared alone as a predictor, in the mutually adjusted model and in the model where poor mental health, poor perceived health and loneliness were controlled for. Additionally the ORs for scratch card gambling predicting disordered gambling were higher among females than males in models 1 and 3 (Supplementary Tables 11 and 12).

Supplementary Tables 13 and 14 display regression models conducted exclusively for females and males where lottery, scratch cards, slot machine gambling and non-gambling

are used as predictors of the indicators of health and well-being (partially corresponding Table 7). The gender specific analyses predicting indicators of health and well-being with gambling types revealed that the association between scratch cards and feeling lonely and the association between slot machine gambling and feeling lonely was higher among females, and were at least near significant only among females. The finding that slot machine gambling was nearing statistical significance for its association to feeling lonely among females ($p = .033$) is in line with the hypothesis that slot machine gambling and loneliness would be associated, which could not be confirmed for the entire sample. Additional small differences were apparent between the genders, but few ORs were significant and OR values were often close to the value 1 (Supplementary Tables 13 and 14), for which reason gender differences are not reported any further.

4. Discussion

4.1 Summary of results

The examination of at-risk behaviours (objective 1) revealed the following gender differences in the study sample. Males consumed alcohol at a risky level more often than females, but both genders smoked tobacco at a similar rate. Males played computer games more often than females, although there was no gender difference for high frequency computer gaming. In regards to age group differences, individuals under 18 years of age were least likely to consume alcohol at a risk level. Fewer underage individuals smoked tobacco compared to individuals over 26 years of age. The younger half of the sample was more likely to play computer games than the older half of the sample. There were no age group differences in regards to the prevalence of disordered gambling.

The examination of disordered gambling with indicators of health and well-being (objective 2) confirmed the hypothesis that males are at higher risk of being disordered gamblers compared to females. Contrary to the hypothesis, age was not related to disordered gambling in any way. In line with the hypotheses, risky consumption of alcohol, tobacco smoking, poor mental health and frequently feeling lonely were significant risk factors of disordered gambling. High frequency computer gaming, contrary to the hypothesis, was not a risk factor of disordered gambling. Poor perceived health was seemingly associated to disordered gambling, but the association was insignificant.

The results of gambling type related analyses (objective 3) revealed that slot machine gambling, other online gambling and private betting were most strongly associated to disordered gambling. This confirms the hypotheses that slot machine gambling is related to disordered gambling. Analyses investigating the associations between gambling types and the indicators of health and well-being revealed that individuals gambling with online poker, casino betting and private betting at least 2-3 times per month were most likely to feel lonely. Online poker was the only type of gambling significantly associated to poor perception of health. Slot machine gambling was associated to loneliness among females, but not for the entire sample, lending only limited support for this hypothesis. Casino betting was most strongly associated to risky alcohol consumption compared to other gambling types, confirming the hypothesis for the presence of this association. Additionally particularly slot machine gambling, other online gambling and sports betting were associated to both risky alcohol consumption and tobacco smoking. Non gamblers were less likely to drink alcohol at a risky level and smoke tobacco compared to gamblers.

4.2 Limitations and strengths

The current study is based on cross-sectional data, for which reason all associations identified can only be treated as correlational. This is a limitation of the study, as causal relationships would be of greater value in studying factors associated to DG. The measurements of interest were utilized as nominal variables, for which reason study variables were less informative than they potentially could have been. However categorical classification of variables was well justified considering the analytical methods used.

The poor mental health was determined as scoring 60 or less on the MHI-5, which in fact covers moderate to poor mental health. Thus, making inferences related to individuals scoring 60 or less on the MHI-5 cannot be attributed to poor mental health with certainty. On the bright side, this rather liberal threshold for the MHI-5 minimizes the risk of false negatives in identifying individuals with poor mental health. Computer gaming was measured only in frequency (hours), and categorized for analyses. This method does not portray the extent of pathology of computer gaming, and may have hindered identifying an association between computer gaming and DG.

The overall rate of disordered gambling was relatively low in the current sample, which decreases the generalizability of results. This is particularly true for results pertaining to females. In a similar manner, rates of gamblers of specific gambling types were also low,

and more so among females. To elaborate, for the entire sample the rate of individuals gambling online poker, other online gambling, casino betting or private betting at a rate of at least 2-3 times per month were about 2 % for each gambling type. Considering the low rates of DG and gamblers of specific gambling types, outliers may have drastic effects on results. Among female gamblers were individuals who gambled at extremely high rates even compared to the male sample. For example, the only individual out of the entire sample that gambled all eight gambling types at a rate of at least 2-3 times per week was female. Anyhow, no outliers exceeded rational limits, for which reason no measures were taken to control for the potential effects of outliers. In further defence of not having attempted to control for the effects of outliers, gender specific regression analyses (analyses most vulnerable to the effects of outliers) were not part of the primary research questions, but rather supplementary.

Other online gambling refers to online gambling other than online poker. In effect, other online gambling includes for example online slot machines and online Black Jack. Considering that gambling websites also provide services for sports betting, the categorization between sports betting and other online betting becomes less distinct, which limits the inferences that can be made related to the other online gambling -gambling type.

Despite its limitations, the current study has numerous strengths as well. The present study was comprehensive in examining disordered gambling, as a broad array of correlates of DG were investigated. Analyses were conducted with a weighted random sample, ensuring high representativeness of the population, while simultaneously slightly increasing sample size. Having conducted separate analyses for males and females in addition to controlling for the effects of gender is a noteworthy strength of the current study. Gender specific analyses enable detection of gender differences that would go unnoticed when exclusively controlling for the effects of gender.

To the knowledge of the author, this is the first study to examine the subjective perception of general health as a correlate of DG. Likewise analyses concerning gambling types were a unique component of the present study. As a final note, the topic and target group of the current thesis is a strength of the present thesis, as it contributes to scientific literature with information of societal importance.

4.3 Objective 1: Examination of at-risk behaviours

The current findings related to at-risk behaviour are in congruence with previous research. Males have been found to consume alcohol at risky levels more often than females (Wilsnack et al. 2000). Likewise, computer gaming has previously been found to be higher among adolescents than older individuals (Festl et al .2012). Procentually high rates of disordered gambling was evident among underaged individuals among males and females. This finding is in line with previous research indicating that the risk of disordered gambling is highest among young individuals (Delfabbro et al. 2014; Hardoon & Derevensky, 2001).

Among males risky consumption of alcohol and tobacco smoking were most common among individuals aged 26-28 years. This finding may indicate that with time, more and more males adopt potentially harmful habits related to substance use. Among females risky alcohol consumption was most common among 18-21 year olds, followed by 22-25 year olds. Female tobacco smoking was most common among 18-21 year olds, with an equivalent rate observable also among 26-28 year olds. The finding that the rate of risky alcohol use and tobacco smoking is high among 18-21 year old females may be explained by experimentation after becoming of legal age (i.e. the novel legal opportunity to buy alcohol and tobacco). On the contrary, it would be expected that the novelty factor related to alcohol and tobacco that arises when coming of legal age would affect both males and females. It is also feasible that social norms influence alcohol use and tobacco smoking related behaviour of males and females in distinct ways at different ages.

Frequent computer gaming was most common among 15-17 year olds among males and females. This may be explained by the fact that computer games are often directed towards young individuals. In addition, individuals in the youngest age group may be more able to devote time to computer gaming than individuals in the older age groups. A plausible explanation for this is that older individuals are likely to have more occupational responsibilities placing restraints on the time available for playing computer games than what young individuals have.

The at-risk behaviours examined in the present study can not be considered to be equivalently accurate estimates of each measured at-risk behaviour. This is due to the fact that some at-risk behaviours have been measured with instruments while others have been measured with single questions. As such, it can be speculated that the present rates of disordered gambling and risky alcohol consumption are more accurate than the rates of

tobacco smoking and frequent computer gaming. For example, the meaning of smoking tobacco occasionally may vary between individuals.

4.4 Objective 2: Examination of disordered gambling and indicators of health and well-being

In relation to previous research this study found male gender to be significantly associated to disordered gambling, which is in line with the evidence base (Williams et al. 2012). Despite previous findings that in Finland the highest rate of disordered gambling is among 25-34 year olds (Turja et al. 2012), increasing age was not associated to disordered gambling within the current sample that was aged 15 to 28. The fact that age was not a risk factor of disordered gambling, may be explained by a proportionately high rate of underaged gambling in combination with a high rate of gambling among emerging adults. In other words, the entire sample may be at near equivalent risk of DG, and this lack of variance hinders an age extremity from being a risk factor. The null-association between age and DG is surprising in the light of the Finnish law prohibiting gambling for all individuals under the age of 18 (Arpajaislaki, 14 a §), that would have been expected to contribute to an association between increasing age and DG. This being said, it is relevant to question whether the law prohibiting gambling under the age of 18 is being enforced to the proper extent.

Although previous research suggests disordered gambling and mental health problems often co-occur (Lorains et al. 2011; Williams et al. 2015) the current study provided limited support of this. Poor mental health was significantly associated to disordered gambling for the entire sample, but gender specific analyses revealed that this association was limited to males. In concordance with previous findings (Castén et al. 2013b), loneliness was significantly associated to disordered gambling. This association is also supported by the previous finding that social support from friends is a protective factor against disordered gambling (Hardoon et al. 2004). Trevorrow and Moore (1998) suggested that loneliness may be linked to gambling among females, and this was evident in the current sample also. On the other hand, loneliness was associated to disordered gambling among males also, suggesting that loneliness need not be an association of DG limited to females. Perceived general health has not been previously studied as a correlate of DG to the knowledge of the author, and as such cannot be compared to previous work.

Disordered gambling was associated to risky alcohol consumption and tobacco smoking, which complements the existing evidence for the co-occurrence of gambling and alcohol and

tobacco use (Castrén et al. 2013a; Hardoon et al. 2004; Järvinen-Tassopoulos & Raitasalo, 2015; Lorains et al. 2011; Molde et al. 2009; Williams et al. 2015). Furthermore, this finding supports the well-established fact that addictions are co-occurring (Hakkarainen et al. 2010; Sussman et al. 2011). The association between smoking tobacco and DG was significant amongst females but not males. This finding is in line with the results of Petry and colleagues (2005) that nicotine dependence was a stronger risk factor among females compared to males. This finding is also congruent to the results of Järvinen-Tassopoulos and Raitasalo (2015) that experimentation with tobacco was prevalent principally among school aged girls who gambled at least once per week. The association between risky consumption of alcohol and disordered gambling was stronger among males than females, which is in line with the findings of Castrén and colleagues (2013a).

High frequency computer gaming was not associated to disordered gambling, which is not in concordance with earlier research suggesting gambling and computer gaming co-occur (Floros et al. 2013; Walther et al. 2011; Wood et al. 2004). This finding also contradicts the notion that as behavioural addictions, comorbidity should be evident (Sim et al. 2012). The current absence of this association also contradicts the finding that playing computer games at least on a weekly basis was associated to disordered gambling among Finnish adolescents (Castrén et al. 2015). It may be that the high prevalence of low frequency gamers and low prevalence of high frequency gamers in the current sample is responsible for the null finding. There may be a lack of variance among gamblers in regards to their computer gaming habits in the present sample, because computer gaming is a common habit. This is highlighted by the fact that over 70 % of the entire sample played computer games 1-4 hours per day.

The cross-sectional design and informational content of the present survey cannot serve to test the Pathways Model (Blaszczynski & Nower, 2002). Particularly no conclusions can be made related to pathway 3 related to impulsivity and antisocial traits. Furthermore, the current study sample was analysed as a whole, in contrast to testing whether the separate pathways can be identified. This being the case, gamblers who potentially are representative of pathways 1 and 2 in the current sample are clumped together, which means that neither pathway can readily be identified. Despite this, some aspects of the theory can be speculated upon.

The fact that loneliness was associated to DG for both genders suggests that the emotional vulnerability pathway is plausible. Also in support of pathway 2 (Blaszczynski & Nower,

2002), poor mental health was associated to DG among males and this association overlapped with the association between loneliness and DG. Here, poor mental health can be interpreted with caution as representing depressive and anxiety symptoms, which are theorized to be part of pathway 2 (Blaszczynski & Nower, 2002). Current findings suggest that risky alcohol consumption together with feeling lonely raise the risk of being a disordered gambler. This finding speaks on behalf of the notion that the emotional vulnerability developmental pathway leading to disordered gambling may be related to substance use. As such, present results indirectly lend support to the conceptualization of the emotional vulnerability pathway.

Having previously discussed the concordance of the present results to previous research, it is opportune to subsequently speculate further upon the study findings. The fact that poor mental health was significantly associated to disordered gambling among males but not females while loneliness was associated to DG for both genders has numerous explanations. It may be that poor mental health was truly not associated to disordered gambling among females, or alternatively loneliness and poor mental health have something in common regarding their associations to disordered gambling. It is also possible that both previously presented speculations explain part of the truth. Present findings cannot explain why poor mental health would not be associated to DG among women. It is perhaps more likely that the low rate of female disordered gamblers accounts for this null-association. It is also possible that the measurement method of mental health is responsible for no association between female disordered gambling and poor mental health being found.

The rather simple approach for measuring loneliness in the present survey hinders enlightening the nature of the detected loneliness. For instance, it may be that adolescents place more gravity to peer relationships than family relationships, possibly indicating that perceived peer support has a stronger effect on behaviour than perceived family support (Ohannessian & Hesselbrock, 1993). Furthermore, loneliness can be the result of feeling alienated as in Trevororrow and Moore's (1998) study, or it could be the result of friendlessness. Acquiring a more detailed account of gambling related loneliness in future studies may even shine light upon its potential relationship to poor mental health. It is highly plausible that a lack of social support, friendlessness or alienation may lead an individual to disordered gambling tendencies, while simultaneously having a negative effect on mental health.

Although poor perception of health was not significantly associated to disordered gambling, there was seemingly a weak association, which was observable among females, but not males. This difference is not simply due to gender differences, as poor perception of health was almost equally common for males and females. This raises thoughts to whether females are more likely to perceive gambling habits as potentially having a negative effect on their health compared to males. To rephrase, is it possible that males are less capable of consciously linking disordered gambling habits as having a negative effect on subjective experience of general health?

As a predictor of DG, computer gaming frequency was incapable of predicting DG in the current sample. It is possible that this is due to the method of measurement for computer gaming frequency. For example, when inquiring about the hours spent with two open ended questions, frequent computer gamers may have not answered at a higher rate or estimated the hours incorrectly. Measuring computer gaming in a manner similar to the present measurement of DG, and by inquiring about how computer gaming gets in the way of other aspects in life (Ferguson et al. 2011) may be more capable of yielding an association between the two. On the other hand, in the study conducted by Castrén and colleagues (2015), computer gaming was measured by inquiring about gaming frequency, similarly to the present study, and a significant association was evident between computer gaming and DG. As such, it cannot be decisively concluded that the present null finding is due to the method of measurement.

The association of frequent computer gaming and disordered gambling among females had an extremely wide confidence interval. This is most likely a distortion due to an outlier. The presence of a few extreme cases of gambling amongst women, may be indicative of temporally fast development on gambling problems among females, referred to as the telescoping phenomenon (Lesieur et al. 1986; Tavares et al. 2001). It may therefore be that while for the most part females do not gamble or gamble relatively seldom, a minority of females that progress into a more substantial habit of gambling are at exceptionally high risk of developing DG.

4.5 Objective 3: Examination of gambling types with disordered gambling and indicators of health and well-being

The finding that slot machine gambling is associated to disordered gambling, even when controlling for the simultaneous effects of other gambling types is in agreement with former

evidence suggesting that slot machine gambling is potentially harmful (Castrén et al. 2013b; Jaakkola et al. 2012; Parke & Griffiths, 2006). Present results suggesting that the apparent association between gambling with slot machines and frequently feeling lonely was limited to females, can be interpreted as support for both of Trevorrow and Moore's (1998) hypothetical explanations that females may be motivated to gamble with slot machines in order to cope with loneliness and / or that gambling habits cause females to become lonely.

In partial support of the association between gambling at the casino and risky alcohol consumption found in the present study, previous research has indicated that gambling both at casinos and non-casino venues is associated to a higher likelihood of alcohol use and abuse (Franco, Maciejewski & Potenza, 2011). It is logical to assume that this association may be related to the fact that alcohol is often served at venues with gambling opportunities. In line with present speculations, Franco and colleagues (2011) also concluded that heightened risk of alcohol use may be attributable to higher availability of alcohol at gambling venues. Due to the uniqueness of present analyses regarding gambling types, there is limited previous research onto which results can be reflected. On the contrary, there is all the more room for conjectures of present study findings.

It is possible, and highly feasible that the association between slot machine gambling and DG is influenced by the high availability of slot machines in Finland, as about 20,000 slot machine units were scattered around the country in 2011 (THL, 2013) in a wide array of locations including supermarkets, restaurants, fuel stations and kiosks as has previously been suggested by Castrén and colleagues (2013a).

In addition to slot machine gambling, the most deleterious types of gambling are other online gambling and private betting. As mentioned previously, other online gambling encompasses among other things online slot machines which intuitively should be at least as potentially harmful as slot machine gambling. Based on present results, it may be that some specific characteristics of slot machine gambling (whether on the internet or somewhere else) causes this gambling type to be particularly strongly associated to DG. Slot machines are designed to create the illusion of being in control of the game, for example with the ability to lock variables for the next round (Castrén, Murto & Salonen, 2014). This may be an aspect of slot machine gambling that, in light of the conditioning component of the Pathways Model (Blaszczynski & Nower, 2002) lures an individual into accepting irrational beliefs about this gambling. The strong association detected in this sample between private betting and

disordered gambling may have to do with the fact that private betting is entirely unregulated (by definition), and as such may appeal to a selective group of individuals with disordered gambling tendencies.

Casino betting was among the strongest predictors of DG, but became only near significant when taking into account the simultaneous effects of other gambling types. Furthermore casino betting was a distinct gambling type for its association to risky alcohol consumption, as previously stated. On top of this taking into account that risky alcohol consumption is strongly associated to DG, casino gambling, risky alcohol consumption and disordered gambling seem to be intertwined, with associations in place capable of causing a vicious cycle. As a gambling type category, casino betting includes a wide range of specific gambling types (e.g. Black Jack and Roulette) which cannot presently be told apart. It is nonetheless possible that specific types of casino gambling more strongly associated to risky alcohol consumption than others.

Among the gambling types and their association to DG, online poker, casino betting and private betting were most strongly influenced by the simultaneous effects of poor mental health, loneliness and poor perceived health. This is explained by the fact that these gambling types had strongest associations with feeling lonely out of the gambling types studied. It is an intriguing finding that these 3 gambling types are related to feeling lonely. Is it possible that gamblers of online poker, casino betting and private betting are more likely to gamble as a response to feeling lonely? Future studies ought to answer this question with appropriate longitudinal study designs. Speculatively, these gambling types at least incorporate social interaction, as individuals compete with each other. On the contrary, these gambling types may be the cause of feeling lonely.

The gamblers of online poker, casino betting and private betting are for the most part males. Thus these gambling types incorporating social interaction may be a means particularly for males to deal with loneliness. These findings and speculations are not contradictory with the propositions of Trevorrow and Moore's (1998) suggestions pertaining specifically to females' motivations to gamble with slot machines discussed previously. Taking together the study findings between gender specific associations for gambling types and loneliness, the findings are in agreement with previous results suggesting that males tend to prefer skill based gambling types while females may prefer gambling types based on chance (Castrén et al. 2013a; Potenza et al. 2001).

It is interesting that no gambling types were significantly associated to poor mental health, as all other indicators of health and well-being had at least one gambling type as a significant predictor. Intuitively this can be considered rational, as it may be arbitrary to suggest some specific gambling type should be associated to poor mental health. On the contrary it is plausible that the consequences of gambling with a certain gambling type could cause a decrease in mental health, such as increased anxiety. Future studies need to resolve this issue by examining the relationship between gambling types and mental health in more detail.

Online poker was significantly associated to poor perception of health, in addition to being associated to feeling lonely. Online poker gambling was the only gambling type that was associated to poor perception of health. It is difficult to say what this may be indicative of. Gender specific examination of this association was not possible due to few female online poker gamblers. It may be that online poker players live somewhat unhealthy lifestyles. This finding needs to be replicated before conclusions can be made.

Slot machine gambling was associated to both risky alcohol consumption and tobacco smoking, along with other online gambling and sports betting. What is it about these three gambling types that makes them associated to both risky alcohol consumption and tobacco smoking? Other online gambling includes webpages that provide services of sports betting, meaning that within the current categorical division of gambling types, other online gambling and sports betting may have more in common than might initially be assumed. Other online gambling also includes online slot machines, so it carries similarities to the gambling slot machines as well, as previously noted. It is plausible that the atmosphere where sports betting and slot machine gambling take place are associated to alcohol and tobacco (i.e. bars and restaurants).

The association between gambling types and disordered gambling seems to be stronger among females compared to males. These results are most likely due exceptionally high cases of gambling among females that distort results. But even so, this may be an indication of a hasty transition from being a gambler of a specific gambling type to being a disordered gambler of that specific gambling type among women, i.e. the telescoping phenomenon (Lesieur, Blume & Zoppa, 1986; Tavares et al. 2001). It is interesting to note that the one and only significant gender difference was the association between slot machine gambling and disordered gambling, where females displayed a higher association between the two. This finding may indicate that females are more prone to develop DG with gambling types

based on chance. This speculation is in line with previous research indicating that females prefer gambling types based on chance, and are more likely than men to develop DG exclusively with gambling types based on chance (Ladd & Petry, 2002; Potenza et al., 2001).

Being a non-gambler was an equivalently protective factor against risky consumption of alcohol and smoking tobacco for males and females. This finding suggests that either those individuals who drink alcohol at risky levels and / or smoke tobacco are more prone to start gambling, or vice versa that alcohol and tobacco succeed gambling. The chronology is likely to vary between individuals. For example somebody might take up the habit of smoking tobacco in response to the betting atmosphere of a sports bar, while somebody else may start to gamble while under the influence of alcohol. Alternatively both causalities may be simultaneously true for some gambling individuals.

Slot machine gambling was a slightly stronger risk factor among females for tobacco smoking and risky alcohol consumption compared to males. These results are intriguing keeping in mind that there was no gender difference in rate of tobacco smoking, and males consumed alcohol at a risky level at a higher rate compared to females. It may be that there is genuinely a higher co-occurrence of gambling with slot machines and tobacco smoking among females compared to males, but this difference between the genders was marginal, for which reason this finding may not portray reality.

4.6 Suggestions

As this study has replicated the finding that gambling types based on chance are potentially detrimental, it is necessary to consider whether measures should be taken to influence public opinion related to these gambling types (e.g. with advertisements or campaigns), as previously put forward by Rahman and colleagues (2012). Public opinion may also be influenced with the modification or removal of advertisements, as formerly suggested by Salonen and colleagues (2014). The prevailing positive attitudes towards gambling in Finland may be influenced by Finnish gambling advertisements which often emphasize that gambling company profits are donated to good causes (Salonen et al. 2014). It has previously been advocated that gambling advertisements should be regulated and enforced by an independent bureau that is not associated to gambling companies (Monaghan, Derevensky & Sklar, 2008). In light of this, it is suggested that a non-government owned agency should be put in place in Finland to oversee the marketing of gambling. This would not be an all encompassing solution though, as advertisement regulation becomes problematic for

international online gambling providers, since companies are under the jurisdiction of the country where the company is established (Castrén, Murto & Salonen, 2014).

As formerly stated, other online gambling was strongly associated to disordered gambling, and this gambling type happens to be advertised in excessive amounts on Finnish television. It would be justified to implement more strict regulations over such advertisement. Particularly the commercials of Music Television® (MTV) to a large extent advertise online gambling providers. Above all what makes this advertisement unprincipled is that the programmes shown on MTV are directed towards adolescent and young adult viewers. Prohibiting gambling advertisements that reach youth to a large extent has also been suggested before by Monaghan and colleagues (2008).

Considering the correlational findings between casino betting, risky alcohol consumption and DG together with the growing consensus that risky alcohol consumption is significantly associated to DG, it can be concluded that casinos combine risk factors of DG in a truly alarming sense. In effect, it is well-grounded to question from a societal perspective whether it is responsible to offer such a combination of services under the same roof.

Study results related to the association between disordered gambling, gambling types and feeling lonely can potentially be utilized in treatment. Hypothetically considering that loneliness may be the reason to gamble for some, as similarly also proposed by Trevorrow and Moore (1998) and Castrén and colleagues (2013b), directing such individuals towards social interactions that are not potentially detrimental would be a valid treatment form. Such social interactions could be achieved for instance by joining a hobby association. For example if competition and individual performance are important to an individual, a snooker or darts club may be suitable. At the very least the current findings suggest that it may be beneficial to evaluate feelings of loneliness among individuals in treatment for gambling problems in order to better understand their psychological needs.

4.7 Recommendations for future studies

More research on gambling needs to be conducted for the adolescent and emerging adult population. Specifically studies need to reach female gamblers to a greater extent, in order to investigate the apparent gender differences in relation to the correlates of disordered gambling, such as the use of alcohol and tobacco. Research needs to be conducted with samples where gamblers of specific gambling types are well represented in order to elucidate how gambling types differ in regards to their harmfulness. This could be achieved by

recruiting participants directly from casinos, horse race tracks or users of online gambling providers. Particularly the role of other online gambling in the development of disordered gambling needs to be clarified. In view of the potential harm of slot machine gambling, it would also be important to inquire specifically about online slot machine gambling in upcoming studies. Clarification of whether certain characteristics of (online) slot machine gambling are responsible for the strong association detected between slot machine gambling and other online gambling with disordered gambling is needed. In addition, the present result indicating an association between casino betting and alcohol consumption calls for further research. It would be important to clarify whether the present association is true for all kinds of casino betting or whether it is true for specific casino betting types.

Future studies need to replicate current findings and shed light upon the relationship between disordered gambling and loneliness. Most importantly, causality ought to be determined with a longitudinal approach, and clarification is needed for whether loneliness is truly associated to different gambling types among males and females. Thorough assessment of loneliness is advised, in order to obtain a comprehensive understanding of gambling related loneliness. Additionally, the relationship between mental health and DG needs to be investigated further, including the potential link between loneliness and mental health.

When examining the gambling related poor mental health, it may be beneficial to inquire about specific expressions of poor mental health that have previously been linked to DG, such as anxiety and depression (Lorains et al. 2011; Williams et al. 2015). Results suggesting there might be a gender difference for the association between DG and perceived health also need to be further examined. Future studies investigating the relationship between computer gaming and DG, ought to measure the extent of computer gaming harmfulness in a comprehensive manner. This can be achieved by inquiring about computer gaming with instruments that resemble instruments of disordered gambling.

5. Conclusions

The present thesis sought to examine numerous associations of disordered gambling among adolescents and emerging adults. Results confirmed several previous findings of the associations of health and well-being with disordered gambling. Such findings include the co-occurrence of substance use with disordered gambling as well as associations with poor mental health and loneliness. As has often been the case in previous studies, males gambled

to a greater extent compared to females, and the rate of female gambling was low, complicating making accurate conclusions about female gambling. Even so, the present results suggest that there are noteworthy differences between males and females in regards to disordered gambling. The gender differences revealed in the present sample include the relationship between disordered gambling and poor mental health, perceived general health, risky alcohol use and tobacco smoking habits.

The endeavour to examine gambling types for their associations to the indicators of health and well-being was a unique part of the present thesis, yielding results that depict how certain gambling types may be more harmful than others, and also suggesting that gender differences are evident in relation to gambling type preferences. In light of present results as well as previous research, slot machine gambling is one of the most noticeable gambling types for its relation to disordered gambling. Additionally other online gambling was found to be strongly associated to DG. A compelling finding of the present study was that loneliness was associated to disordered gambling, and simultaneously plausibly associated to distinct gambling types among males and females.

As an overarching understanding of the correlates of disordered gambling is forming with the amounting research evidence, it is important to focus future endeavours at specific populations. Particularly sampling needs to target young individuals, females who gamble, and gamblers of specific gambling types in order to gain a more comprehensive understanding disordered gambling.

Findings elucidating the correlates of disordered gambling can be utilized within health care to enhance the efficiency of detecting individuals at risk of developing gambling problems, as formerly concluded by Castrén and colleagues (2013b). The present study findings advocate among other things that risky alcohol consumption, smoking tobacco, and feeling lonely indicate a heightened risk to be a disordered gambler, along with gambling with slot machines, other online gambling or private betting on a regular basis.

Having replicated the finding that slot machine gambling is strongly associated to DG, policy-makers ought to consider changing current practices and downgrade the availability and visibility of slot machines around the country, as also previously suggested by Castrén and colleagues (2013a). Characteristics of slot machine gambling and its online counterpart may be accountable for their apparent association to DG, further suggesting that these gambling types need to be made less accessible.

Gambling is currently advertised excessively. This is particularly true for online gambling, which is unfortunate as current findings suggest that this gambling type is potentially harmful. The extensive amount of gambling advertisements, along with the positive picture the advertisements may portray about gambling may influence the predominant opinion of gambling as a favorable and harmless pastime (Salonen et al. 2014). This being the case, the advertisement of gambling should be regulated to a higher degree in order to avoid unnecessary exposure to incentives to gamble, especially among the youth.

6. References

- Abbott, M. W. & Volberg, R. A. (2006). The Measurement of Adult Problem and Pathological Gambling. *International Gambling Studies*, 6(2), 175-200.
- Alho, H., Heinälä, P., Kiianmaa, K., Lahti, T., & Murto, A. (in press). *Rahapeliriippuvuus*. Helsinki: Kustannus Oy Duodecim.
- American Psychiatric Association. (1994). *DSM-IV: Diagnostic and statistical manual*. Washington (DC): American Psychiatric Association.
- American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*. Arlington, VA: American Psychiatric Association.
- American Psychiatric Association (2013a). *Substance-Related and Addictive Disorders*. Retrieved from <http://www.dsm5.org/Documents/Substance%20Use%20Disorder%20Fact%20Sheet.pdf>
- Arnett, J. (1994). Sensation seeking: A new conceptualization and a new scale. *Personality and Individual Differences*, 16(2), 289-296.
- Arnett, J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist*, 55(5), 469.
- Arpajaislaki (24.6.2010/661) Rahapeli-ikäraja. [Law for age limit of gambling]. Retrieved from: <https://www.finlex.fi/fi/laki/ajantasa/2001/20011047>
- Betancourt, L. M., Brodsky, N. L., Brown, C. A., McKenna, K. A., Giannetta, J. M., Yang, W., ... & Hurt, H. (2012). Is executive cognitive function associated with youth gambling?. *Journal of Gambling Studies*, 28(2), 225-238.
- Blakemore, S. J., & Robbins, T. W. (2012). Decision-making in the adolescent brain. *Nature Neuroscience*, 15(9), 1184-1191.
- Blaszczyński, A., & Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction*, 97(5), 487-499.
- Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., & Bradley, K. A. (1998). The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. *Archives of Internal Medicine*, 158(16), 1789-1795.

- Castrén, S., Basnet, S., Pankakoski, M., Ronkainen, J. E., Helakorpi, S., Uutela, A., ... & Lahti, T. (2013a). An analysis of problem gambling among the Finnish working-age population: a population survey. *BMC Public Health*, 13(1), 519.
- Castrén, S., Basnet, S., Salonen, A. H., Pankakoski, M., Ronkainen, J. E., Alho, H., & Lahti, T. (2013b). Factors associated with disordered gambling in Finland. *Substance Abuse Treatment, Prevention and Policy*, 8(1), 24.
- Castrén, S., Grainger, M., Lahti, T., Alho, H., & Salonen, A. H. (2015). At-risk and problem gambling among adolescents: a convenience sample of first-year junior high school students in Finland. *Substance Abuse Treatment, Prevention and Policy*, 10(1), 9.
- Castrén, S., Murto, A., & Salonen, A. (2014). Rahapelimarkkinointi yhä aggressiivisempää–unohtuvatko hyvät periaatteet?. *Yhteiskuntapolitiikka*, 79(4), 438-443.
- Castrén, S., Salonen, A. H., Alho, H., Lahti, L. (2014a). Rahapeliriippuvuuden diagnostiikka muutoksessa. *Suomen Lääkärilehti*, 7, 469-472.
- Castrén, S., Salonen, A. H., Alho, H., & Lahti, T. (2014b). Challenges in translating DSM-5 criteria for Gambling Disorder into Finnish. *Nordic Studies on Alcohol and Drugs*, 31(2), 221-224.
- Chambers, R. A., Taylor, J. R., & Potenza, M. N. (2003). Developmental neurocircuitry of motivation in adolescence: a critical period of addiction vulnerability. *American Journal of Psychiatry*, 160(6), 1041-1052.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-334.
- Cummings, H. M., & Vandewater, E. A. (2007). Relation of adolescent video game play to time spent in other activities. *Archives of Pediatrics & Adolescent Medicine*, 161(7), 684-689.
- Currie, S. R., Hodgins, D. C., & Casey, D. M. (2013). Validity of the problem gambling severity index interpretive categories. *Journal of Gambling Studies*, 29(2), 311-327.

- Dawson, D. A., Grant, B. F., Stinson, F. S., & Zhou, Y. (2005). Effectiveness of the derived alcohol use disorders identification test (AUDIT-C) in screening for alcohol use disorders and risk drinking in the US general population. *Alcoholism: Clinical and Experimental Research*, 29(5), 844-854.
- Delfabbro, P., King, D., & Griffiths, M. D. (2014). From adolescent to adult gambling: An analysis of longitudinal gambling patterns in South Australia. *Journal of Gambling Studies*, 30(3), 547-563.
- Derevensky, J. L. & Gupta, R. (2004). The measurement of youth gambling problems: current instruments, methodological issues and future directions. In Derevensky, J. & Gupta, R. *Gambling problems in youth: Theoretical and applied perspectives* (pp. 121-144). New York: Kluwer.
- Donati, M. A., Chiesi, F., & Primi, C. (2013). A model to explain at-risk/problem gambling among male and female adolescents: gender similarities and differences. *Journal of Adolescence*, 36(1), 129-137.
- Doremus-Fitzwater, T. L., Varlinskaya, E. I., & Spear, L. P. (2010). Motivational systems in adolescence: possible implications for age differences in substance abuse and other risk-taking behaviors. *Brain and Cognition*, 72(1), 114-123.
- Ferguson, C. J., Coulson, M., & Barnett, J. (2011). A meta-analysis of pathological gaming prevalence and comorbidity with mental health, academic and social problems. *Journal of Psychiatric Research*, 45(12), 1573-1578.
- Ferris, J. & Wynne, H. 2001. *The Canadian Problem Gambling Index: Final Report*. Ottawa: Canadian Centre on Substance Abuse (CCSA).
- Festl, R., Scharkow, M., & Quandt, T. (2012). Problematic computer game use among adolescents, younger and older adults. *Addiction*, 108(3), 592-599.
- Floros, G. D., Siomos, K., Fisoun, V., & Geroukalis, D. (2013). Adolescent online gambling: The impact of parental practices and correlates with online activities. *Journal of Gambling Studies*, 29(1), 131-150.
- Franco, C. A., Maciejewski, P. K., & Potenza, M. N. (2011). Past-year recreational gambling in a nationally representative sample: Correlates of casino, non-casino, and both casino/non-casino gambling. *Psychiatry Research*, 188(2), 269-275.

- Goudriaan, A. E., Oosterlaan, J., de Beurs, E., & van den Brink, W. (2006). Neurocognitive functions in pathological gambling: a comparison with alcohol dependence, Tourette syndrome and normal controls. *Addiction*, 101(4), 534-547.
- Greene, K., Krcmar, M., Walters, L. H., Rubin, D. L., & Hale, L. (2000). Targeting adolescent risk-taking behaviors: the contributions of egocentrism and sensation-seeking. *Journal of Adolescence*, 23(4), 439-461.
- Griffiths, M., & Delfabbro, P. (2001). The biopsychosocial approach to gambling: Contextual factors in research and clinical interventions. *The Electronic Journal of Gambling Issues*. Available at: <http://www.camh.net/egambling/issue5/feature/index.html>
- Gupta, R., & Derevensky, J. L. (2011). Understanding the etiology of youth gambling. In J. L. Derevensky, D. T. L. Shek & J. Merrick (Eds.), *Youth gambling: The hidden addiction*. Berlin: de Gruyter.
- Gupta, R., Nower, L., Derevensky, J. L., Blaszczynski, A., Faregh, N., & Temcheff, C. (2013). Problem gambling in adolescents: an examination of the pathways model. *Journal of Gambling Studies*, 29(3), 575-588.
- Grüsser, S. M., Thalemann, R., & Griffiths, M. D. (2007). Excessive computer game playing: evidence for addiction and aggression?. *CyberPsychology & Behavior*, 10(2), 290-292.
- Hakkarainen, P., Järvinen-Tassopoulos, J. & Metso, L. (2010). Miten alkoholinkäyttö, rahapelaaminen ja huumeiden-käyttö kytkeytyvät toisiinsa? In *Suomi Juo* (2010). Mäkelä, P., Mustonen, H. & Tigerstedt, C. (Eds.). *Terveiden ja hyvinvoinninlaitos*. Helsinki: Yliopistopaino.
- Hardoon, K. K., & Derevensky, J. L. (2001). Social influences involved in children's gambling behavior. *Journal of Gambling Studies*, 17(3), 191-215.
- Hardoon, K. K., Gupta, R., & Derevensky, J. L. (2004). Psychosocial variables associated with adolescent gambling. *Psychology of Addictive Behaviors*, 18(2), 170.
- Hodgins, D. C., Stea, J. N., & Grant, J. E. (2011). Gambling disorders. *The Lancet*, 378(9806), 1874-1884.

- Holtgraves, T. (2009). Evaluating the problem gambling severity index. *Journal of Gambling Studies*, 25(1), 105-120.
- Jaakkola, T., Murto, A., & Pajula, M. (2012). Peliklinikan toimintakatsaus 2012 & Peluurin puolivuotisraportti 2012. Helsinki: Peliklinikka-hanke.
- Jiménez-Murcia, S., Álvarez-Moya, E. M., Stinchfield, R., Fernández-Aranda, F., Granero, R., Aymamí, N., ... & Menchón, J. M. (2010). Age of onset in pathological gambling: clinical, therapeutic and personality correlates. *Journal of Gambling Studies*, 26(2), 235-248.
- Joutsa, J., Johansson, J., Niemelä, S., Ollikainen, A., Hirvonen, M. M., Piepponen, P., ... & Kaasinen, V. (2012). Mesolimbic dopamine release is linked to symptom severity in pathological gambling. *Neuroimage*, 60(4), 1992-1999.
- Järvinen-Tassopoulos, J., & Raitasalo, K. (2015). Ikärajoja ja rajojen kokeilua. Raha-automaattipelejä pelaavien 9.-luokkalaisten alkoholin, kannabiksen ja tupakkatuotteiden käyttö vuosina 1995–2011. *Yhteiskuntapolitiikka*, 80(2), 160-172.
- Kaarne, T., Aalto, M., Kuokkanen, M., & Seppä, K. (2010). AUDIT-C, AUDIT-3 and AUDIT-QF in screening risky drinking among Finnish occupational health-care patients. *Drug and Alcohol Review*, 29(5), 563-567.
- Kelly, M. J., Dunstan, F. D., Lloyd, K., & Fone, D. L. (2008). Evaluating cutpoints for the MHI-5 and MCS using the GHQ-12: a comparison of five different methods. *BMC Psychiatry*, 8(1), 10.
- Ladd, G. T., & Petry, N. M. (2002). Gender differences among pathological gamblers seeking treatment. *Experimental and Clinical Psychopharmacology*, 10(3), 302.
- Lesieur, H. R., Blume, S. B., & Zoppa, R. M. (1986). Alcoholism, drug abuse, and gambling. *Alcoholism: Clinical and Experimental Research*, 10(1), 33-38.
- Lorains, F. K., Cowlishaw, S., & Thomas, S. A. (2011). Prevalence of comorbid disorders in problem and pathological gambling: systematic review and meta-analysis of population surveys. *Addiction*, 106(3), 490-498.

- McCabe CJ, Thomas KJ, Brazier JE, Coleman P (1996). Measuring the mental health status of a population: a comparison of the GHQ-12 and the SF-36 (MHI-5). *British Journal of Psychiatry*, 169(4): 517–21.
- McMillen, J., & Wenzel, M. (2006). Measuring problem gambling: Assessment of three prevalence screens. *International Gambling Studies*, 6(2), 147-174.
- Milosevic, A., & Ledgerwood, D. M. (2010). The subtyping of pathological gambling: A comprehensive review. *Clinical Psychology Review*, 30(8), 988-998.
- Molde, H., Pallesen, S., Bartone, P., Hystad, S., & Johnsen, B. H. (2009). Prevalence and correlates of gambling among 16 to 19-year-old adolescents in Norway. *Scandinavian Journal of Psychology*, 50(1), 55-64.
- Monaghan, S., Derevensky, J., & Sklar, A. (2008). Impact of gambling advertisements and marketing on children and adolescents: Policy recommendations to minimise harm. *Journal of Gambling Issues*, 22, 252-274.
- National Research Council. (1999). *Pathological Gambling: A Critical Review*. Washington D.C.: National Academy Press.
- Nower, L., Derevensky, J. L., & Gupta, R. (2004). The relationship of impulsivity, sensation seeking, coping, and substance use in youth gamblers. *Psychology of Addictive Behaviors*, 18(1), 49-55.
- Nuorisolaki 72/2006. [Youth Law]. Retrieved from <http://www.finlex.fi/fi/laki/alkup/2006/20060072>
- Ohannessian, C. M., & Hesselbrock, V. M. (1993). The influence of perceived social support on the relationship between family history of alcoholism and drinking behaviors. *Addiction*, 88(12), 1651-1658.
- Orford, J., Wardle, H., Griffiths, M., Sproston, K., & Erens, B. (2010). PGSI and DSM-IV in the 2007 British Gambling Prevalence Survey: Reliability, item response, factor structure and inter-scale agreement. *International Gambling Studies*, 10(1), 31-44.
- Pagani, L. S., Derevensky, J. L., & Japel, C. (2009). Predicting gambling behavior in sixth grade from kindergarten impulsivity: a tale of developmental continuity. *Archives of Pediatrics & Adolescent Medicine*, 163(3), 238-243.

- Parke, J., & Griffiths, M. (2006). The psychology of the fruit machine: The role of structural characteristics (revisited). *International Journal of Mental Health and Addiction*, 4(2), 151-179.
- Peng, C. Y. J., Lee, K. L., & Ingersoll, G. M. (2002). An introduction to logistic regression analysis and reporting. *The Journal of Educational Research*, 96(1), 3-14.
- Petry N. M., Blanco C, Stinchfield R, Volberg R. (2013). An empirical evaluation of proposed changes for gambling diagnosis in the DSM-5. *Addiction*, 108(3), 575-581.
- Petry, N. M., & O'Brien, C. P. (2013). Internet gaming disorder and the DSM-5. *Addiction*, 108(7), 1186-1187.
- Petry, N. M., Stinson, F. S., & Grant, B. F. (2005). Comorbidity of DSM-IV pathological gambling and other psychiatric disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *The Journal of Clinical Psychiatry*, 66(5), 564-574.
- Piccinelli, M., & Wilkinson, G. (2000). Gender differences in depression Critical review. *The British Journal of Psychiatry*, 177(6), 486-492.
- Potenza, M. N. (2006). Should addictive disorders include non-substance-related conditions? *Addiction*, 101(Supplement s1), 142-151.
- Potenza, M. N., Steinberg, M. A., McLaughlin, S. D., Wu, R., Rounsaville, B. J. & O'Malley, S. S. (2001). Gender-Related Differences in the Characteristics of Problem Gamblers Using a Gambling Helpline. *American Journal of Psychiatry*, 158(9), 1500-1505.
- Rahman, A. S., Pilver, C. E., Desai, R. A., Steinberg, M. A., Rugle, L., Krishnan-Sarin, S., & Potenza, M. N. (2012). The relationship between age of gambling onset and adolescent problematic gambling severity. *Journal of Psychiatric Research*, 46(5), 675-683.
- Raisamo, S., Halme, J., Murto, A., & Lintonen, T. (2013). Gambling-related harms among adolescents: a population-based study. *Journal of Gambling Studies*, 29(1), 151-159.

- Raisamo, S. U., Mäkelä, P., Salonen, A. H., & Lintonen, T. P. (2014). The extent and distribution of gambling harm in Finland as assessed by the Problem Gambling Severity Index. *The European Journal of Public Health*, 1-7.
- Reinert, D. F., & Allen, J. P. (2007). The alcohol use disorders identification test: an update of research findings. *Alcoholism: Clinical and Experimental Research*, 31(2), 185-199.
- Rumpf, H. J., Meyer, C., Hapke, U., & John, U. (2001). Screening for mental health: validity of the MHI-5 using DSM-IV Axis I psychiatric disorders as gold standard. *Psychiatry Research*, 105(3), 243-253.
- Salonen, A. H., Castrén, S., Raisamo, S., Orford, J., Alho, H., & Lahti, T. (2014). Attitudes towards gambling in Finland: a cross-sectional population study. *BMC Public Health*, 14(1), 982.
- Sim, T., Gentile, D. A., Bricolo, F., Serpelloni, G., & Gulamoydeen, F. (2012). A conceptual review of research on the pathological use of computers, video games, and the Internet. *International Journal of Mental Health and Addiction*, 10(5), 748-769.
- Spear, L. P. (2000). The adolescent brain and age-related behavioral manifestations. *Neuroscience & Biobehavioral Reviews*, 24(4), 417-463.
- Staff, J., Schulenberg, J. E., Maslowsky, J., Bachman, J. G., O'Malley, P. M., Maggs, J. L., & Johnston, L. D. (2010). Substance use changes and social role transitions: Proximal developmental effects on ongoing trajectories from late adolescence through early adulthood. *Development and Psychopathology*, 22(04), 917-932.
- Steinberg, L. (2004). Risk taking in adolescence: what changes, and why?. *Annals of the New York Academy of Sciences*, 1021(1), 51-58.
- Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Sciences*, 9(2), 69-74.
- Stevens, M., & Young, M. (2010). Who plays what? Participation profiles in chance versus skill-based gambling. *Journal of Gambling Studies*, 26(1), 89-103.

- Stone, A. L., Becker, L. G., Huber, A. M., & Catalano, R. F. (2012). Review of risk and protective factors of substance use and problem use in emerging adulthood. *Addictive Behaviors, 37*(7), 747-775.
- Strand, B. H., Dalgard, O. S., Tambs, K., & Rognerud, M. (2003). Measuring the mental health status of the Norwegian population: a comparison of the instruments SCL-25, SCL-10, SCL-5 and MHI-5 (SF-36). *Nordic Journal of Psychiatry, 57*(2), 113-118.
- Sussman, S., Lisha, N., & Griffiths, M. (2011). Prevalence of the addictions: a problem of the majority or the minority?. *Evaluation & the Health Professions, 34*(1), 3-56.
- Tavares, H., Zilberman, M. L., Beites, F. J., & Gentil, V. (2001). Brief communications: Gender differences in gambling progression. *Journal of Gambling Studies, 17*(2), 151-159.
- Terveyden ja hyvinvoinnin laitos. (2013). [National Institute for Health and Welfare]. *Suomalaisten rahapelaamisen vuosikirja 2012*. Avellan, M. (Ed.). Helsinki: Valopaino Oy.
- Theunissen, M. J., Jansen, M., & van Gestel, A. (2011). Are mental health and binge drinking associated in Dutch adolescents? Cross-sectional public health study. *BMC Research Notes, 4*(1), 100.
- Trevorrow, K., & Moore, S. (1998). The association between loneliness, social isolation and women's electronic gaming machine gambling. *Journal of Gambling Studies, 14*(3), 263-284.
- Turja, T., Halme, J., Mervola, M., Järvinen-Tassopoulos, J., & Ronkainen, J. E. (2012). *Suomalaisten rahapelaaminen 2011*. [Finnish gambling 2011]. Helsinki: Terveyden ja hyvinvoinnin laitos.
- Turja, T. & Mervola, M. (2012). *Suomalaisten rahapelaaminen 2011 Menetelmäraportti*. [Finnish gambling 2011 methods report]. Helsinki: Terveyden ja hyvinvoinnin laitos.
- Veit, C. T., & Ware, J. E. (1983). The structure of psychological distress and well-being in general populations. *Journal of Consulting and Clinical Psychology, 51*(5), 730-742.

- Walther, B., Morgenstern, M., & Hanewinkel, R. (2011). Co-occurrence of addictive behaviours: personality factors related to substance use, gambling and computer gaming. *European Addiction Research*, 18(4), 167-174.
- Ware, J. E., & Gandek, B. (1998). Overview of the SF-36 health survey and the international quality of life assessment (IQOLA) project. *Journal of Clinical Epidemiology*, 51(11), 903-912.
- Ware, J. E., Kosinski, M., Gandek, B., Aaronson, N. K., Apolone, G., Bech, P., ... & Sullivan, M. (1998). The factor structure of the SF-36 Health Survey in 10 countries: Results from the IQOLA Project. *Journal of Clinical Epidemiology*, 51(11), 1159-1165.
- Wood, R. T., Gupta, R., Derevensky, J. L., & Griffiths, M. (2004). Video game playing and gambling in adolescents: Common risk factors. *Journal of Child & Adolescent Substance Abuse*, 14(1), 77-100.
- World Health Organisation (1993). ICD-10 classification of mental and behavioral disorders: Diagnostic criteria for research. Geneva: World Health Organization.
- Williams, R. J., Hann R. G., Schopflocher, D., West, B., McLaughlin, P., White, N., King, K., & Flexhaug, T. (2015). *Quinte Longitudinal Study of Gambling and Problem Gambling*. Ontario: Ontario Problem Gambling Research Centre. Retrieved from <http://hdl.handle.net/10133/3641>
- Williams, R. J., & Volberg, R. A. (2014). The classification accuracy of four problem gambling assessment instruments in population research. *International Gambling Studies*, 14(1), 15-28.
- Williams, R. J., Volberg, R. A., & Stevens, R. M. (2012). The population prevalence of problem gambling: Methodological influences, standardized rates, jurisdictional differences, and worldwide trends. Ontario: Ontario Problem Gambling Research Centre. Retrieved from <https://www.uleth.ca/dspace/bitstream/handle/10133/3068/2012-PREVALENCE-OPGRC%2520%282%29.pdf%3Fsequence%3D3>
- Wilsnack, R. W., Vogeltanz, N. D., Wilsnack, S. C., & Harris, T. R. (2000). Gender differences in alcohol consumption and adverse drinking consequences: cross-cultural patterns. *Addiction*, 95(2), 251-265.

Zuckerman, M., Eysenck, S. B., & Eysenck, H. J. (1978). Sensation seeking in England and America: cross-cultural, age, and sex comparisons. *Journal of Consulting and Clinical Psychology*, 46(1), 139-149.

7. Supplementary tables and histograms

Table 1. Descriptive statistics for background information for unweighted sample.

		N (%)	Mean	Std. Dev.
Marital status				
	Married / in registered relationship	61 (7.4)		
	Cohabitation	196 (23.8)		
	Divorced / judicial separation	3 (0.4)		
	Single	550 (66.9)		
	Does not want to say	12 (1.5)		
Occupation				
	Working	282 (34.4)		
	Part-time pension	1 (0.1)		
	Pension (age related)	1 (0.1)		
	Suspended without pay	2 (0.2)		
	Unemployed	42 (5.1)		
	Student	451 (54.9)		
	On leave for family matters, still employed	13 (1.6)		
	Home parent, unemployed	10 (1.2)		
	Long term sick leave	3 (0.4)		
	Disability pension / in rehabilitation	3 (0.4)		
	Other	12 (1.5)		
	Does not want to say	2 (0.2)		
Monthly salary (net)			998.4	913.1
	Does not want to say	158 (19.2)		
Years of education			13.2	2.7
	Does not want to say / inadequate answer	4 (0.5)		

Table 2. Descriptive statistics for continuous variables with unweighted and weighted sample.

	Unweighted			Weighted		
	N	Mean	Std. Dev.	N	Mean	Std. Dev.
PGSI sum score	822	0.476	1.397	948	0.477	1.420
AUDIT-C sum score	822	4.006	2.633	948	4.028	2.648
MHI-5 sum score	822	79.492	13.023	948	79.533	13.095
Loneliness	822	1.876	0.814	948	1.883	0.824
Perceived health	822	4.640	0.639	948	4.634	0.648
Computer gaming (hrs/week)	614	4.739	8.841	709	4.865	8.982
Computer gaming (hrs/month)	737	13.360	24.812	850	13.830	25.841

Table 3. Classification frequencies for nominally coded variables with unweighted and weighted sample.

		Unweighted		Weighted	
		N	%	N	%
Life time gambling	No	94	11.4	108	11.4
	Yes	728	88.6	839	88.6
PGSI score	0-1	745	90.6	859	90.6
	≥2	77	9.4	89	9.4
Smoking	No	479	58.3	548	57.8
	Occasionally / Daily	343	41.7	400	42.2
AUDIT-C score	Non-risky consumption	542	65.9	620	65.4
	Risky consumption	280	34.1	328	34.6
MHI-5 score	Normal mental health	775	94.3	892	94.2
	Poor mental health	47	5.7	55	5.8
Loneliness	Low frequency	801	97.4	920	97.1
	High frequency	21	2.6	27	2.9
Perceived health	Poor	58	7.1	69	7.3
	Good	764	92.9	879	92.7
Computer gaming frequency	None	197	26.3	222	25.7
	Low	537	71.8	622	72.2
	High	14	1.9	18	2.1

Table 4. Pearson correlations for females (N = 405) below diagonal and for males (N = 417) above diagonal.

	1.	2.	3.	4.	5.	6.	7.	8.
1. Age		.02	.16**	.21**	-.02	.05	.06	-.06
2. PGSI sum score ¹	-.07		.19**	.23**	-.18**	.13**	.18**	.00
3. Tobacco smoking ²	.05	.15**		.39**	-.02	-.06	.12**	-.04
4. AUDIT-C sum score ³	.14**	.12**	.33**		-.04	.00	-.02	-.06
5. MHI-5 sum score ⁴	.01	-.17**	-.11*	-.12*		-.45**	-.30**	-.01
6. Loneliness ⁵	.03	.21**	.12**	.10*	-.46**		.18**	-.01
7. Perceived health ⁶	.00	.09	.13**	.04	-.37**	.19**		.11*
8. Gaming ⁷ †	-.26**	.07	.00	-.07	-.04	.10	.07	

Categorical codings for variables: ²Does not smoke = 0; ⁷no gaming = 0, 1-4 h/day = 1, ≥ 5 h/day = 2. High values for continuous variables represent: ¹disordered gambling, ³risky alcohol consumption, ⁴good mental health, ⁵frequently feeling lonely, ⁶poor perceived health; † Spearman's correlations (male n = 392; female n = 356); statistical significance ** p<0.01; *p<0.05 (2-tailed).

Table 5a. Frequencies (%) of PGSI classification by age group for entire sample (n = 822).

		15-17	18-21	22-25	26-28	Total
PGSI classification	Non-problem ¹	105 (75.5)	197 (72.4)	200 (84.4)	139 (79.9)	641 (78.0)
	Low risk ²	33 (23.7)	71 (26.1)	31 (13.1)	31 (17.8)	166 (20.2)
	Moderate risk ³	0 (0.0)	2 (0.7)	4 (1.7)	1 (0.6)	7 (0.9)
	Problem gambler ⁴	1 (0.7)	2 (0.7)	2 (0.8)	3 (1.7)	8 (1.0)

Classifications based on PGSI score of ¹0, ²1-4, ³5-7, ⁴8-27

Table 5b. Frequencies (%) of PGSI classification by age group for male sample (n = 417).

		15-17	18-21	22-25	26-28
PGSI classification	Non-problem ¹	48 (64.0)	86 (63.7)	91 (74.6)	63 (74.1)
	Low risk ²	27 (36.0)	46 (34.1)	26 (21.3)	18 (21.2)
	Moderate risk ³	0 (0.0)	2 (1.5)	3 (2.5)	1 (1.2)
	Problem gambler ⁴	0 (0.0)	1 (0.7)	2 (1.6)	3 (3.5)

Classifications based on PGSI score of ⁰1, ¹1-4², ⁵5-7³, ⁸8-27⁴

Table 5c. Frequencies (%) of PGSI classification by age group for female sample (n = 405).

		15-17	18-21	22-25	26-28
PGSI classification	Non-problem ¹	57 (89.1)	111 (81.0)	109 (94.8)	76 (85.4)
	Low risk ²	6 (9.4)	25 (18.2)	5 (4.3)	13 (14.6)
	Moderate risk ³	0 (0.0)	0 (0.0)	1 (0.9)	0 (0.0)
	Problem gambler ⁴	1 (1.6)	1 (0.7)	0 (0.0)	0 (0.0)

Classifications based on PGSI score of ⁰1, ¹1-4², ⁵5-7³, ⁸8-27⁴

Table 6: Logistic regression models for females (objective 2), page 66

Table 6. Binary logistic regression models predicting disordered gambling behaviour presented as odds ratios (95% confidence interval) for females.

	Model 1: substance use	Model 2: Poor mental health	Model 3: Loneliness	Model 4: Models 2. and 3. combined	Model 5: Models 1. and 4. combined	Model 6: Perceived health	Model 7: Computer gaming
Age	0.93 (0.83, 1.04)	0.94 (0.84, 1.05)	0.95 (0.84, 1.06)	0.94 (0.84, 1.06)	0.94 (0.83, 1.05)	0.93 (0.82, 1.04)	0.92 (0.81, 1.05)
Risky alcohol consumption	1.23 (0.48, 3.14)				1.19 (0.45, 3.12)		
Tobacco smoking	4.24* (1.53, 11.77)				4.01* (1.43, 11.24)		
Poor mental health		2.19 (0.55, 8.71)		0.88 (0.16, 4.99)	0.99 (0.18, 5.39)		
Feeling lonely			7.81* (2.10, 29.01)	8.30* (1.78, 38.60)	6.46 (1.42, 29.34)	3.80 (1.10, 13.19)	
Poor perceived health							2.70 (0.77, 9.41)
Gaming [†] 1-4 h/day							8.54 (0.72, 101.37)
Gaming \geq 5 h/day							
Nagelkerke R ^{2†}	0.081	0.016	0.057	0.057	0.12	0.033	0.058

reference group: [†]no gaming

[†] pseudo estimate of variance explained (%) for each regression model; * statistical significance *ps.01

Table 7: Logistic regression models for males (objective 2), page 67

Table 7. Binary logistic regression models predicting disordered gambling behaviour presented as odds ratios (95% confidence interval) for males.

	Model 1: substance use	Model 2: Poor mental health	Model 3: Loneliness	Model 4: Models 2. and 3. combined	Model 5: Models 1. and 4. combined	Model 6: Perceived health	Model 7: Computer gaming
Age	0.98 (0.91, 1.05)	1.01 (0.94, 1.08)	1.01 (0.94, 1.08)	1.01 (0.94, 1.08)	0.97 (0.90, 1.04)	1.01 (0.95, 1.08)	1.01 (0.95, 1.08)
Risky alcohol consumption	2.77* (1.53, 5.00)				2.57* (1.40, 4.74)		
Tobacco smoking	1.79 (1.00, 3.19)				1.95 (1.07, 3.56)		
Poor mental health		4.05* (1.79, 9.16)		2.23 (0.82, 6.06)	2.63 (0.96, 7.26)		
Feeling lonely			8.80* (2.92, 26.48)	5.26* (1.46, 18.98)	4.41 (1.20, 16.23)		
Poor perceived health						1.88 (0.86, 4.12)	
Gaming [†] 1-4 h/day							0.96 (0.45, 2.05)
Gaming ≥5 h/day							0.51 (0.06, 4.51)
Nagelkerke R ^{2†}	0.087	0.036	0.051	0.059	0.139	0.009	0.002

reference group: 'no gaming

† pseudo estimate of variance explained (%) for each regression model; statistical significance *p≤.01

Table 8. Content for each gambling type category

Gambling type	Content
Lottery	Veikkaus lottery, Viking lottery, Jokeri, Keno, Syke & eBingo
Scratch cards	Veikkaus scratch cards
Slot machine gambling	RAY slot machines
Online poker	Online poker (e.g. RAY, PAF, Centrebet, Ladbrokers & Unibet)
Other online gambling	Other online gambling (e.g. RAY, PAF, Centrebet, Ladbrokers & Unibet)
Casino betting	Betting at casino & gambling managed by coopier elsewhere
Sports betting	Veikkaus sports betting & Fintoto horse race betting
Private betting	Private betting & card game with stakes

Table 9. Frequencies for gamblers of specific gambling types who gamble at least 2-3 times per month (%).

	Females	Males	Total
Lottery	60 (14.8)	94 (22.5)	154 (18.7)
Scratch cards	18 (4.4)	24 (5.8)	42 (5.1)
Slot machine gambling	35 (8.6)	152 (36.5)	187 (22.7)
Online poker	1 (0.2)	16 (3.8)	17 (2.1)
Other online gambling	4 (1.0)	11 (2.6)	15 (1.8)
Casino betting	1 (0.2)	13 (3.1)	14 (1.7)
Sports betting	7 (1.7)	51 (12.2)	58 (7.1)
Private betting	2 (0.5)	13 (3.1)	15 (1.8)

Table 10. Frequencies for how many different gambling types are engaged in at a rate of at least 2-3 times per month by individual gambling types (%).

	Amount of gambling types played at least 2-3 times per month							
	1	2	3	4	5	6	7	8
Lottery	68 (44.2)	46 (29.9)	26 (16.9)	4 (2.6)	5 (3.2)	2 (1.3)	2 (1.3)	1 (0.6)
Scratch cards	5 (11.9)	8 (19.0)	16 (38.1)	4 (9.5)	5 (11.9)	2 (4.8)	1 (2.4)	1 (2.4)
Slot machine gambling	86 (46.0)	53 (28.3)	33 (17.6)	5 (2.7)	5 (2.7)	2 (1.1)	2 (1.1)	1 (0.5)
Online poker	1 (5.9)	4 (23.5)	6 (35.3)	0 (0.0)	1 (5.9)	2 (11.8)	2 (11.8)	1 (5.9)
Other online gambling	2 (13.3)	3 (20.0)	3 (20.0)	0 (0.0)	3 (20.0)	2 (13.3)	1 (6.7)	1 (6.7)
Casino betting	2 (14.3)	4 (28.6)	3 (21.4)	0 (0.0)	1 (7.1)	1 (7.1)	2 (14.3)	1 (7.1)
Sports betting	9 (15.5)	18 (31.0)	18 (31.0)	5 (8.6)	4 (6.9)	1 (1.7)	2 (3.4)	1 (1.7)
Private betting	4 (26.7)	2 (13.3)	3 (20.0)	2 (13.3)	1 (6.7)	0 (0.0)	2 (13.3)	1 (6.7)

Table 11. Binary logistic regression models predicting disordered gambling presented as odds ratios (95 % CI) for females.

	Gambling type models 1	Mutually adjusted model 2	Gambling type models 3
Lottery	3.89* (1.42, 10.62)	0.57 (0.15, 2.19)	3.36 (1.18, 9.54)
Scratch cards	12.46* (4.08, 38.12)	2.63 (0.60, 11.60)	12.28* (3.64, 41.46)
Slot machine gambling	36.91* (13.49, 101.04)	35.36* (11.24, 111.27)	33.54* (11.93, 94.26)

Models 1 display 3 regression models where each gambling type is used individually as a predictor. Model 2 is a mutually adjusted model where all gambling types are simultaneously used as predictors. Models 3 display 3 regression models where mental health, loneliness and perceived health are controlled for while using each gambling type as an individual predictor. Age is controlled for in all models; *statistically significant $p \leq .01$

Table 12. Binary logistic regression models predicting disordered gambling presented as odds ratios (95 % CI) for males.

	Gambling type models 1	Mutually adjusted model 2	Gambling type models 3
Lottery	2.35* (1.34, 4.14)	1.54 (0.84, 2.83)	2.19* (1.22, 3.91)
Scratch cards	3.96* (1.75, 8.97)	1.75 (0.73, 4.22)	3.83* (1.65, 8.88)
Slot machine gambling	4.60* (2.65, 7.97)	3.86* (2.16, 6.89)	5.03* (2.82, 8.98)

Models 1 display 3 regression models where each gambling type is used individually as a predictor. Model 2 is a mutually adjusted model where all gambling types are simultaneously used as predictors. Models 3 displays 3 regression models where mental health, loneliness and perceived health are controlled for while using each gambling type as an individual predictor. Age is controlled for in all models; *statistically significant $p \leq .01$

Table 13. Binary logistic regression models predicting indicators of health and well-being with gambling types for females.

	Poor mental health	Feeling lonely	Poor perceived health	Risky alcohol consumption	Tobacco smoking
Lottery	1.08	4.21	1.36	1.01	1.63
Scratch cards	1.24	9.20*	0.00	1.12	1.93
Slot machine	1.70	3.95	2.42	3.05*	4.68*
Non-gambler	0.92	0.32	1.3	0.21*	0.46*

Columns represent nominal outcome variables and rows represent the predictors (gambling type). Each cell thus represents an individual regression model in odds ratios. Age is controlled for in all models; *statistical significance $p \leq .01$

Table 14. Binary logistic regression models predicting indicators of health and well-being with gambling types for males.

	Poor mental health	Feeling lonely	Poor perceived health	Risky alcohol consumption	Tobacco smoking
Lottery	1.04	2.96	0.80	1.08*	1.07*
Scratch cards	2.60	1.77	1.1	2.46	1.09*
Slot machine	1.51	0.91	1.65	2.53*	3.83*
Non-gambler	1.83	2.17	2.21	0.28*	0.45

Columns represent nominal outcome variables and rows represent the predictors (gambling type). Each cell thus represents an individual regression model in odds ratios. Age is controlled for in all models; *statistical significance $p \leq .01$

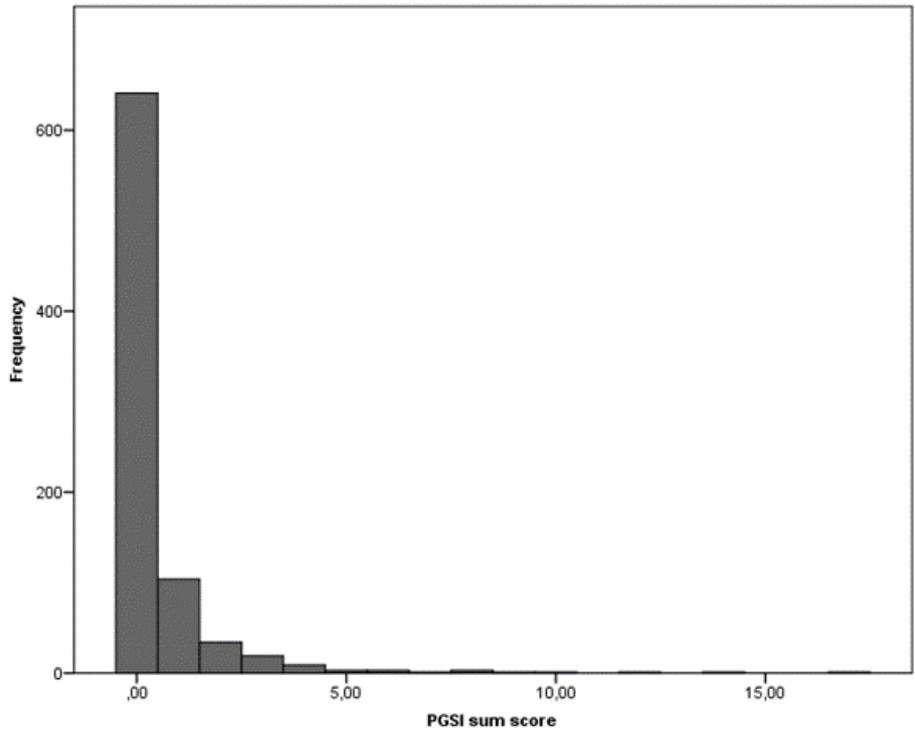


Figure 1. Histogram for frequencies of PGSI score

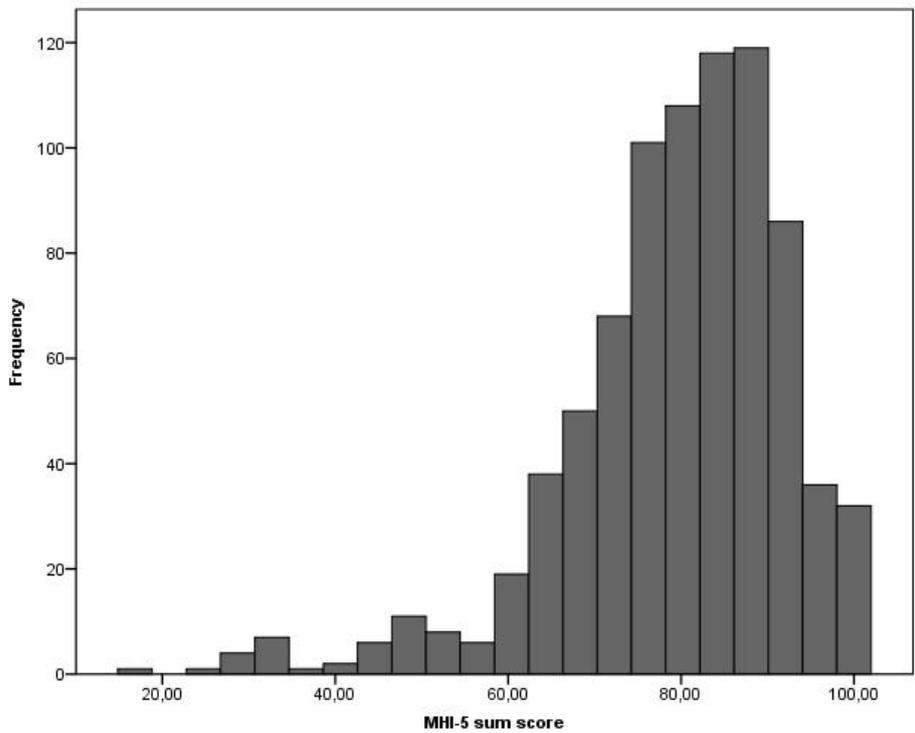


Figure 2. Histogram for frequencies of MHI-5

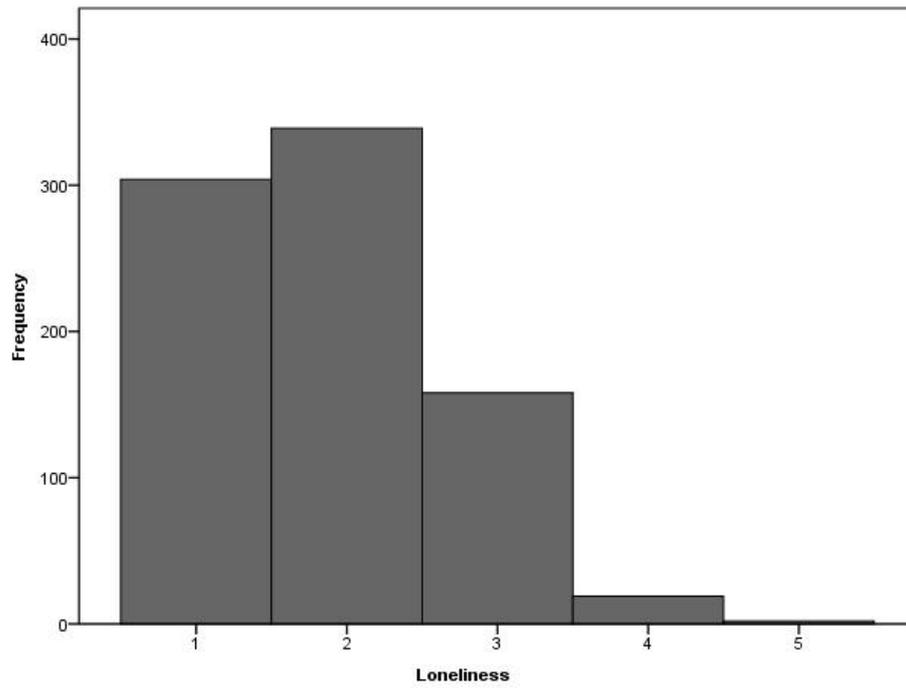


Figure 3. Histogram for frequencies of loneliness

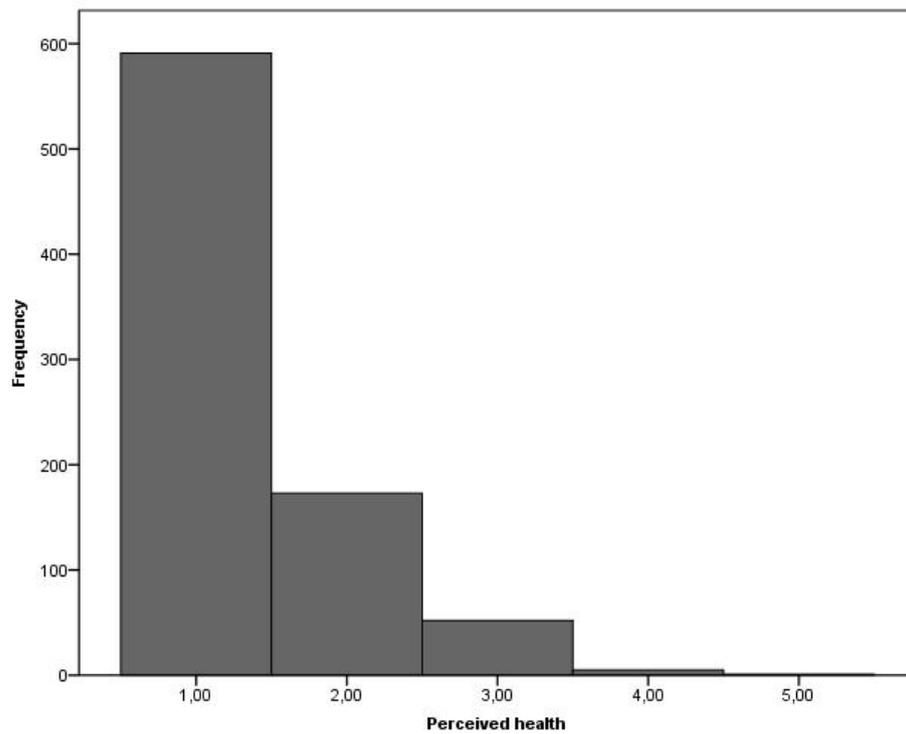


Figure 4. Histogram for frequencies of perceived health ratings

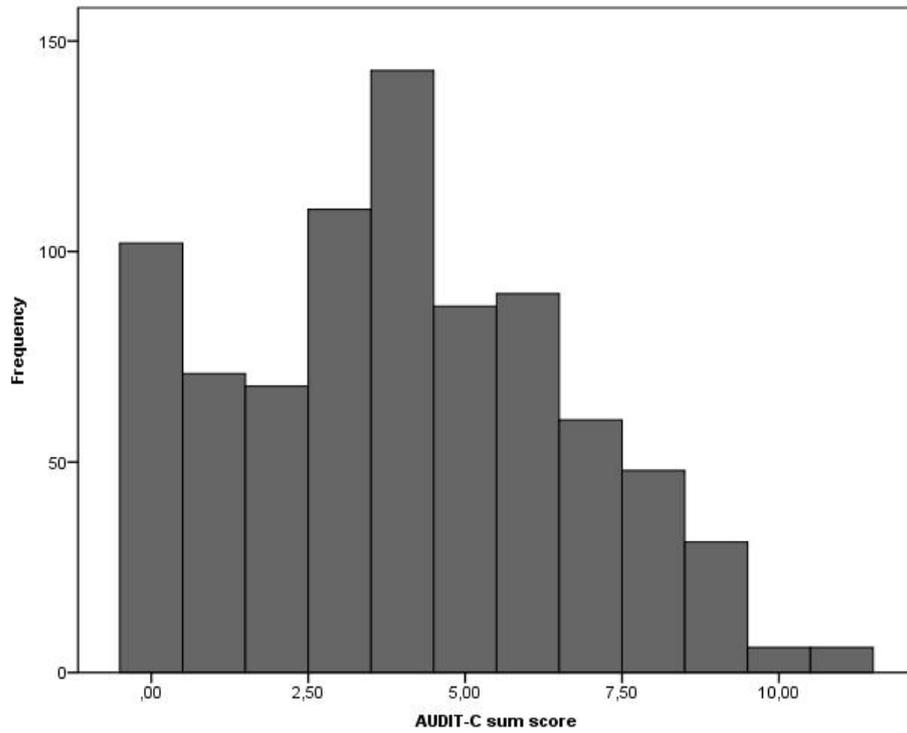


Figure 5. Histogram for frequencies of AUDIT-C

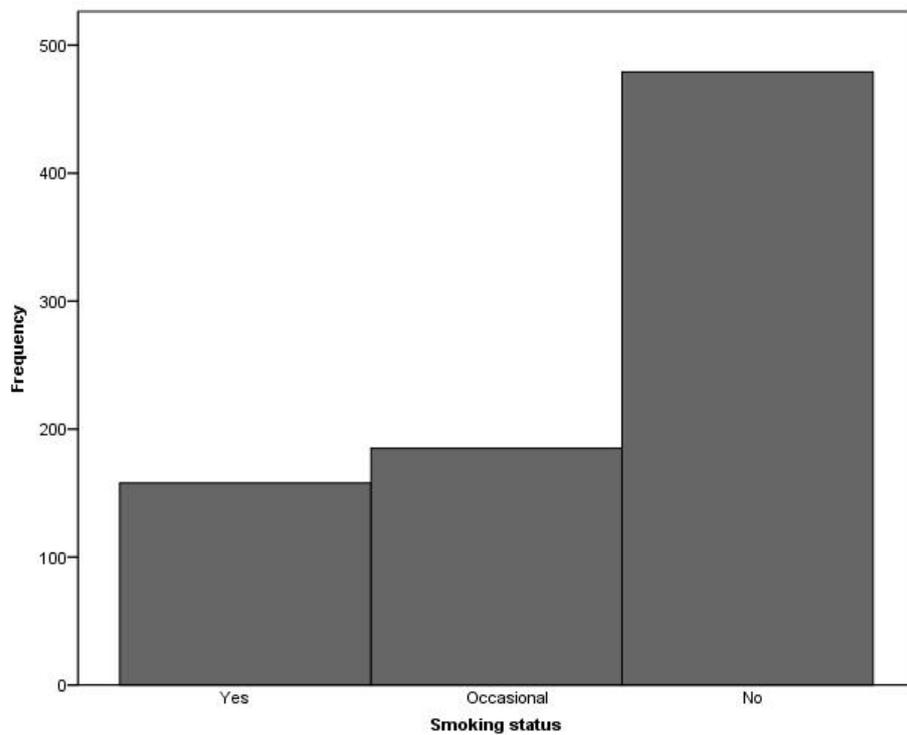


Figure 6. Histogram for frequencies of tobacco smoking

Figure 7: Histogram for computer gaming frequencies, page 74

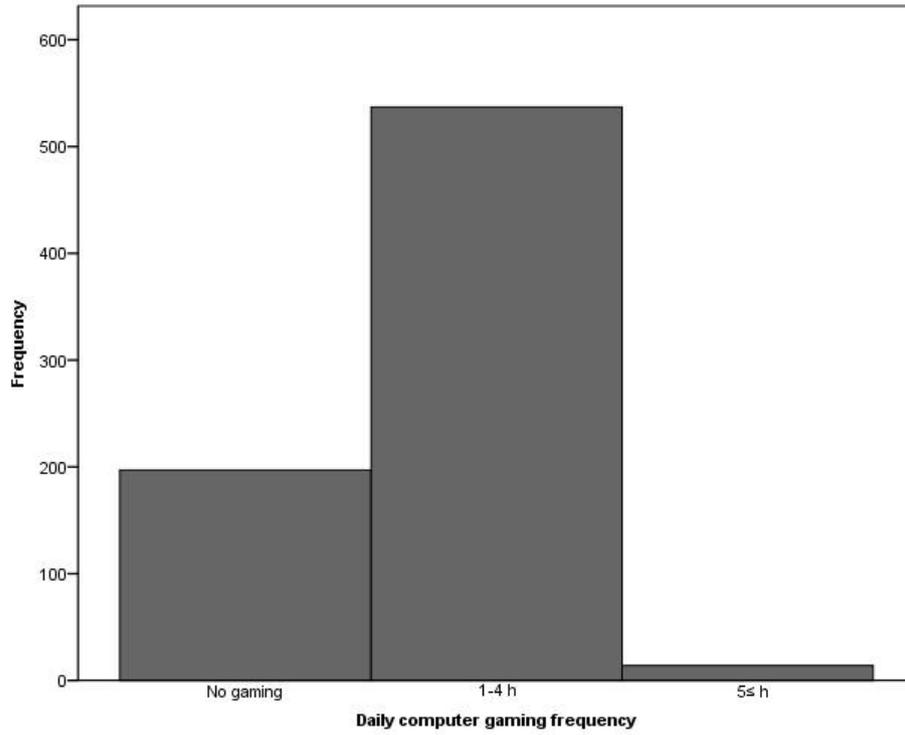


Figure 7. Histogram for frequencies of computer gaming classification