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Research Article

Depression and Suicidal Risk in Gambling Disorder (GD) and Internet Gaming Disorder (IGD): Clinical, Neurobiological and Social Preconditions for this Comorbid Psychopathology

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ABSTRACT

Depression is one of the most common concomitant mental disorders associated with gambling addiction and internet gaming disorder. It is diagnosed in 23.1%-41.3% of patients with GD. The conducted meta-analysis and reviews of internet addiction studies, which included IGD and SNS addiction, reveal a high degree of correlation with depression in 75%-89% of studies. Patients with GD, there is a high suicide risk in 25.6%-49.2%, in 81.4% there are suicidal thoughts, which in 29.6-49.2% of cases having a permanent, obsessive nature, 6.9%-30.2%, commit suicide attempts. Suicide is the main cause of death (31%) in this category of patients. High suicidal risk (thoughts, attempts) is found by researchers in different countries in IGD, with both problematic and pathological users.

The analysis of clinical and neurobiological studies, as well as their own clinical cases, reveals that emotional dysregulation, constant emotional distress, experienced altered states of consciousness with a violation of self-identification during the game and with problematic use of social networks, as well as increasing negative social consequences, are predisposing risk factors for the development of depression in these behavioral dependencies. As for the time sequence, few longitudinal studies have found a bi-directional relationship between depression and the severity of addiction symptoms. More than half of the patients had clinically significant symptoms of depression after the start of the game and the formation of a particular behavioral dependence.

Based on all the results obtained, we can conclude that dependent players and users of social networks can become both initially mentally healthy people, and those who have already experienced subclinical and clinical manifestations of depression. In the first case, the depression was added in the process of aggravating the symptoms of addiction, and in the second, the depressive symptoms increased and worsened. But when healthy life activity was restored, the severity of symptoms of depression also decreased.

This study also shows that information game and network technologies are the main risk factor for the development of both addiction and comorbid psychopathology, up to suicidal behavior.

The search of studies was conducted using the following databases: Scopus, PsycINFO, Science Direct, Psycarticles, PubMED, Wiley Online Library and Google Scholar.

Keywords: Gambling disorder; Depression; Suicidal risk; Psychopathology

INTRODUCTION

Gambling disorder and Internet gaming disorder are behavioral dependencies in the center of which is dependence from a certain type of the gaming behavior over which the control is lost, both in frequency of involvement in the game as well as in time. A pathological craving for play appears and eventually increases to a compulsive urge, which is constantly embodied almost without a struggle of motives. The dependent person continues to play despite the negative consequences for his mental and physical health, personality, relationships in the family, with friends and in the team, in the professional sphere or in school. The pathological need for the game or using a social network becomes dominant and replaces all other interests, hobbies, forms of activity, relationships end even the basic needs: food, sleep, intimacy, child care, etc. There are some cases when players ignored the deterioration of physical health and even severe pain, they did not hear loud sounds such as screaming and crying children or pets.

One teenager gamer, who was playing in the toilet hiding from his parents, was so carried away and detached from the surrounding reality that he did not hear any screams and knocks on the door of frightened

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parents, or even how his father broke down the door. He woke up only when somebody took his smartphone.

Gamers and gamblers and pathological social media users isolate themselves from the environment. Their relationships with family, friends, and work colleagues become conflicted, shallow, and consumering.

Here's how one 24-year-old gambler described it: "Before I started betting, I had relationships with my parents, girlfriend, friends, and work colleagues, which were not always smooth, but I had some feelings for them, they were important and interesting for me. And after I got carried away with sports betting, all people seemed to be depersonalized and divided into two categories: those that prevented me from doing this and those that contributed. And my attitude to them was determined by which of these two categories they belong to."

Epidemiology

Prevalence of IGD: In the detailed epidemiological review of 2017, which analyzed studies prior to May 2016, the prevalence of IGD in general samples varied from 0.7% to 27.5%. In the vast majority of studies, it was higher among young people under 35 years of age [1-9]. The overall picture of prevalence studies suggests that this issue is poorly understood and these indicators not even approximately reflect the real picture today.

For example, a 2015 study by Russian scientists showed that gaming is widespread among students: 92% of high school students play computer games, 65% of college students, and 41% of university students. And almost half of high school students (45.5%), a third of college students (29.3%) and one in ten students of the university (13.4%) have signs of excessive enthusiasm for computer games or problem games [10].

Today, the game industry is a hundred billion business with billions of active users of different ages, among which people in the age range from 10 to 36 years old predominate. Information technologies for engagement and retention in the game are constantly being improved [11]. As a result of this effect on the human mind and brain, the prevalence of GD and IGD exceeded the prevalence of all SUD combined.

Prevalence of GD: Prevalence of clinical dependencies pathological and problematic gambling according to various studies for the period from 2000 to 2016, it varies from 0.7% to 7.2% among adults and almost 2 times more from 0.2% to 12.5% among adolescents [12-17]. This is despite the fact that gambling by teenagers is an illegal activity. Data from Italian researchers show an increase in the prevalence of GD in the population to 23% during the period of isolation in connection with the COVID-19 pandemic [18]. The number of players experiencing serious subclinical problems is 2-3 times more. It is also well known that most problem gamblers never seek professional treatment, and no more than 5%-10% of applicants, making research on and prevention of suicide challenging [19-21].

Negative consequences: In general, game addictions lead to various and sometimes very serious negative consequences for mental and physical health, personality, relationships in the family, with friends, work colleagues, for professional activities and education. Up to complete social maladjustment, suicide, and spiritual and moral degradation of the individual [9,11-17].

MATERIALS AND METHODS

For the review, a total of 30 articles were selected and analyzed for the association of IGD and GD with depression, suicidal ideation, and behavior. Fourteen articles examined the relationship and reciprocal influence between IGD and depression and suicidality. Sixteen articles examined this relationship in GD. The articles varied in content and study design: cross-sectional, longitudinal studies, reviews, and meta-analyses.

Also included was research examining the effects of altered states of consciousness, chronic emotional distress, and negative psycho-social consequences on the development of depression and suicidal behavior in GD and IGD [21-36].

RESULTS

Depression is one of the most common co-morbid psychiatric disorders of gambling addiction and Internet gaming disorder. It is diagnosed in 23.1%-41.3% of patients with GD. Patients with GD, there is a high suicide risk in 25.6%-40.21%, in 81%, 4% there are suicidal thoughts, which in 29%, 6%-49.2% of cases having a permanent, obsessive nature, 6.9%-30.2% commit suicide attempts. Suicide is the main cause of death (31%) in this category of patients and is twice as high as death from cancer (16%) and cardiovascular disease (12%). Overall, suicide deaths are 15.1 times higher among those with a gambling disorder in the age range 20-74 and 19.3 times higher in the age range 20-49 than in the general population (Table 1).

Table 1: Studies of depression and suicidal risk at GD.

Author/Year	Task/Method	Sample	Results
Wardle, et al. (2020) [22]	Secondary analysis of the Adult Psychiatric Morbidity Survey 2007, a cross-sectional national probability sample survey of 7403 adults living in households in England.	N=7403	Past year suicidality was reported in 19.2% of problem gamblers, compared with 4.4% in the rest of the population. Their unadjusted Odds Ratios (OR) of suicidality were 5.3 times higher.
Valenciano-Mendoza, et al. (2021) [23]	The participants completed self-reported questionnaires to explore GD, personality traits, and psychopathological symptomatology.	N=1112 GDp F =211 M=901	Of the total sample, 229 patients (26.6%) reported suicidal ideation and 74 patients (6.7%), suicide attempts. The likelihood of presenting suicidal ideation was higher for women than men, but no differences were observed based on gambling preference. Suicidal ideation and attempts were associated with higher GD severity, a worse psychopathological state and higher self-transcendence levels.
Karlsson and Håkansson (2018) [24]	This is a longitudinal nationwide register study on 2,099 individuals with a GD diagnosis in the Swedish inpatient and/or outpatient specialist health care system between the years of 2005–2016.	N=2099 GDp F=474 M=1625	The leading causes of death were suicide (31%) and the median age at suicide death was 32.5 years. However, it has been reported that some deaths classified as "events of undetermined intent" (21%) may in fact represent actual suicides. SMR for suicide indicated a 15.1 times increase for men and women 20–74 years of age and in the younger and older age categories 19.3 and 9.6 times, respectively. Multivariate Cox regression analysis of potential psychiatric predictors of suicide death showed that the main predictor was depression.

Sharman, et al. (2021) [25]	A series of Chi-Square analyses and binary logistic regressions were run to identify clinical and sociodemographic variables associated with suicide attempts.	N=621 GDp	Regression analysis showed that individuals were more likely to have reported suicide attempts if they had experienced loss of family relationships (1.65 times), loss of a home (1.87 times), prior depression (3.2 times), prior suicidal thoughts (6.14 times), or were taking medication (1.95 times) compared to those not reporting such individual events.
Håkansson and Karlsson (2020) [26]	The present study is a longitudinal nationwide, diagnostic register study assessing the risk of suicide attempts (including fatal ones) in gambling disorder in Sweden in 2005–2016.	N=2099 GDp F=474 M=1625	417 individuals (19,9%) had a suicide attempt (including 10 fatal cases of suicide) during the study period. n logistic regression, suicidal behavior was significantly associated with female gender, depression , anxiety disorders , and with alcohol or drug use disorders.
Battersby, et al. (2006) [27]	Seventy-nine people with a diagnosis of pathological gambling received a mail out survey that included questions on postulated risk factors for suicidal ideation and behaviour, the modified Suicide Ideation Scale (SIS), the South Oaks Gambling Screen (SOGS), the Beck Depression Inventory (BDI) and the CAGE.	N=79 GDp	A total of 54.4% of the surveys were returned completed. There were 81.4% who showed some suicidal ideation and 30.2% reported one or more suicide attempts in the preceding 12 months. Suicidal ideation and behaviours were positively correlated with the gambling severity.
Petry and Kiluk (2002) [28]	At intake to gambling treatment programs, 342 pathological gamblers completed the Addiction Severity Index and the South Oaks Gambling Screen.	N=342 GDp	Persistent suicidal ideation was present (N=109,32%), and suicide attempters (N=58,17%). The presence of suicidal ideation correlated with the severity of gambling disorder.
Guillou-Landreat, et al. (2016) [29]	Patients underwent a semi-structured clinical interview and completed self-report questionnaires. The "suicidal risk module" of the Mini International Psychiatric interview (MINI) allowed to constitute two groups of patients that were compared, according to the presence of a suicidal risk.	N=194 GDp	A logistic regression was performed to identify factors related to suicidal risk in PGs. In 40.21% of patients presented a suicidal risk. A history of major depression and anxiety disorders were predictors of suicidal risk as well as the severity of gambling disorder.
Moghaddam, et al. (2015) [30]	This study utilized subgroups derived from a nationally representative data set, examining different characteristics of suicidal behavior and several gambling levels, including subclinical groups.	N=13578 GDp	Problem gambling was associated with suicidal ideation [adjusted odds ratio (AOR)=1.64,95% confidence interval (CI)=1.19-2.26] and suicide attempts [(AOR)=2.42,95%(CI)=1.60-3.67] after adjustment for sociodemographic variables. Pathological gambling was associated with suicidal ideation [(AOR)=2.86, 95% (CI)=1.98-4.11] and suicide attempts [(AOR)=2.77,95% (CI)=1.72-4.47) after adjustment for sociodemographic variables.
Mallorquí-Bagué, et al. (2018) [31]	The aim of this study is to investigate the association between trait impulsivity, emotion dysregulation, and the dispositional use of Emotion Regulation (ER) strategies with suicidal ideation and psychopathological symptom severity in GD.	N=249 GDp N =166 GDp. with suicidal ideation	Analyses of variance showed higher comorbid symptoms, emotion dysregulation, and trait impulsivity in patients with suicidal ideation. SEM analysis revealed that a worse psychopathological state directly predicted suicidal ideation and that both emotion dysregulation and GD severity indirectly increased the risk of suicidal ideation through this state.
Ledgerwood, et al. (2005) [32]	Logistic regression analyses were applied to data from problem gamblers calling a helpline.	N=986 GDp	Problem gamblers who reported gambling-related suicidality (n=252;25.6%) acknowledged family, financial, legal, mental health, and substance-related problems. Among problem gamblers admitting gambling-related suicidality, 21.5% (n=53) reported gambling-related suicide attempts.
Ledgerwood and Petry (2004) [33]	The adult participants recruited from gambling treatment centers were included in an examination of gambling-related suicidal ideation and attempt. Measures of gambling experience, impulsiveness, and dissociation were evaluated across groups.	N=125 GDp.	In this sample, 48% (N=60) had a history of gambling-related suicidal ideation, and an additional 12% (N=15) reported at least one gambling-related suicide attempt.
Black, et al. (2015) [34]	The relationship with suicidal ideas and attempts in pathological gamblers and in the healthy control group was examined. The results were analyzed using logistic regression with GEE.	N=95 GDp N=91 HCs	34 GD probands (35.8%) and 4 controls (4.4%) had attempted suicide; Lifetime suicidal ideations occurred in 60 GD probands (63.2%) and 12 controls (13.2%). Suicidality in GD probands is a marker of GD severity and is associated with greater psychiatric comorbidity.
Jolly, et al. (2021) [35]	Comparison of suicidal behavior in patients with Major Depressive Disorder (MDD) with and without GD/ Data for the study were obtained retrospectively from the Nationwide Inpatient Sample (NIS) dataset for the years 2006-2017.	N=6646 MDD, GDp N=4,021, 063 MDD	In the outcome analysis, suicidal ideation (45.4% *vs.* 39.5%, p<0.001), suicide attempt (7.2% v. 4.5%,p<0.001) and composite of suicidal ideation/attempt (50.7% *vs.* 43.1%, p<0.001) were more common in MDD with GD group compared to MDD without GD. In the multivariate analysis, GD was associated with higher odds of suicidality.

Dowling, et al. (2015) [36]	The systematically review and meta-analyse the prevalence of co-morbid psychiatric disorders (DSM-IV Axis I disorders) among treatment-seeking problem gamblers.	N=36 studies	High rates of co-morbid current (74.8%,95%CI 36.5-93.9) and lifetime (75.5%, 95%CI 46.5-91.8) Axis I disorders. There were high rates of current mood disorders (23.1%,95%CI 14.9-34.0), alcohol use disorders (21.2%,95%CI 15.6-28.1), anxiety disorders (17.6%, 95% CI 10.8-27.3) and substance (non-alcohol) use disorders (7.0%,95%CI 1.7-24.9). Specifically, the highest mean prevalence of current psychiatric disorders was for nicotine dependence (56.4%,95%CI 35.7-75.2) and major depressive disorder (29.9%,95%CI 20.5-41.3).

Cross-sectional studies have demonstrated a significant and positive association between IGD and depression, anxiety disorder (Table 2). Participants with IGD, both adolescents and adults, showed significantly higher levels of deliberate self-harm and suicidal behaviour compared to healthy controls [37,40-43,47-50]. The conducted meta-analysis and reviews of internet addiction studies, which included IGD, reveal a high degree of correlation with depression in 75%-89% of studies [46]. A large-scale nationwide cross-sectional study of 11,356 school-based adolescent students in eleven European countries on the prevalence of pathological Internet use and its association with comorbid psychopathology and suicidal behavior among adolescents found that [47-50]:

- In the AIU group (n=9,355), results showed that the prevalence of moderate to severe depression and anxiety was 5%, respectively.
- In the MIU group (n=1,523), 17.1% were identified with moderate to severe depression and 16.4% with moderate to severe anxiety.
- In the PIU group (n=478), 33.5% reported moderate to severe depression and 27.6% reported moderate to severe anxiety. The proportion of depression and anxiety was significantly higher in the MIU and PIU groups (Table 2). The prevalence of self-destructive behavior was 4.5% among adaptive users, 12.2% among maladaptive users and 22.2% among pathological users.

Table 2: Studies of depression and suicidal risk at IGD.

Study	Task/Method	Sample	Results
Liu, L. et al. (2018) [37]	This study has addressed the comorbidity between IGD and depression symptoms and underlying neural mechanisms. - a longitudinal survey study - a cross-sectional resting-state functional connectivity (rsFC) study - an intervention study.	Study 1 N-563 F-124 M-439 Study 2 N=76 IGDp N=41 HCs Study 3 N=63 IGDp N=44 (CBI+ group), 23 rsFC (fMR) N=19 (CBI − group), 16 rsFC (fMR)	- Autoregressive cross-lagged modeling on a longitudinal dataset of college students showed that IGD severity and depression are reciprocally predictive. At the neural level, individuals with IGD exhibited enhanced rsFC between the left amygdala and right DorsoLateral PreFrontal Cortex (DLPFC), inferior frontal and precentral gyrus, compared with control participants. - The amygdala-frontoparietal connectivity at the baseline negatively predicted reduction in depression symptoms following av psychotherapy intervention. - Further, following the intervention, individuals with IGD showed decreased connectivity between the left amygdala and left middle frontal and precentral gyrus, as compared with the non-intervention group.
Jeong, H. et al. (2019) [38]	The reciprocal relationship between level of depressive symptoms and IGD among children in a longitudinal study (12 months).	N=366 elementary-school students IGDp	- The cross-lagged analysis revealed that level of depression at baseline significantly predicted severity of IGD features at the 12-month follow- up (β=0.15,p=0.003). - Severity of IGD features at baseline also significantly predicted level of depression at the 12-month follow-up (β=0.11,p=0.018). - The cross-lagged path analysis indicates a reciprocal relationship between severity of IGD features and level of depressive symptoms.
Gentile, D. A. et al. (2011) [39]	A 2-year, longitudinal, panel study was performed with a general elementary and secondary school.	N=3034 children in grades 3 (N=743), 4 (N=711), 7 (N=916), 8 (N=664)	The prevalence IGD - 9% Greater amounts of gaming, lower social competence, and greater impulsivity seemed to act as risk factors for becoming pathological gamers, where as depression, anxiety, social phobias, and lower school performance seemed to act as outcomes of pathological gaming.
Kaess, M. et al. (2014) [40]	The main objective of this cross- sectional study was to investigate the association between PIU, psychopathology and self-destructive behaviours among school-based adolescents in eleven European countries. This cross-sectional study was implemented within the framework of the European Union project: Saving and Empowering Young Lives in Europe. Psychopathology was measured using - the Beck Depression Inventory-II, - Zung Self-Rating Anxiety Scale and - Strengths and Difficulties Questionnaire. - Self-destructive behaviours were evaluated by the Deliberate Self- Harm Inventory and Paykel Suicide Scale.	N=11,356 school-based adolescents (M/F: 4,856/6,500); mean age: 14.9	- In the AIU group (n=9,355), results showed that the prevalence of moderate to severe depression and anxiety was 5%, respectively. - In the MIU group (n=1,523), 17.1% were identified with moderate to severe depression and 16.4% with moderate to severe anxiety. - In the PIU group (n=478), 33.5% reported moderate to severe depression and 27.6% reported moderate to severe anxiety. The proportion of depression and anxiety was significantly higher in the MIU and PIU groups. - The prevalence of borderline and severe emotional symptoms was 10.8% for adaptive users, 23.7% for maladaptive users and 32% for pathological users. - The prevalence of SIB was 4.5% among adaptive users, 12.2% among maladaptive users and 22.2% among pathological users. - A similar pattern was observed for the prevalence of suicidal ideation (12.7,31.9, 42.3%) and suicide attempts (0.3,1.1,3.1%). - The strongest correlations within the psychopathological domain were observed between PIU and symptoms of depression (p<0.001) and anxiety (p<0.001). - In regards to self-destructive behaviours, SIB (p=0.014), suicidal ideation (p< 0.001) and suicide attempts (p=0.003) were significantly correlated with PIU.

Fischer, G. et al.(2012) [41]	The cross-sectional study students from the area of Heidelberg/Germany were recruited during the SEYLE study, a European school-based intervention study and completed an assessment of different questionnaires, including the Young Diagnostic Questionnaire for the assessment of risky and pathological internet use, the Beck Depression Inventory, the Deliberate Self Harm Inventory, and the Paykel Suicide Scale.	N=1435 students M=48% F=52% 80.7% of the students reported regular, 14.5% risky, and 4.8% pathological internet use.	The risky and the pathological internet users showed significant higher rates of depression, deliberate self-harm and suicidal behaviour compared to students with regular internet use. Remarkably, there were no significant differences of levels of depression and suicidal behaviour between risky and pathological users. These results suggest that not only pathologic internet use but also risky internet use is associated with symptoms of depression, self-harm and suicidal behaviour.
King, D. L. et al. (2013) [42]	Participants were assessed using the PTU checklist, Revised Children's Anxiety and Depression Scale, Social Anxiety Scale for Adolescents, revised UCLA Loneliness Scale, and Teenage Inventory of Social Skills. Adolescents who met the criteria for PVG or PIU or both were compared to normal adolescents in terms of axis I comorbidity.	N=1287 South Australian secondary school students aged 12-18 years	The prevalence rates of PIU and PVG were 6.4% and 1.8%, respectively. A subgroup with co-occurring PIU and PVG was identified (3.3%). The most distinguishing clinical features of PTU were withdrawal, tolerance, lies and secrecy, and conflict. Symptoms of preoccupation, inability to self-limit, and using technology as an escape were commonly reported by adolescents without PTU, and therefore may be less useful as clinical indicators. Depression, panic disorder, and separation anxiety were most prevalent among adolescents with PIU.
Ho, R. C. et al. (2014) [43]	Meta-analyses were conducted on cross-sectional, case–control and cohort studies which examined the relationship between IA and psychiatric co-morbidity.	8 studies N=1641 IA p N= 11210 HCs	Our analyses demonstrated a significant and positive association between IA and alcohol abuse (OR=3.05,95% CI=2.14-4.37,z=6.12,P<0.001), attention deficit and hyperactivity (OR = 2.85, 95% CI = 2.15-3.77, z = 7.27, P < 0.001), depression (OR=2.77,95% CI=2.04-3.75,z=6.55,P<0.001) and anxiety (OR =2.70, 95% CI=1.46-4.97,z=3.18,P=0.001).
Wartberg L, et al. (2019) [44]	In a cross-lagged panel design study, family dyads (FD-adolescent with a parent each) were examined in 2016 (t1) and again 1 year later (2017, t2). Overall, 1095 family dyads were assessed at t1 and 985 dyads were re-assessed at t2 with standardized measures of IGD and several aspects of adolescent and parental mental health. Data were analyzed with structural equation modeling (SEM).	N=1095 FD In 2016 N=985 FD in 2017	- Male gender, a higher level of hyperactivity/inattention, self-esteem problems and IGD at t1 were predictors of IGD at t2. - IGD at t1 was a predictor for adolescent emotional distress at t2. - Overall, 357 out of the 985 adolescents received a diagnosis of IGD at t1 or t2: 142 (14.4%) at t1 and t2, 100 (10.2%) only at t1, and 115 (11.7%) only at t2. Conclusions: Hyperactivity/inattention and self- esteem problems seem to be important for the development of IGD. We found first empirical evidence that IGD could prospectively contribute to a deterioration of adolescent mental health. Only a subgroup of affected adolescents showed IGD consistently over 1 year.
Lin P.C., et al. (2016) [45]	All participants received a diagnostic interview based on the Internet gaming disorder in the Fifth Edition of the Diagnostic Manual for Mental Disorders, and completed copies of questionnaire for depression, anxiety, and hostility. Results: We found that subjects with Internet gaming disorder in remission had signifi cant lower	N=85 IGDp N=85 IGDsr	We found that subjects with Internet gaming disorder in remission had signifi cant lower depression (20.64 ± 10.04 *vs.* 15.04 ± 9.10, p < 0.001), anxiety (53.81 ± 10.89 *vs.* 49.72 ± 11.27, p<0.05), and hostility (63.62 ± 13.24 *vs.* 55.00 ± 12.65,p <0.001) than those with Internet gaming disorder.
González-Bues, V. et al. (2018) [46]	The aim of this study is to review systematically the current literature in order to explore the association between Internet Gaming Disorder (IGD) and psychopathology.	24 articles. 21 cross-sectional and three prospective designs	The significant correlations reported comprised: 92% between IGD and anxiety, 89% with depression, 85% with symptoms of Attention Deficit Hyperactivity Disorder (ADHD), and 75% with social phobia/anxiety and obsessive- compulsive symptoms.
Park, S. et al. (2013) [47]	The Internet Addiction Proneness Scale for Youth-Short Form (KS- scale) was used to evaluate the presence and severity of problematic internet use. The frequencies of depression, suicidal ideation and probable bipolar disorder were compared between adolescents with and without internet addiction. The associations between the severity of problematic internet use and the severity of depressive symptoms, bipolar symptoms and suicidal ideation were also analyzed.	N=795 middle and high school students. (538 girls; mean age, 13.87 ± 1.51 years)	Seventy-five adolescents (9.4%) met the criteria for problematic internet use. - The presence of problematic internet use was significantly associated with suicidal ideation (OR=5.82,95% CI = 3.30-10.26,p<0.001) as well as depression (OR= 5.00,95% CI=2.88- 8.66,p< 0.001). - There was a marginally significant association between problematic internet use and probable bipolar disorder (OR=3.05,95% CI=0.96- 9.69,p=0.059). - In the path model, problematic internet use significantly predicted depressive symptoms (β=0.296,95% CI=0.214-0.367,p=0.005), which predicted suicidal ideation (β=0.699,95% CI=0.631-0.751,p=0.009). - Problematic internet use also predicted suicidal ideation directly (β=0.115,95% CI=0.052- 0.193,p=0.006). - Conversely, depressive symptoms (β=0.119,95% CI=-0.005-0.219,p=0.040) and suicidal ideation (β=0.215,95% CI=0.089-0.346,p=0.005) predicted problematic internet use.

Kim, K. et al. (2006) [48]	A questionnaire survey. The participants were high-school students living in a city who completed the self-reported measures of the Internet Addiction Scale, the Korean version of the Diagnostic Interview Schedule for Children- Major Depression Disorder-Simple Questionnaire, and the Suicidal Ideation Questionnaire-Junior. A correlational survey design was employed.	N=1573	A correlational survey design was employed. Among the samples, 1.6% was diagnosed as Internet addicts, while 38.0% was classified as possible Internet addicts. The prevalence of Internet addiction did not vary with gender. The levels of depression and suicide ideation were highest in the Internet-addicts group.
Lin I. H, et al. (2014) [49]	A questionnaire survey. - The five questions from the Kiddie Schedule for Affective Disorders and Schizophrenia were used to inquire as to the participants' suicidal ideation and attempt in the past one month. - The Chen Internet Addiction Scale was used to assess participants' Internet addiction. - The kinds of Internet activities thatthe adolescents participated in were also recorded.	N=9510 adolescent students aged 12-18 years	- Internet addiction was significantly associated with suicidal ideation and suicidal attempt. - Online gaming, MSN, online searching for information, and online studying were associated with an increased risk of suicidal ideation. - While online gaming, chatting, watching movies, shopping, and gambling were associated with an increased risk of suicidal attempt, watching online news was associated with a reduced risk of suicidal attempt.
Akin, A., and İskender, M. (2011) [50]	Participants were university students who were enrolled in mid-size state University, in Turkey. In this study, the Online Cognition Scale and the Depression Anxiety Stress Scale were used.	N=300	In correlation analysis, internet addiction was found positively related to depression, anxiety, and stress. According to path analysis results, depression, anxiety, and stress were predicted positively by internet addiction. This research shows that internet addiction has a direct impact on depression, anxiety, and stress.

Abbreviations: PTU: Pathological Technology Use; PVG: Pathological Video Gaming; PIU: Pathological Internet Use; FD: Family Dyads; AIU: Adaptive Internet Use; MIU: Maladaptive Internet Use

A similar pattern was observed for the prevalence of suicidal ideation (12.7,31.9,42.3%) and suicide attempts (0.3,1.1,3.1%) (Table 2).

These results indicate that the prevalence of self-destructive behavior was almost three times higher among maladaptive users and almost five times higher among pathological users compared to adaptive users. The proportion of suicidal ideas was two and a half times higher among maladaptive users and three times higher among pathological users compared to adaptive users, while suicide attempts were almost four times higher among maladaptive users and ten times higher among pathological users compared to adaptive users [40,41]. The severity of the accompanying psychopathology increases several times as the symptoms of addiction itself become more severe.

Clinical syndromes contribute the most to the development of depression and suicidal behavior

First of all, it is the severity of the addiction itself. First of all, it is the severity of the addiction itself. It develops an irresistible urge to gamble in spite of losses and negative consequences. The mesocorticolimbic reward system is retrained so that a chase for losses develops, an escalation of gambling behavior in response to losses. The game or social networking activity itself becomes a significant need.

Altered state of consciousness: From the clinical observations, thanks to the self-reports of the players themselves, it is well known that during the game, as the addiction progresses, a person enters an altered state of consciousness like a trance or hypnosis. In the scientific literature, the term flow state, flow experience, or dark flow of a dark stream occurs, but the definitions of game trance or hypnosis better characterize these states.

Detachment from problems, the disappearance of the entire surrounding world, complete absorption in the game process with GD computer game with IGD which become the only reality for the person. Change of self-identification up to merging with a slot machine, game avatar or a network image. Increases the sharpness of perception of sounds and color effects in the game. And in the case of a computer game, the sharpness of perception of the game world to the point that the player ceases to perceive the flaws and imperfections of computer graphics. For its narrowed perception, the game space becomes a full-fledged three-dimensional reality, the same as the real world. By the way, the design of online games and gambling in online casinos very much contributes to this immersion, so its realism is very seriously worked on [51-61].

Tachyronia develops - a change in the perception of time. A person feels that he has spent much less time in the game or on the social network than in reality. Memory of some events and circumstances in the game is violated. For example, only wins or almost wins are remembered, which, as has already been proven, motivates to continue playing, and losses are forgotten or minimized. As a result, a person does not remember how much he lost, and how much he won, as well as where, when and how much he borrowed. Memory is also erased for behavior in the game especially for episodes of aggressive behavior toward family members when they tried to interfere or stop participation in the game or communication in the social network. Dark flow state itself with the effect of detachment from life's problems and from negative emotional experiences about them, with the subsequent stimulating and euphoric effect (or immersive pleasure) can be very desirable for the addicted person and increase the attraction to the game and therefore the development of addiction. After returning from this illusionally free state, problems return, new debts and difficulties are added, and with them depression [10,51-54,60].

Neurobiological studies confirm that dependent Internet gamers exhibit increased activation in brain regions such as the angular gyrus, inferior frontal gyrus, precuneus, and in the medial prefrontal cortex, during avatar reflection compared to self-reflection. For reference, these brain regions are associated with the processing of identification, empathy, and the process of self-determination in healthy subjects. In research there was a decrease in bilateral brain activation in the AG

and the middle occipital gyrus during self-perception and hyperactivity of the left angular gyrus during perception of avatar movement in the game and correlation with the severity of symptoms. Based on this, it was concluded that the stronger the player's identification with the avatar, the heavier the dependence [55-61].

Twelve internet-addicted adolescents and fifteen adolescents without addiction reported whether short phrases described themselves, a wellknown historical person, or their own game character while undergoing a functional magnetic resonance imaging. Different patterns of activity emerged for adolescents with internet game addiction compared to healthy adolescents when they were thinking about themselves, another person, and their game characters. Specifically, when addicted adolescents were thinking about their own game characters, more global and significant medial prefrontal and anterior cingulate activations were observed, than even when compared to thinking about themselves. The ACC activation was correlated with the symptom severity. The activation patterns demonstrated that addicted adolescents were most attached to their game characters and equated their game characters to human [61]. Changes in the emotional areas of the brain (in the right putamen and caudate as well as in the inferior and middle frontal gyrus) of pathological users of social networks during the actualization of the network image indicate a greater attachment to it and social reactions to this image than to the real self.

Emotional dysregulation and stress in GD and IGD

Many people, both children, teenagers, and adults, begin to get involved in gambling or internet video games in order to relax, disconnect from problems, or from hard work and thus improve their emotional state as the players say themselves: “Remove stress”. Of course, they do not go away from the problems into the game, but switch their attention from thoughts about problems and emotional experiences about these mental assessments and conclusions about life circumstances. All their problems are made largely by the work of the mind, nothing else. But instead of looking for solutions, changing themselves, changing the situation, as we say, growing up, developing, taking responsibility, making efforts, a person is immersed in virtual reality or the world of gambling. From one illusion with negative images, thoughts, and emotions created in one's own mind, a person goes to another, created by information technology [62,63]. The primary psychotropic effect of this switch, associated with detachment from negative thoughts, disappears quite quickly. The game itself is an emotional stress. Participation in the game is accompanied by strong excitement, like the action of stimulants, contrasting emotions that resemble swings or swings of a pendulum: from extreme euphoria to all sorts of negative emotions. A constant game at the level of problematic and pathologic is a distress that is caused not only by events in the games, but also by their negative consequences. The arousal phase is followed by an exhaustion phase with asthenic emotions, depression, lack of desire and strength to do anything, and cognitive dysfunction. All this we observe in patients with IGD and GD [64,65]. Indicators of experienced distress are functional and structural changes in the brain, vegetative shifts, changes in the secretion of hormones of the hypatoadrenal system and neurotransmitters: cortisol, norepinephrine, and epinephrine.

Morphometric and functional neurobiological studies

On patients with IGD determine the dysfunction of the right dorso-medial prefrontal cortex, the bilateral insular lobe and the orbitofrontal cortex, the right amygdala, and the left fusiform sulcus. These areas of the brain are associated with emotional regulation, inhibitory control in relation to undesirable behavior. Previous morphometric studies have shown that IGD is associated with structural abnormalities in gray matter, such as decreased gray matter volume in the frontal, cingulate, insular, parietal cortex, and amygdala. In the same zones, a decrease in the volume of gray matter is found in post-traumatic stress syndrome as a result of severe chronic distress and depression. A decrease in the volume of gray matter in these areas of the brain is observed due to the debilitating effect on the Central nervous system of chronic distress [37,66-68].

In patients with GD, there was a decrease in the content of gray matter in similar areas of the brain according to the results of morphometric studies. In structural MRI studies, a significant decrease was found in the orbitofrontal cortex, in the anterior cingulate cortex, in the amygdala and hippocampus [69-72]. A decrease in white matter density in studies using diffusion-tensor imaging was observed in corticolimbic tracts [73,74]. All these structural changes in the brain are associated with emotional dysregulation and appear in part as a result of constant severe emotional distress during gambling.

The fact that gamblers and Internet gamers experience stress during the game, problem and pathological players experience emotional distress can be confirmed by the results of studies of the sympathoadrenal system and the Hypothalamic-Pituitary-adrenal Axis (HPA-axis). There is a high activation of the sympathoadrenergic system and the HPA axis, both in GD and IGD during the game, before and after the game. Increased levels of cortisol, norepinephrine and epinephrine, both during gaming sessions and the day before in anticipation of the game. Also, cortisol levels increased, both during the game, and for a long time with a problem game. This increase was similar to an increase in cortisol levels in people who were exposed to acute stress factors [75-80].

DISCUSSION

A review of studies has revealed that individuals (children, adolescents, and adults) with gambling disorder and internet gaming disorder are often diagnosed with depression and suicidal behavior. Depression is the most common comorbid psychopathology in this in this group of patients along with anxiety disorder and other addictions. According to the results of cross-sectional studies, depression was diagnosed in 23.1-41.3% of patients with GD [36]. Patients with GD, there are a high suicide risk in 25.6%-49.2%,6.9%-30.2% commit suicide attempts [26-30,32-35]. Suicide is the main cause of death (31%) in this category of patients. Overall, suicide deaths are 15.1 times higher among those with a gambling disorder in the age range 20-74 and 19.3 times higher in the age range 20-49 than in the general population [24].

The conducted meta-analysis and reviews of internet addiction studies, which included IGD, reveal a high degree of correlation with depression in 75%-89% of studies [46]. A large-scale nationwide cross-sectional study of 11,356 school-based adolescent students in eleven European countries found depression in 17.1% of problem users and 33.5% of pathological gamers and social media users. Self-destructive behavior was observed in 12.2% of problem gamers and Internet users and in 22.2% of pathological ones. A similar pattern was observed in the percentages of healthy controls/problematic/pathological gamers or social media users regarding the prevalence of suicidal thoughts (12.7%,31.9%,42.3%) and suicide attempts (0.3%,1.1%,3.1%) [40,41]. These results demonstrate that the prevalence of comorbid psychopathology, in this case depression, and suicide risk increase several times as the symptoms of addiction themselves become more severe.

Patients with IGD and GD experience altered states of consciousness (flow or dark flow state) with changes in players' self-identification up to merging with an avatar, slot-machine, game or network image, as proved by various neurobiological studies [51-61]. This most important clinical phenomenon, contributes to the development of depression, suicidal behavior and addiction. Unfortunately, the phenomenon of Altered State of Consciousness (ASC) is still very poorly investigated.

A constant game at the level of problematic and pathologic is a distress that is caused not only by events in the games, but also by their negative consequences. Morphometric and functional neurobiological studies on patients with IGD and GD determine the dysfunction in areas of the brain is associated with emotional regulation, inhibitory control in relation to undesirable behavior. Previous morphometric studies have shown that IGD and GD is associated with structural abnormalities in gray matter, such as decreased gray matter volume in the orbitofrontal, cingulate, insular, parietal cortex, and amygdala. In the same zones, a decrease in the volume of gray matter is found in post-traumatic stress syndrome as a result of severe chronic distress and depression. A decrease in the volume of gray matter in these areas of the brain is observed due to the debilitating effect on the Central nervous system of chronic distress [66-72].

The fact that gamblers and internet gamers experience stress during the game, problem and pathological players experience emotional distress can be confirmed by the results of studies of the sympathoadrenal system and the Hypothalamic-Pituitary-Adrenal axis (HPA-axis) [73 - 80].

A limitation of this review is the lack of longitudinal studies that would help establish the temporal sequence and mutual influence between the progression of depression, suicidal behavior, and severity of addiction. There is also a great lack of research on emotional distress and altered states of consciousness with changes in self-identification in GD and IGD. In the future, extensive, comprehensive research in these areas is recommended.

CONCLUSION

The analysis of clinical and neurobiological studies, as well as their own clinical cases, reveals that emotional dysregulation, constant emotional distress, experienced altered states of consciousness with a violation of self-identification during the game as well as increasing negative social consequences, are predisposing risk factors for the development of depression in these behavioral dependencies. As for the time sequence, few longitudinal studies have found a bi-directional relationship between depression and the severity of addiction symptoms. Based on all the results obtained, we can conclude that dependent players can become both initially mentally healthy people, and those who have already experienced subclinical and clinical manifestations of depression. In the first case, the depression was added in the process of aggravating the symptoms of addiction, and in the second, the depressive symptoms increased and worsened. But when healthy life activity was restored, the severity of symptoms of depression also decreased. This study also shows that information game technologies are the main risk factor for the development of both addiction and comorbid psychopathology, such as depression up to suicidal behavior.

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