

ORIGINAL ARTICLE

The Prevalence and Psychosocial Correlates of Internet Gaming Disorder

Analysis in a Nationally Representative Sample of 12- to 25-Year-Olds

Lutz Wartberg, Levente Kriston, Rainer Thomasius

SUMMARY

Background: Internet gaming disorder (IGD) is the problematic use of computer games (whether online or offline). Its prevalence throughout Germany among children, adolescents, and young adults has not yet been estimated.

Methods: A representative sample of 1531 12- to 25-year-olds in Germany was studied in September 2016 with a standardized instrument (Internet Gaming Disorder Scale, IGDS). Sociodemographic and psychosocial data about the participants were also obtained. Prevalence estimates and binary logistic regressions were calculated (both with and without multiple imputations in the IGDS).

Results: The estimated prevalence of IGD among 12- to 25-year-olds in Germany is 5.7% (95% confidence interval: [4.5; 6.9]). In a sensitivity analysis taking multiple imputations into account, this value rose to 7.0% [5.8; 8.5]. The estimated prevalence was higher in males than in females: 8.4% [6.4; 10.4] versus 2.9% [1.7; 4.1], $p < 0.001$. Statistically significant associations with IGD were seen for male sex, lower age, higher depressiveness, higher anxiety, and more frequent neglect of social contacts due to computer games.

Conclusion: In view of the IGD prevalence estimates obtained in this study, further research on this disorder, its correlates, and its etiology is warranted, particularly longitudinal studies. Young persons with the psychosocial features mentioned above should be specifically asked about their use of computer games.

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Internet gaming disorder (IGD) has been included as a new research diagnosis in Section III of the current version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (1, 2). IGD refers to problematic use of computer games (both online and offline). A diagnosis of IGD is based on a total of nine criteria derived from those for the diagnosis of gambling disorder and substance use disorder (*Table 1*) (3). According to the DSM-5 standards, IGD can be diagnosed if at least five of these nine criteria were met in the past 12 months (1). In initial studies on IGD, the value of a cut-off of at least five criteria was also proven empirically (4, 5).

Although comprehensive models for IGD development are still missing, initial theoretical approaches have been proposed. For example, Kiraly et al. (6) highlight the interplay of three key factors in IGD development:

- Structural aspects of computer games
- Psychological characteristics of the player
- Motivational aspects of computer game playing.

A more generalized model for various, specifically Internet-related disorders, among which IGD could be classified, was recently reported by Brand et al. (7) and should be empirically verified in the future. Cross-sectional studies have provided first indications for IGD being associated with an increased psychopathological burden (8) and being male (9).

In 2015, only two studies worldwide had reported prevalence estimates of IGD based on representative samples collected using suitable (e.g., DSM-5–based) instruments, according to Petry et al. (3). Thus, Rehbein et al. (10) reported a prevalence estimate for IGD of 1.2% (95% confidence interval: [1.0; 1.4] from a large sample of ninth-graders (representative of Lower Saxony, Germany; age range 13 to 18 years; surveyed in the spring of 2013). Lemmens et al. (5) examined a sample of adolescents and adults (age range 13 to 40 years) representative of the Netherlands in June 2013. They obtained a prevalence estimate of 3.8% after latent class analysis and of 5.4% based on the (DSM-5) cut-off value (5). In 2016, Pontes et al. (11) reported a prevalence estimate of 2.5% ([1.7; 3.7]) for a representative sample of eighth-graders in Slovenia (age range 12 to 16 years; surveyed in April and May 2015). Finally, in 2016, Yu and Cho (9) reported a

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THE CLINICAL PERSPECTIVE

Currently, ICD-10 does not include a diagnosis of dependence (or “harmful use”) for computer gaming. Alternatively, the diagnostic criteria for Internet gaming disorder from the DSM-5 can be used to classify such a behavioral problem. The criteria mentioned therein (mental preoccupation, withdrawal symptoms, development of tolerance, loss of control, loss of interest in other activities, continuation despite psychosocial consequences, deception of others, dysfunctional coping, and risks or losses) must be examined separately for their occurrence in the last 12 months. A diagnosis of Internet gaming disorder requires at least 5 of the above 9 criteria to be met specifically for computer gaming, and that this has led to a clinically significant impairment or suffering.

The main characteristic of the Internet gaming disorder is, according to DSM-5, persistent and repetitive game playing, which due to its excessive and severe occurrence leads to neglecting other activities. A typical example is (temporarily) not eating or sleeping to deal with the current tasks or missions of a computer game. Frequently, school or work commitments are neglected in favor of more intensive gaming. This often leads to increased tension or conflict in the family setting or with interpersonal relationships in general.

At the moment, for the new DSM-5 research diagnosis *Internet gaming disorder*, treatment studies of good methodological quality are still lacking, such that current evidence-based therapy recommendations can not yet be made. In the case of Internet addiction, on the other hand, there are already first empirical indications for the efficacy of cognitive behavioral therapeutic approaches. Therapeutic interventions for those affected with Internet gaming disorder should take place in specialized counseling and treatment facilities for Internet-based addiction, which now exist in all German states.

prevalence estimate of 5.9% for a national South Korean sample of students (age range 13 to 15 years).

In the present study, we investigated the following two questions:

- How high is the prevalence of IGD in the age group 12- to 25-year-olds in Germany?
- Which sociodemographic, psychopathological, and social aspects are associated with IGD?

Methods

Data collection

The scientific concept of the study, the development of the questionnaire used, and the evaluation and preparation of the collected data was done exclusively by the authors at the University Medical Center Hamburg-Eppendorf (UKE). Data were collected by a market and opinion research institute (Forsa), which is a member of the Bundesverband Deutscher Markt- und Sozialforscher (Association of German Market and Social Researchers) and the Arbeitskreis Deutscher Markt- und Sozialforschungsinstitute (ADM; Working Group of German Market and Social Research Institutes).

Data were collected via the Internet using a standardized (online) questionnaire. The market research institute involved, Forsa, has an extensive pool of addresses of potential participants for online surveys. All participants (who were from this address pool) were recruited in a multi-stage random procedure and exclusively by telephone (offline, with the ADM sampling scheme). This recruitment procedure allowed some arguments against online surveys (e.g., of self-selection—especially when recruiting participants exclusively on the Internet, lack of representativity of the sample, general exclusion of persons who can not be recruited online) to be demonstrably invalidated or to be better controlled for sources of possible distortion. An important aspect of representativeness is the

extremely high widespread Internet use among adolescents and young adults in Germany: Internet is used by 100% of the 14- to 19-year-old respondents, and by 98.4% of the 20- to 29-year-old respondents (12). The average daily duration of Internet use is 245 minutes for the 14- to 29-year-olds (12). Thus, for this age group, the arguments that online surveys will favor people with a strong Internet affinity, or exclude people who do not use the Internet, are therefore significantly less important.

In order to collect data, randomly selected persons within the online survey address pool were contacted by mail and invited to participate in the survey (taking age requirements into account). Data were collected in September 2016 by the investigators. After data collection was completed, samples were weighted for sex, age, education, and region, based on the results of the Microcensus 2014 (representative household survey of the Federal Statistical Office of Germany), to obtain a representative selection for the 12- to 25-year-olds in Germany. Respondents were given a (small) incentive for participation, which could be exchanged for vouchers at the market research institute Forsa or, alternatively, be converted into a donation for a charity organization.

Research methods

To determine the degree of severity of IGD in the last 12 months, the Internet Gaming Disorder Scale (IGDS) was used (5). The IGDS comprises a total of 9 items (*eTable 1*) with a binary response format (0 = no, 1 = yes). Responses to the IGDS were summed, and a positive score for IGD was determined by having 5 or more of the 9 IGDS questions answered with yes, as recommended by Lemmens et al. (5). Thus, IGD determination was based on self-assessment in a questionnaire rather than on a diagnosis from a standardized

TABLE 1

Diagnostic criteria of the Internet gaming disorder (DSM-5, 2015)*

| | |
|-------------|---|
| Criterion 1 | Excessive preoccupation (e. g., mental preoccupation with playing computer games) |
| Criterion 2 | Withdrawal symptom (e. g., irritability, anxiety, or sadness) when not playing |
| Criterion 3 | Development of tolerance (e. g. need for increasingly longer periods of play) |
| Criterion 4 | Unsuccessful attempts to control playing |
| Criterion 5 | Loss of interest in previous hobbies and leisure activities (as a result of playing) |
| Criterion 6 | Continuation of excessive playing, despite insight into the psychosocial consequences |
| Criterion 7 | Deceiving family members, therapists, and others regarding the scope of playing |
| Criterion 8 | Use of games to escape or weaken a negative mood (e. g., feelings of helplessness, guilt, or anxiety) |
| Criterion 9 | Risks or loses an important relationship, job, or training/career opportunity because of playing |

* For diagnostic purposes, at least 5 of 9 criteria must have been fulfilled in the last 12 months

structured clinical interview. However, this approach is generally the rule rather than the exception for epidemiological studies, due to the high case number of respondents (for an IGD example, see [10]).

The severity of depressive symptoms was determined with the Patient Health Questionnaire-2 (PHQ-2) (13). The PHQ-2 consists of two items (*eTable 1*) that are used to query the frequency of depressive symptoms in the last two weeks (with a four-step response format: 0 = not at all; 1 = several days; 2 = more than half the days; 3 = nearly every day). A higher score indicates higher depressiveness.

The Generalized Anxiety Disorder Scale-2 (GAD-2) was used to determine whether anxiety symptoms had been present in the previous two weeks (14). GAD-2 also consists of two items with a four-step response format (0 = not at all; 1 = several days; 2 = more than half of the days; 3 = nearly every day) (*eTable 1*). A higher sum score indicates more intense anxiety.

Additionally, a single question (*eTable 1*) recorded the subjectively perceived frequency of neglect of social contacts with persons who were previously important for the respondent (for example, friends or family members) due to gaming (five-step response format: 0 = never; 1 = rarely; 2 = sometimes; 3 = frequently; 4 = very often). Sociodemographic data (sex, age, and education level) were also collected.

Data analysis

To estimate prevalence, relative frequencies were calculated with 95% confidence intervals, both for the total sample and after stratification by sex. The weight variables were adjusted for each subgroup. A total of 152 people (9.9% of the total sample) reported that they did not play computer games. For these 152 cases, no IGDS questions were asked, and all IGDS items were set to 0. Group comparisons were made with chi-square tests and Student's *t*-tests for independent samples. The relationship of IGD with sex, age, school status, depression, anxiety, and neglect of social contacts due to gaming was analyzed using logistic regression

(IGD-based negative versus positive). The primary analysis (conservative prevalence estimation) was made after all missing values in the IGDS items were estimated conservatively (that is, set to 0 in each case). A second evaluation was carried out as a sensitivity analysis after all missing values were replaced only for the IGDS (361 of a total of 13 379 given data, or 2.6%) and only for people who played computer games, using multiple imputation (MI) (20 imputations). To predict the missing IGDS values, the following parameters were used for MI:

- All existing values from the IGDS
- Characteristics of age, sex, and educational status
- The sum values of the PHQ-2, the GAD-2, and of three other questions on social support
- Time spent gaming, and the number of days played (each week).

To estimate the prevalence after MI, a logit transformation of the results was performed and, after the aggregation of the imputed results, a back-transformation was conducted. All calculations were performed using the analysis software SPSS version 22.0 (IBM Inc., Armonk, NY, USA).

Results

The representative sample of the present study comprised a total of 1531 persons (2893 persons were invited to participate, and 52.9% participated). A description of the sample with regard to sociodemography can be found in *Table 2*.

A positive finding for IGD (total value of IGDS ≥ 5) was found for 88 of the 1531 study participants. This gives a prevalence estimate for IGD in the age group of 12- to 25-year-olds in Germany of 5.7% [4.5; 6.9]. For males (8.4% [6.4, 10.4]), a statistically significantly higher prevalence estimate (chi-square test = 20.81, *df* = 1, *p* < 0.001) was observed than for females (2.9% [1.7, 4.1]). Persons with IGD (*M* = 15.58 years, *SD* = 3.65) were significantly younger than respondents without IGD (*M* = 19.06 years, *SD* = 4.00, *t* = -8.61, *df* = 100.02, *p* < 0.001). In the sensitivity

TABLE 2

Sociodemographic description of the total sample examined (N = 1531)

| | |
|--|--------------------|
| Female sex | 48.6% |
| Male sex | 51.4% |
| Age* ¹ | 18.86 (4.06) years |
| Student* ² | 43.9% |
| No secondary school qualification* ³ | 0.5% |
| Completed general secondary school (Hauptschule)* ³ | 11.9% |
| Completed intermediate secondary school (Realschule)* ³ | 18.0% |
| Qualification for entering technical college or university* ³ | 18.8% |
| Obtained degree from a technical college or university* ³ | 6.6% |

*¹Average (standard deviation); *²Currently a student; *³Completed school education

analysis (after MI), a prevalence estimate of 7.0% [5.8; 8.5] was calculated.

IGD was associated with being male and with lower age. However, if only one additional characteristic was included in these sex- and age-adjusted models, statistically significant associations were observed between IGD and higher levels of depression, higher anxiety, and more frequent neglect of social contacts due to gaming (Table 3). The question about whether or not the person was still attending school was irrelevant. However, if all characteristics were analyzed in one model, only the relationships between IGD and being male, lower age, and a more frequent neglect of social contacts could be observed (Nagelkerke’s $R^2 = 0.34$) (Table 3). Regarding the associated factors, the results of the sensitivity analysis strongly matched the findings from the primary analysis (eTable 2).

Discussion

In this study, the 12-month prevalence for the new DSM-5 diagnosis Internet gaming disorder (IGD) was determined for the first time in a random sample of 12- to 25-year-olds representative of Germany. There was a prevalence estimate for IGD of 5.7% (with a maximum conservative estimate of missing values) and 7.0% (based on multiple imputations of missing values). The results of the conservative estimation give approximately comparable percentages as the prevalence estimate of 5.4% reported by Lemmens et al. (5) for a representative Dutch sample of adolescents and adults, aged 13 to 40 (based on a cut-off value of ≥ 5) and as the prevalence of 5.9% reported by Yu and Cho (9) for South Korean students.

Both of our prevalence estimates were significantly higher than the IGD findings of Rehbein et al. (10) for Lower Saxony students and of Pontes et al. (11) for Slovenian students. Likewise, they are also higher than the value (2.4%) published in 2011 for Internet addiction among 14- to 24-year-olds in Germany (15). These differences in the findings could be explained by

differences in the analyzed age groups, geographical regions, and/or time of data collection, or by the instruments used. In this study, we used the IGDS as described in Lemmens et al. (5), which had also been matched with the Dutch original version to ensure the most exact fit possible. In contrast, different questionnaires were used in the other three studies (9–11). Our reported findings on associated traits, such as being male, lower age, higher levels of depression, higher anxiety, and more frequent neglect of social contacts due to playing computer games, are very compatible with published findings on IGD (8, 9).

Limitations

The present study has several limitations. The IGD criteria were acquired using a self-assessment questionnaire, rather than by a standardized structured clinical interview (16), which would have allowed a more accurate assessment of the DSM-5 diagnostic criteria. This methodological restriction affects the investigated psychopathological aspects (depression and anxiety) in the same way. However, the use of questionnaires is very widespread in epidemiological studies from an economic point of view, and questionnaires have also been used in the other prevalence studies to record IGD (5, 9–11).

The investigated correlates reported in this study are certain to cover only some of the relevant factors. For example, relationships between IGD and self-esteem problems have frequently been published (such as [17]), whereas our study only considered the psychopathological associations with depression and anxiety for the participants.

As is often the case with population surveys, it was difficult in this study to recruit sufficient numbers of people who had left school without any qualifications. We cannot rule out that having a slightly higher proportion of this subgroup in our sample (which we would have welcomed) would have altered the results. On the other hand, the question pertaining to the highest level of education might have been answered by the participants with a bias of “social desirability”.

In contrast to the DSM-5, there is currently no comparable diagnosis for IGD in ICD-10 (18). However, the ICD-11 beta draft currently contains the diagnosis of a “gaming disorder” (19), suggesting that the two classification systems of the American Psychiatric Association and the World Health Organization may become more similar with respect to this behavior pattern in the future. In general, the chosen design of a population-representative cross-sectional study is well suited for estimating prevalence (20). However, no causal or therapeutic interrelationship can be drawn, for example, between IGD and the correlates.

Conclusion

Despite the above mentioned limitations, this study has provided remarkable new findings on the prevalence of IGD among 12- to 25-year-olds in Germany, as well as on the multifactorial psychosocial correlates, which are

TABLE 3

Primary analysis (data set without multiple imputation)*¹

| Variable | Logistic regression model, Internet gaming disorder, adjusted odds ratios [95% CI] | | | | |
|--|--|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Sex* ² | 0.32 ^(***) [0.19; 0.53] | 0.27 ^(***) [0.16; 0.46] | 0.26 ^(***) [0.15; 0.44] | 0.48 ^(*) [0.28; 0.84] | 0.40 ^(***) [0.21; 0.74] |
| Age* ³ | 0.83 ^(**) [0.75; 0.93] | 0.77 ^(***) [0.71; 0.82] | 0.76 ^(***) [0.71; 0.82] | 0.82 ^(***) [0.76; 0.88] | 0.84 ^(**) [0.74; 0.95] |
| Student status* ⁴ | 1.80 [0.76; 4.29] | – | – | – | 1.56 [0.55; 4.48] |
| Depressiveness* ⁵ | – | 1.39 ^(***) [1.17; 1.66] | – | – | 1.12 [0.87; 1.44] |
| Anxiety* ⁶ | – | – | 1.47 ^(***) [1.25; 1.73] | – | 1.17 [0.91; 1.49] |
| Neglect of social contacts* ⁷ | – | – | – | 3.86 ^(***) [2.94; 5.07] | 3.49 ^(***) [2.62; 4.65] |
| Nagelkerke's R ² | 0.16 | 0.17 | 0.18 | 0.34 | 0.34 |

*¹ Categorical relationships between psychosocial aspects and Internet gaming disorder in a representative German sample of 12- to 25-year-olds. All connections were first analyzed separately (only adjusted for age and sex) and then analyzed in a common model;

*² Sex coding: 0 = male, 1 = female; *³ Unit: per year (range: 12 to 25); *⁴ Current educational status; coding: 0 = not a student, 1 = student; *⁵ Unit: per scale point in PHQ-2 (range: 0 to 6);

*⁶ Unit: per scale point in GAD-2 (range: 0 to 6); *⁷ Unit: per point in the question (range: 0 to 4).

Significance level of p-values: *p <0.05; **p <0.01; ***p <0.001

CI, confidence interval

highly relevant for both health policies and healthcare. In view of the high prevalence estimates in this age group, further evidence-based research on IGD, its correlates, and its etiology—for example, its biopsychosocial risk factors, or as a potential behavioral addiction—should be especially addressed in longitudinal studies.

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Conflict of interest statement

The authors declare that no conflict of interest exists.

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KEY MESSAGES

- Internet gaming disorder has been included in the current version of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) as a new research diagnosis.
- Internet gaming disorder refers to the problematic use of computer games (both online and offline).
- A prevalence estimate for Internet gaming disorder in the age group of 12- to 25-year-olds in Germany was 5.7% in the primary analysis, with an increase to 7.0% after sensitivity analysis (with multiple imputations of missing values).
- A significantly higher prevalence estimate of Internet gaming disorder was found for males (8.4%) compared to females (2.9%).
- Statistically significant relationships were observed between Internet gaming disorder and being male, lower age, higher levels of depression, higher anxiety, and more frequent neglect of social contacts due to computer gaming.

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Supplementary material:

eTables:
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Supplementary material to:

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eTABLE 1

Questions from the diagnostic tool used

| | |
|----------------------------|--|
| IGDS Item 1 | During the last year, have there been hour-long periods when all you can think of is the next time you can play a game? |
| IGDS Item 2 | During the last year, have you felt unsatisfied because you wanted to play more? |
| IGDS Item 3 | During the last year, have you felt unhappy because you were unable to play a game? |
| IGDS Item 4 | During the last year, were you unable to reduce your playing time even though others had told you that you had to? |
| IGDS Item 5 | During the last year, have you played games so that you would not have to think about unpleasant things? |
| IGDS Item 6 | During the last year, have you had arguments with others about your gaming behavior? |
| IGDS Item 7 | During the last year, have you kept the time you spent on game playing secret from others? |
| IGDS Item 8 | During the last year, have you had no interest in hobbies or other activities because gaming is all you wanted to do? |
| IGDS Item 9 | During the last year, have you had serious problems with family, friends or a partner because of gaming? |
| PHQ-2 Item 1 | Over the last 2 weeks, how often have you been bothered by any of the following problems? Little interest or pleasure in doing things |
| PHQ-2 Item 2 | Over the last 2 weeks, how often have you been bothered by any of the following problems? Feeling down, depressed, or hopeless |
| GAD-2 Item 1 | Over the last 2 weeks, how often have you been bothered by any of the following problems? Feeling nervous, anxious, or on edge |
| GAD-2 Item 2 | Over the last 2 weeks, how often have you been bothered by any of the following problems? Not being able to stop or control worrying |
| Neglecting social contacts | How often do you neglect social contacts (e.g., friends or family members), who used to be important to you, because of computer game playing? |

eTABLE 2

Sensitivity analysis (data set with imputed values in the IGDS)*

| Variable | Logistic regression model, Internet gaming disorder, adjusted odds ratios [95% CI] | | | | |
|--|--|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Sex ^{*2} | 10.27 ^(***) [0.17; 0.44] | 0.23 ^(***) [0.14; 0.39] | 0.22 ^(***) [0.13; 0.37] | 0.40 ^(**) [0.23; 0.68] | 0.33 ^(***) [0.18; 0.62] |
| Age ^{*3} | 0.83 ^(***) [0.75; 0.92] | 0.76 ^(***) [0.71; 0.82] | 0.76 ^(***) [0.71; 0.81] | 0.81 ^(***) [0.76; 0.87] | 0.85 ^(**) [0.75; 0.96] |
| Student ^{**4} | 1.98 [0.88; 4.47] | – | – | – | 1.84 [0.67; 5.03] |
| Depressiveness ^{*5} | – | 1.41 ^(***) [1.20; 1.66] | – | – | 1.15 [0.90; 1.47] |
| Anxiety ^{*6} | – | – | 1.50 ^(***) [1.28; 1.76] | – | 1.19 [0.93; 1.51] |
| Neglect of social contacts ^{*7} | – | – | – | 3.91 ^(***) [3.00; 5.09] | 3.48 ^(***) [2.64; 4.60] |
| Nagelkerke's R ² | 0.19 ^{*8} | 0.20 ^{*8} | 0.21 ^{*8} | 0.37 ^{*8} | 0.36 ^{*8} |

*1 Categorical relationships between psychosocial aspects and Internet gaming disorder in a representative German sample of 12- to 25-year-olds. All connections were first analyzed separately (only adjusted for age and gender) and then analyzed in a common model;

*2 Sex coding: 0 = male, 1 = female; *3 Unit: per year (range: 12 to 25); *4 Current educational status; coding: 0 = not a student, 1 = student; *5 Unit: per scale point in PHQ-2 (range: 0 to 6);

*6 Unit: per scale point in GAD-2 (range: 0 to 6); *7 Unit: per point in the question (range: 0 to 4); *8 Median after 20 imputations;

Significance level of p-values: *p <0.05; **p <0.01; ***p <0.001

CI, Confidence interval