Association of Increased Impulsiveness and Internet Use Disorder in Adolescents and Young Adults with Different Main Activities on the Internet

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Abstract: *Objective:* Increased impulsiveness is a risk factor for health-endangering behavior patterns. Little is known about whether increased impulsiveness is associated with Internet Use Disorder (IUD) and whether individuals with various main activities on the internet differ in their levels of impulsiveness. *Methods:* In total, we screened 8,230 vocational students for problematic internet use with the Compulsive Internet Use Scale (CIUS). Participants scoring at least 21 points in the CIUS took part in an in-depth diagnostic interview. IUD was assessed according to the criteria of Internet Gaming Disorder (IGD) as suggested in the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Impulsiveness was assessed with the Barratt Impulsiveness Scale (BIS-15). We analyzed the data using binary logistic regression models and nonparametric tests. *Results:* Participants with IUD ($n = 144$) showed increased impulsiveness ($p = .005$) compared to those without IUD ($n = 774$). Participants with different main activities on the internet did not differ in their levels of impulsiveness. *Conclusions:* Results indicate that impulsiveness is associated with IUD, independent of the main internet activity. This highlights the necessity to consider patients' impulsiveness in prevention and therapeutic approaches. Because of the cross-sectional study design, further research with longitudinal study designs is needed.

Keywords: Internet Use Disorder, impulsiveness, proactive recruitment, vocational students, unselected sample

Zusammenhang zwischen erhöhter Impulsivität und Internetgebrauchsstörung bei Jugendlichen und jungen Erwachsenen mit unterschiedlichen Internethauptaktivitäten

Zusammenfassung: *Fragestellung:* Erhöhte Impulsivität ist ein Risikofaktor für gesundheitsgefährdende Verhaltensweisen wie z.B. Alkohol- oder Drogenmissbrauch. Bislang ist wenig darüber bekannt, ob erhöhte Impulsivität mit Internetnutzungsstörung assoziiert ist und ob sich Personen mit verschiedenen Hauptaktivitäten im Internet in ihrem Ausmaß an Impulsivität unterscheiden. *Methodik:* Insgesamt wurden 8.230 Berufsschüler_innen mit der Compulsive Internet Use Scale (CIUS) bezüglich problematischer Internetnutzung gescreent. Personen, die mindestens 21 Punkte in der CIUS erfüllten, wurden mit einem standardisierten Interview befragt, um die adaptierten Kriterien für Internetnutzungsstörung (INS) gemäß den Kriterien der Internet Gaming Disorder (IGD) der 5. Auflage des Diagnostic and Statistical Manual of Mental Disorders (DSM-5) zu untersuchen. Die Impulsivität wurde mit der Barratt Impulsiveness Scale (BIS-15) erhoben. Die Daten wurden mit binären-logistischen Regressionsmodellen und non-parametrischen Tests analysiert. *Ergebnisse:* Teilnehmer_innen mit IUD ($n = 144$) zeigten eine erhöhte Impulsivität ($p = .005$) im Vergleich zu denen ohne IUD ($n = 774$). Die Teilnehmer_innen mit unterschiedlichen Hauptaktivitäten im Internet unterschieden sich jedoch nicht in ihrem Ausmaß an Impulsivität. *Schlussfolgerung:* Die Ergebnisse deuten darauf hin, dass Impulsivität mit IUD assoziiert ist, unabhängig von der Hauptaktivität der Internetnutzung. Dies unterstreicht die Notwendigkeit Impulsivität in Präventions- und Therapieansätzen bei allen Betroffenen mit IUD zu berücksichtigen. Aufgrund des Querschnittsstudiendesigns ist weitere Forschung mit Längsschnittstudiendesigns erforderlich.

Schlüsselwörter: Internetnutzungsstörung; Impulsivität; Proaktive Rekrutierung, Berufsschüler_innen, unselektierte Stichprobe

Introduction

The internet has become an important part of adolescents' and young adults' daily life. Despite many benefits, excessive use is associated with significant impairments and leads to a discussion about a potential new behavioral disorder called Internet Use Disorder (IUD, e.g., Cerniglia et al., 2016). However, previous studies found that certain online activities appear to elicit more compulsive tendencies than others (Griffiths & Szabo, 2014). To date, IUD has most convincingly been linked to gaming and social media use (Gentile et al., 2011; Wegmann et al., 2020). In 2013, Internet Gaming Disorder (IGD) was included as a tentative disorder in the appendix in the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, APA, 2013). Furthermore, IGD will be included in the 11th edition of the *International Classification of Diseases* (ICD-11; World Health Organization (WHO), 2020; Jakob, 2018). The multidimensional construct underlying IGD refers to the pathological use of computer games for both online and offline activities (Wartberg et al., 2017). Following the DSM-5, the diagnosis includes at least five of the following nine criteria: (1) strong mental and emotional involvement, (2) withdrawal, (3) tolerance, (4) unsuccessful attempts or persistent desire to limit or completely give up certain internet activities, (5) loss of interest in other activities due to internet activity, (6) excessive internet use despite negative consequences, (7) deceiving others about the extent of internet activities, (8) use of internet activities to escape negative moods, and (9) endangerment or loss of relationships, job or training-related or professional opportunities due to the internet activities (APA, 2013).

With the inclusion of the IGD in the DSM-5, the topic of behavioral addictions received much attention (Petry & O'Brien, 2013). In several studies, the above-mentioned criteria for IGD were adapted to assess general pathologic internet behavior patterns (Besser et al., 2017; Rumpf et al., 2013; Zadra et al., 2016). In Germany, the prevalence rate of IUD in the general population is considered to lie at around 1%, while a higher percentage of 4% was found among underaged individuals between 14 and 16 years (Rumpf et al., 2014).

Previous studies analyzing risk factors for problematic behavior patterns concerning internet usage found that depressive symptoms, feelings of loneliness, and low self-confidence were related to pathological internet use (Gentile et al., 2011). Besides, increased impulsiveness is considered a risk factor for addictive internet use. According to the definition of Barratt (1985), impulsiveness can be considered as a three-dimensional concept including motoric, attention-based, and nonplanning dimensions: Motor impulsiveness is defined as lacking

thorough consideration before acting; attention-based impulsiveness involves rapid decision making; and nonplanning impulsiveness is defined as behaviors indicating concern only for the present but not for the future planning (Barratt, 1985). Deficits in impulse control are associated with an increased risk for several health-endangering and addictive behavior patterns, e.g., pathological gambling (Lee et al., 2012) and alcohol or drug abuse (Simons et al., 2005). Besides, it can be assumed that individuals with increased impulsiveness are at risk of having trouble limiting the frequency and duration of their internet use and are often facing difficulties regulating themselves in a self-determined way (Rehbein et al., 2013; Stoltenberg et al., 2008). Although previous studies found associations between increased impulsiveness and addictive use of online video games (Şalvarlı & Griffiths, 2019), little is known on whether these findings also refer to other main activities on the internet such as social networks.

Aim of this Study

Therefore, this study investigates whether (a) participants with IUD have increased levels of impulsiveness compared to participants without IUD. Based on previous studies, we assume higher levels of impulsiveness in the subscales Attention-Based, Nonplanning, and Motor Impulsiveness for participants with IUD compared to participants without IUD. Furthermore, this study investigates whether (b) participants with different main internet activities like social networks, online gaming, and other activities differ in their levels of impulsiveness.

Methods

Participants and Procedure

Participants were proactively recruited in 13 vocational schools in Schleswig-Holstein and Hamburg from March 2018 to March 2019 as part of the iPIN Study (Brandt et al., 2020). Inclusion criteria were a minimum age of 16 years and sufficient knowledge of the German language. In total 8,607 eligible participants, 8,230 participants were screened for problematic internet use with the Compulsive Internet Use Scale (CIUS). Participants scoring at least 21 points in the CIUS were asked to participate in an in-depth telephone interview. IUD was assessed according to the criteria of IGD as suggested in the 5th edition of the DSM-5.

Of the 1,475 participants eligible for the diagnostic interview, 938 were interviewed, 918 of whom answered all questions and were therefore included in the analysis. The informed consent of all participants was obtained. In cases of underage students, parental informed consent was additionally obtained. The study design and procedure are shown in Figure 1.

Measures

Sociodemographic Data

The assessed demographic data included sex, age, migration background, partnership, and school education. All sociodemographic data were assessed by single items.

Internet Use Disorder

IUD was assessed with the Internet-Related Disorders – Clinical Assessment Tool (I-CAT), a fully structured interview based on the structure and principles of the Composite International Diagnostic Interview (CIDI; Wittchen et al., 1995). I-CAT covers the adapted DSM-5 criteria for IGD generalized to different internet applications and has been

used in several studies (e.g., ICAT_006 “What is your main activity when using the internet via computer, laptop, smartphone or other internet-enabled device for private purposes?” ICAT_007 “Have you ever worried in the past few years that you might have a problem with your internet usage?”; Besser et al., 2017, 2019; Sevelko et al., 2018; Zadra et al., 2016). Data suggest good reliability for an IUD diagnosis within the past 12 months (Yule’s $Y = .84$; Brandt et al., 2018). Participants were assigned to the group with IUD when they fulfilled at least five criteria of the I-CAT.

Main Activity on the Internet

Participants were asked via forced-choice items to choose only their main activity on the internet. A variety of internet applications were measured, including social networks, online gaming, YouTube, gambling, and online shopping. For the analysis, YouTube, gambling, shopping, and further activities were combined in the category “other activities.”

Impulsiveness

Impulsiveness was assessed with the Barratt Impulsiveness Scale-15 items (BIS-15; Stoltzenberg et al., 2008). In total, 15 items on three subscales (attention-based impul-

Figure 1. Flow chart of the iPIN study.

siveness, nonplanning, and motor impulsiveness) could be answered on a four-level Likert scale, ranging from *rarely/never* to *almost always/always* (Preuss et al., 2018).

Statistical Analysis

All data analyses were performed with IBM SPSS Statistics 26.0. The level $p \leq .05$ was defined as statistically significant. Only data of those participants who completed the interview were analyzed ($n = 918$). Univariate analyses were performed with chi-square tests and Mann-Whitney U -tests. Differences in impulsiveness in participants with and without IUD (Hypothesis 1) were tested with binary logistic regression analyses, separately for each impulsiveness subscale of the BIS-15 and by adjusting for sex, age, school education, and migration background. Odds ratio (OR) was interpreted after Cohen (1988): An OR < 1.5 indicates a small effect or weak association, OR > 5 is defined as a large effect (Chen et al., 2010; Cohen, 1988).

For Hypothesis 2, we assessed associations between impulsiveness and main internet activities separately in the groups with and without IUD and performed a median split on the BIS-15 scale to separate into low and high impulsiveness. We then examined the differences in impulsiveness in participants with different main activities on the internet with chi-square tests.

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The iPIN study was approved by the Ethics Committee of the University of Lübeck. The Ministries of Education of Schleswig-Holstein and Hamburg authorized the recruitment of participants in vocational schools. All students were informed about the study and the participation was voluntary.

Results

Sample Characteristics

The final sample consisted of 918 participants. Of these, 144 (15.7%) fulfilled at least five criteria of IUD. Participants with and without IUD did not differ in sociodemographic data and main activities on the internet (Table 1).

Association Between Internet Use Disorder and Impulsiveness

Participants with IUD had increased levels of impulsiveness compared to those without IUD after adjusting for age, school years, and migration (Table 2). Further, when

Table 1. Sample characteristics

	Total $n = 918$	IUD $n = 144$	No IUD $n = 774$	p
Age, M (SD)	20.76 (4.1)	21.09 (4.3)	20.70 (4.0)	.120
Male sex, n (%) ¹	391 (42.6)	61 (42.4)	330 (42.6)	1.00
Migration background, n (%) ²	241 (26.3)	45 (31.3)	196 (25.3)	.149
Current partnership, n (%) ³	362 (39.4)	49 (34.0)	313 (40.4)	.164
Years in school ⁴				.782
<10 years, n (%)	541 (59.0)	86 (60.1)	455 (58.8)	
10 or more years, n (%)	376 (41.0)	57 (39.9)	319 (41.2)	
Main internet activity				.861
Gaming, n (%)	161 (17.5)	27 (18.8)	134 (17.3)	
Social Networking, n (%)	539 (58.7)	85 (59.0)	454 (58.7)	
Other applications, n (%)	218 (23.7)	32 (22.2)	186 (24.0)	

Note: n = valid values (%), ¹reference category: female, ²reference category: 0 = No migration background, ³reference category: no partnership, ⁴ $n = 917$ due to missings, M = mean, SD = standard deviation, IUD = Internet Use Disorder. p -values were derived from chi-square tests for sex, migration background, partnership, and main internet activity. A Mann-Whitney U -Test was performed for age.

considering the subscales, participants with IUD had increased levels of attention-based impulsiveness compared to those without IUD (Table 2). The BIS-15 Sum score (OR = 1.04, 95 %-CI 1.01–1.07) as well the subscale Attention-Based Impulsiveness show a small effect (OR = 1.19, 95 %-CI 1.11–1.28).

Table 3 shows that individuals with different main activities while using the internet did not differ in their impulsiveness. These findings refer to both individuals with and without IUD.

Discussion

The main finding was that participants with IUD have increased levels of impulsiveness compared to those without IUD, although individuals with different main activities on the internet did not differ in their impulsiveness.

Confirming the first hypothesis and in line with previous studies (e.g., Cao et al., 2007; Chen et al., 2017), increased impulsiveness was associated with addictive behavior patterns on the internet. Although impulsiveness is described as a stable personality trait, longitudinal studies showed a possible developmental shift (Chen et al., 2017). In particular during adolescence, the tendency toward impulsiveness and exploring new risky behavior patterns is increased (Chen et al., 2017; Spear, 2000; Steinberg et al., 2008). When using the internet, young individuals might thus experience difficulties limiting the frequency and du-

Table 2. Association of IUD and impulsiveness by adjusting sociodemographic variables

IUD	B	OR	(95 %-CI)	p
BIS-15 Sum Score ¹	.04	1.04	(1.01–1.07)	.005*
Sex, female ²	.00	1.00	(.70–1.44)	.993
Age	.03	1.03	(.99–1.07)	.203
School education, more than 10 years ³	–.01	.99	(.68–1.44)	.947
Migration ⁴	.31	1.36	(.92–2.01)	.127
BIS-15 Subscale: Nonplanned Impulsiveness ⁵	.05	1.05	(.99–1.11)	.099
Sex, female ²	.01	1.01	(.70–1.45)	.955
Age	.03	1.03	(.99–1.07)	.200
School education, more than 10 years ³	–.05	.95	(.65–1.39)	.792
Migration ⁴	.31	1.36	(.92–2.01)	.123
BIS-15 Subscale: Motor impulsiveness ⁶	.02	1.02	(.97–1.09)	.427
Sex, female ²	.01	1.01	(.71–1.46)	.945
Age	.03	1.03	(.99–1.07)	.219
School education, more than 10 years ³	–.07	.94	(.64–1.37)	.733
Migration ⁴	.29	1.34	(.91–1.98)	.143
BIS-15 Subscale: Attention-Based Impulsiveness ⁷	1.7	1.19	(1.11–1.28)	.000***
Sex, female ²	–.02	.98	(.68–1.42)	.918
Age	.02	1.02	(.98–1.07)	.328
School education, more than 10 years ³	–.01	1.01	(.69–1.48)	.972
Migration ⁴	.36	1.43	(.96–2.13)	.077

Note: * $p < .05$, ** $p < .01$, *** $p < .001$, OR = odds ratio, B = regression coefficient B, CI = confidence interval. Reference category: participants without IUD, ²reference category: 0 = male, ³reference category: 0 = up to 10 years, ⁴reference category: 0 = no migration background, ⁵ $n = 917$, Nagelkerke's $R^2 = .022$, ⁶ $n = 917$, Nagelkerke's $R^2 = .012$, ⁷ $n = 917$, Nagelkerke's $R^2 = .008$, ⁸ $n = 917$, Nagelkerke's $R^2 = .047$.

Table 3. Associations of impulsiveness and different main internet activities in participants with and without IUD

	Total	Low impulsiveness	High impulsiveness	
	<i>n</i> = 937	<i>n</i> = 471	<i>n</i> = 466	<i>p</i>
IUD ¹				.627
Social media, <i>n</i> (%)	85 (57.8)	37 (60.7)	48 (55.8)	
Gaming, <i>n</i> (%)	27 (18.4)	12 (19.7)	15 (17.4)	
Other activities, <i>n</i> (%)	35 (23.8)	12 (19.7)	23 (26.7)	
No IUD ²				.970
Social media, <i>n</i> (%)	465 (58.9)	243 (59.3)	222 (58.4)	
Gaming, <i>n</i> (%)	137 (17.3)	70 (17.1)	67 (17.6)	
Other activities, <i>n</i> (%)	188 (23.8)	97 (23.7)	91 (23.9)	

Note: ¹*n* = 147, ²*n* = 790, IUD = Internet Use Disorder.

ration of their use and regulating it in a self-determined manner (Rehbein et al., 2013).

When considering the three impulsiveness subscales of the BIS-15, we found that Attention-Based Impulsiveness was associated with IUD. This is in line with a previous study that found associations between attentional impulsiveness and addictive use of social networks (Wegmann et al., 2020). In contrast to our expectations and previous studies (e.g., Lee et al., 2012), however, individuals with and without IUD did not differ in the subscale Motor Impulsiveness. In terms of nonplanning, there was a tendency but no significant difference between individuals with and without IUD.

Further, we found that individuals with different main activities while using the internet did not differ in their levels of impulsiveness. Thus, it seems to be of importance to include techniques for managing impulses (e.g., enhancing self-awareness and delaying action on impulses) in the prevention and therapy approaches for all individuals with at-risk use of the internet, independent of the main activity while using the internet.

Strengths and Limitations

The results should be interpreted with caution due to some limitations of this study. Because of the cross-sectional study design, no causal interpretations can be drawn. It remains unclear whether either individuals with IUD tend to be more impulsive or, vice versa, whether impulsive individuals show a higher risk of developing pathological internet use behavior patterns compared to nonimpulsive individuals. Although impulsiveness is considered a stable

characteristic, the relationship between impulsiveness and IUD is not necessarily constant across time. Further longitudinal studies are required. Besides, another limitation is that impulsiveness was assessed with a screening scale instead of an in-depth diagnostic instrument.

All participants (*n* = 918) were characterized by having increased levels of internet use. This limits the representativity of the sample. Despite a wide selection of different branches, varying focal points of chosen vocational schools, and different school grades, a representative selection of all vocational school students in Schleswig-Holstein and Hamburg cannot be guaranteed. Despite these limitations and in contrast to previous studies, IUD was assessed with an in-depth assessment based on the DSM-5 diagnostic criteria for IGD instead of screening instruments. Because of the proactive recruitment, a pre-selected sample could be avoided.

Conclusion

Our results indicate that increased impulsiveness in adolescents and young adults is associated with addictive internet use. This should be considered in prevention and therapeutic interventions, e.g., by providing techniques for managing impulses, enhancing self-awareness, and delaying action on impulses. Because of the cross-sectional study design, however, longitudinal study designs are required to investigate whether impulsiveness is a cause or a consequence of IUD. Furthermore, future research may consider whether mediating or moderating variables (e.g., sex or age) are involved in the relationship between impulsiveness and IUD.

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History

Manuscript submitted: 28.02.2021

Accepted after revision: 20.05.2021

Published online: 16.07.2021

Conflicts of interests

No conflicts of interest exist.

Authorship

EK: data assessment, statistical analysis, and interpretation of findings, preparation of the manuscript draft. HS: study concept and design, data assessment, statistical analysis and

interpretation of findings, revision of the manuscript draft. DB: study concept and design, statistical analysis and interpretation of findings, revision of the manuscript draft. GB, AB: study concept and design, revision of the manuscript draft. BB, SO: data assessment, revision of the manuscript draft. HJR: study concept and design, obtained statistical analysis and interpretation of findings.

Funding

The iPIN-study was funded by the German Federal Ministry of Health (Grant number ZMVI1-2517DSM210).

Open access publication enabled by University of Lübeck.

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