













AKADÉMIAI KIADÓ

# Motivational brief interventions for adolescents and young adults with Internet use disorders: A randomized-controlled trial

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## FULL-LENGTH REPORT



### ABSTRACT

**Background:** Adolescents and young adults (AYA) have an increased risk for Internet use disorders (IUD) compared to older individuals that may lead to functional impairments in daily life. To date, evidence-based brief interventions are lacking. This study aimed to test the efficacy of a low-threshold counseling approach based on Motivational Interviewing (MI) in a vocational school setting. **Methods:** Of 8.230 vocational students (age  $M=20.56$ ,  $SD=4.68$ ; 51.85% female) being proactively screened for IUD, 937 with positive screenings took part in telephone-based diagnostic interviews. IUD were assessed in line with the criteria of the Internet Gaming Disorder in the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5). Readiness to change, self-efficacy, and impairments in daily life were additionally assessed with standardized screening instruments. Participants fulfilling at least two IUD criteria were randomized to the intervention group ( $n=240$ , up to three MI-based counseling sessions via telephone) or the control group ( $n=257$ , information brochure on responsible Internet use). Follow-up interviews were conducted after five and ten months. The primary outcome was the reduction of IUD criteria. Secondary outcomes were improvements of readiness/ self-efficacy to change and the reduction of daily impairments. Data were analyzed with Intention-to-Treat (ITT) and complier average causal effect (CACE) analyses. **Results:** Overall, 153 (63.75%) individuals assigned to the intervention group participated at least in one counseling session (=compliers). Both groups reduced the number of IUD criteria over time. In ITT analyses, however, we did not find intervention effects for primary and secondary outcomes. Bayes statistics were inconclusive. Based on low participation rates in the intervention group, explorative CACE analyses were conducted to compare compliers in the intervention group to potential compliers in the control group. Again, we did not find intervention effects apart from improvements in self-efficacy after five months. **Discussion:** Telephone-based counseling seems not appropriate to address AYA at risk for IUD. Low participation rates in the intervention group caused underpowered analyses. Besides, dealing with the own Internet use during intensive assessments and receiving an information brochure led to behavioral changes also in the control group. Since the efficacy of brief interventions under the condition of higher participation rates cannot be fully ruled out, further research is required by taking the implications of this study into account.

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### KEYWORDS

Internet use disorders, brief intervention, motivational interviewing, adolescents, young adults

## INTRODUCTION

### “Internet use disorders” as an umbrella construct

Internet use disorders (IUD) have widely been discussed as a potential new disorder in the spectrum of behavioral addictions (Kuss & Lopez-Fernandez, 2016). To date, it is an important area of research that has not yet reached full clarification in terms of the classification and diagnostic criteria (Fineberg et al., 2018; Griffiths, 2021; Mihajlov & Vejmelka, 2017). In 2013, Internet Gaming Disorder (IGD) was included as a distinct behavioral addiction on the Internet under the 3rd section in the 5th edition of the “Diagnostic and Statistical Manual of Mental Disorders” (DSM-5) as a condition requiring further research before becoming an official mental disorder (American Psychiatric Association, APA, 2013). In 2019, Gaming Disorder (GD) was included in the 11th edition of the “International Classification of Diseases and Health Related Problems” (ICD-11; World Health Organization, WHO, 2019). The inclusion of IGD and GD in both diagnostic systems was done due to the evidence in the literature (Saunders et al., 2017) and the clinical need (Rumpf et al., 2018). Both diagnostic systems differ in their definition of disordered gaming (Jo et al., 2019): In the DSM-5, IGD is characterized by fulfilling at least five of the following nine diagnostic criteria: Preoccupation, withdrawal, tolerance, unsuccessful attempts to reduce or stop, giving up other activities, continuation despite problems, deception, mood modification, and risk or loss of relationships or career opportunities (APA, 2013). The ICD-11 includes the criteria impaired control, increasing priority over other activities, and continuation despite negative consequences (WHO, 2019). Besides, individuals must experience clinically significant distress or impairments of functioning (WHO, 2019). To date, most studies analyzing IUD as an umbrella construct that covers a broad spectrum of potentially addictive Internet applications refer to the criteria and classification of IGD as suggested in the DSM-5. With respect to ICD-11, researchers have suggested that problematic and disordered online-shopping/buying, online-pornography viewing, and the use of online social networks are candidates with sufficient evidence under the category of other specified behavioral addictions (Andreassen, 2015; D’Arienzo, Boursier, & Griffiths, 2019; Griffiths, 2021).

### Intervention approaches

Epidemiological studies found that adolescents and young adults (AYA) have an increased risk for problematic or disordered Internet use compared to older individuals: In Germany, a prevalence rate of 1–2% in the general population was found (Müller, Glaesmer, Brahler, Woelfling, & Beutel, 2014; Rumpf et al., 2014). Slightly increased prevalence rates of up to 4% were found in a population of AYA aged 14–16 years (Müller et al., 2014). A recent international meta-analysis with 113 epidemiologic studies for IUD from 1996 to 2018 even found an increased prevalence rate of 7% (Pan, Chiu, & Lin, 2020). The potential negative impact of

IUD on AYAs’ offline lives covers a broad spectrum of impairments in daily functioning such as refusal to attend school, social withdrawal, or comorbid depressive symptoms (Costa, Patrão, & Machado, 2019; de Vries, Nakamae, Fukui, Denys, & Narumoto, 2018; Gecaite-Stonciene et al., 2021). Despite these impairments and in line with other behavioral or substance-related disorders, only a minority of those affected seek professional help (Rumpf et al., 2014). In particular, women are less likely to seek help compared to men (Rumpf et al., 2014). Besides, most existing therapy approaches for individuals with IUD are high-threshold approaches. Proactive approaches based on screening and brief interventions might help to lower barriers for seeking help or even prevent the development of severe symptoms. Brief interventions typically range from one single session to four sessions and were effective in the field of hazardous alcohol use (Kaner et al., 2007). Such brief interventions aim to increase the individual’s motivation and self-efficacy for health-related behavior changes and, if requested by the client, provide information and advice for implementing the desired behavioral changes (Kaner et al., 2007). A review found positive effects of brief interventions in the context of IUD for reducing the time spent online and associated impairments (King, Delfabbro, Griffiths, & Gradisar, 2011). However, the design and methods of most included studies have some important limitations: Several studies were characterized by inconsistent definitions of IUD, lacking control groups, insufficient statistical power, short follow-up periods, and preselection effects caused by convenient samples (King et al., 2011). In addition, most brief interventions were not based on evidence-based psychological concepts (King et al., 2011).

### Strengthening motivation for health-related behavioral changes

Motivational Interviewing (MI) is an evidence-based patient- and goal-centered counseling approach aimed at strengthening the intrinsic motivation and commitment for health-related behavior changes in a non-judgmental and empathic framework (Miller & Rollnick, 2012). The efficacy of MI-based brief interventions has been proven in various health-related fields, even during brief interventions (Lundahl et al., 2013). In the field of addictive behaviors as well as in other health-related fields, MI-based interventions were effective to increase participants’ readiness and self-efficacy for behavioral changes, especially when adding elements of cognitive-behavioral therapy (CBT; Lundahl et al., 2013; Miles, Rodrigues, Sniehotta, & French, 2020). To date, the proof of efficacy for MI-based brief interventions in the context of IUD is still pending. To the best of our knowledge, only three MI-based pilot studies with AYA at-risk for IUD are yet published. One study aimed to reduce the time spent online in a sample of Chinese students ( $n = 65$ ; Su, Fang, Miller, & Wang, 2011): Participants were recruited via announcements and randomly divided into four groups: (1) MI-based approach under laboratory conditions, (2) MI-based approach in a natural setting (at home), (3) non-interactive and computer-assisted approach, and (4) control group. At 1-month follow-up, all three intervention groups

significantly decreased their time spent online and Internet-related problems compared to the control group (Su et al., 2011). Another telemedical study tested the efficacy of brief motivational interventions for AYA with IUD in Germany ( $n = 73$ ; Bottel et al., 2021). Significant increases in their motivation to change and reductions of the IUD criteria and the time spent online were found (Bottel et al., 2021). However, a control group was lacking. A third study, which was a feasibility project of the present study (Besser et al., 2022), offered brief motivational interventions (one face-to-face counseling and up to three further counseling sessions via telephone). Participants ( $n = 36$ , age  $M = 26.3$ ,  $SD = 8.1$ ) were recruited in the setting of German job centers (Besser et al., 2022). At the two-months follow-up, the decrease of IUD criteria was higher in the intervention group ( $n = 16$ ) compared to the control group ( $n = 20$ ), although not statistically significant (Besser et al., 2022). Summing up, important limitations of these pilot approaches are either small sample sizes, lacking control groups, or insufficient follow-up periods. Therefore, the efficacy of motivational brief interventions for AYA with IUD has to be tested in a randomized-controlled trial.

### Aim of this study

The study “Intervention in problematic Internet use - preventive approaches for risk groups” (iPIN) aimed to examine the efficacy of a brief MI-based counseling approach for vocational students with problematic and disordered Internet use. The primary outcome was the reduction of the IUD criteria that were adopted from the IGD criteria as suggested in the DSM-5. Secondary outcome variables were improvements of participants’ readiness and self-efficacy to change their Internet use behavior and the reduction of impairments in daily life caused by dysfunctional Internet use. It was hypothesized that participating in MI-based counseling sessions via telephone leads to significant improvements of the predefined primary and secondary outcomes after five months (T1) and ten months (T2) compared to a control group receiving a brochure on responsible Internet use by post.

## METHODS

### Study design und procedure

**Screening.** All participants were proactively recruited in 12 vocational schools in the German federal states Schleswig-Holstein and Hamburg. Screening data were collected between March 2018 and March 2019. The proactive screening (45 minutes) was conducted in the classroom. Each student answered the screening items via one tablet. During the tablet-assisted screening process, at least two members of the project team were present in the classroom to answer potentially arising questions of the students. The main aim of this proactive screening was to systematically identify all vocational students at risk for IUD who were eligible for further in-depth diagnostic interviews. IUD were screened with the “Compulsive Internet Use Scale”

(CIUS, Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009; see section “Measures”). Besides IUD, sociodemographic variables, mental health, general health behaviors (fruit and vegetable intake and physical activity), and substance-related risk behaviors (e.g., alcohol consumption and smoking) were assessed (see section “Measures”). Of 8,607 students being present in the classrooms, 8,230 (95.6%) completed the screening. The reasons for non-termination are shown in Fig. 1. Inclusion criteria for the further telephone-based diagnostic interview were a CIUS sum score  $\geq 21$ , sufficient knowledge of the German language, and a minimum age of 16 years. All eligible students fulfilling the inclusion criteria were asked to take part in a telephone-based diagnostic interview (=baseline interview).

**Baseline interviews.** Of 3,078 students with a CIUS sum score  $\geq 21$  (=positive screening), 1,475 agreed to be contacted for further telephone-based diagnostic interviews (=Baseline interview). The Baseline interview covered an in-depth clinical assessment of IUD (see section “Measures”). Additionally, sociodemographic variables, personality characteristics, comorbidity, and health behavior were assessed. All baseline interviews were conducted by psychologists or study nurses who received a comprehensive training in advance. Before starting the main data collection, the feasibility of the computer-assisted baseline interviews was tested in the research group. Standard Operating Procedures (SOP’s) ensured the quality of the baseline interviews. After five unsuccessful contact attempts to call an eligible participant, he or she was contacted via email or post by the study coordinator to optimize the recruitment. After ten unsuccessful attempts to call an eligible participant with systematically changing days and time slots, an exchange among the interviewers took place. After five further unsuccessful attempts with systematically changing calling times, the contact attempts were stopped (see Fig. 1 for Drop-outs). In total, 937 baseline interviews were realized between April, 2018 and April, 2019. Participants who could not be contacted or refused to take part in the baseline interview compared to those who took part were characterized by younger age, sex (male), still living with their parents, lower education level, and migration background. There were no systematic differences between both groups in terms of their CIUS sum score (data available on request). As an incentive, all participants who took part in the baseline interview received 20 Euros.

**Randomization and intervention.** Inclusion criteria for the present randomized-controlled trial were sufficient knowledge of the German language and the fulfilment of at least two IUD criteria recorded in the baseline interview. The cut-off of two IUD criteria was consciously set low to cover all individuals with at-risk Internet use. Individuals who currently attended or wait for psychotherapy and those who reported online gambling as main activity on the Internet were excluded from the randomization process ( $n = 17$ ). In total, 497 participants fulfilled at least two IUD criteria in the last three months and were randomly assigned to the



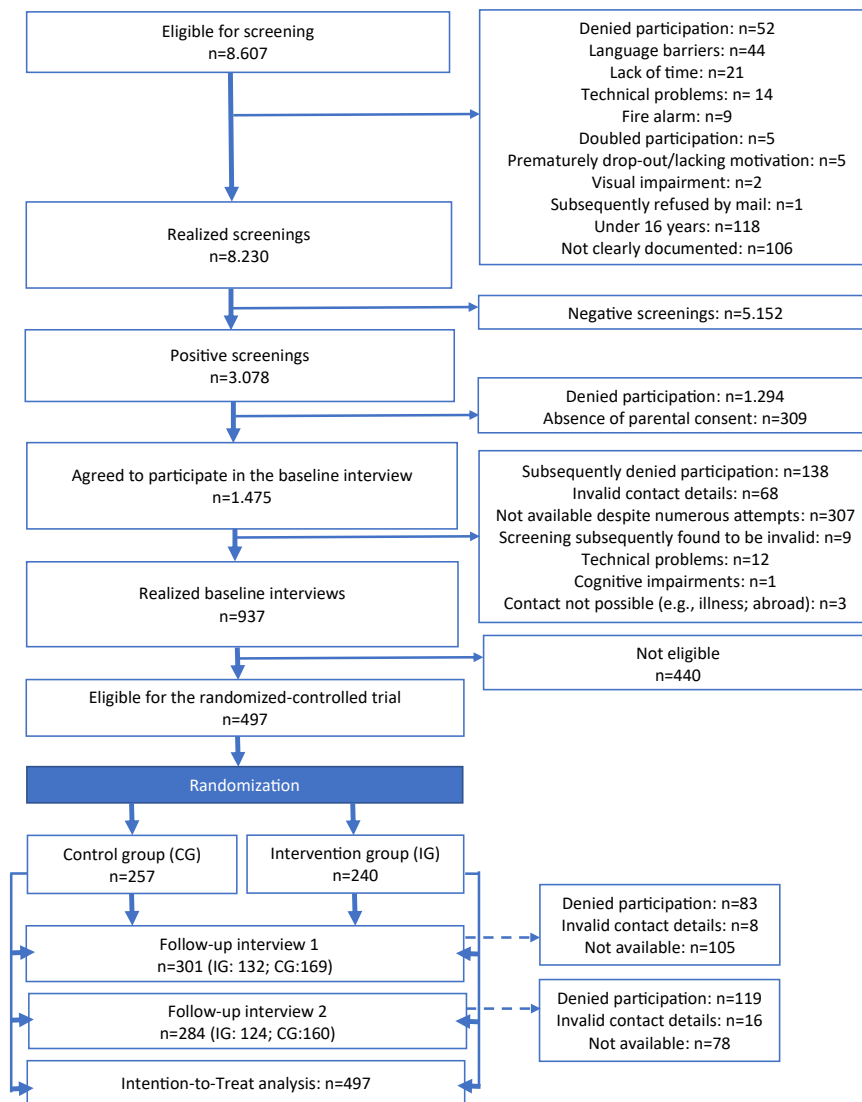


Fig. 1. Flow-chart

Notes: The term “positive screening” refers to a total sum score of at least 21 points in the Compulsive Internet Use Scale (CIUS) that was used as a screening instrument for problematic and disordered Internet use.

intervention or the control group (Fig. 1). The intervention group received up to three telephone-based counseling sessions, depending on individual needs. If the participants agreed, all conversations were audio-recorded for supervision purposes. The mean time between the counseling sessions was two weeks. The duration of each counseling session was 30–45 min. As an incentive for participation, two vouchers (50 and 100 euros) and one tablet were distributed among those who took part in all three counseling sessions. The control group received a brochure on responsible Internet use by post. The complete procedure of the iPIN study based on the CONSORT statement is shown in Fig. 1.

**Treatment fidelity.** The intervention concept was developed in the project team and pretested in the iPIN pilot study (Rumpf et al., 2021). All counselling sessions were carried out by psychologists. In advance, all psychologists were trained in a two-day MI workshop by a member of the Motivational

Interviewing Network of Trainers (MINT; AB, GB, HJR). To ensure the quality of the intervention, intervention and supervision groups took place at least once a week. For this purpose, audio-recordings of the intervention were discussed to ensure the adherence with the MI approach. In all supervision meetings, at least one member of MINT (AB, GB, HJR) took part.

**Follow-up interviews.** Follow-up interviews were conducted after five months ( $n = 301$ ) and ten months ( $n = 284$ ) via telephone. In line with the baseline interview, participants answered standardized questionnaires on IUD, sociodemographic variables, and health-related behavior (see section “Measures”). The duration of both follow-up interviews was 30–45 min. To ensure the quality of the interview, all interviewers received a comprehensive training. The SOP of the previous baseline interview was adapted and a computer-assisted interview version with the final instruments

was again tested for its feasibility. All participants received financial incentives (20 Euros) for participation in each follow-up. Participants who could not be contacted for the first follow-up were still called for the second follow-up. In both follow-ups, there were no systematic differences between those who took part in the interview compared to those who refused to take part apart from the fact that the compliers were slightly older (data available on request).

### Assessments in the classroom screening

**Sample characteristics.** The following sample characteristics were assessed: Age, sex, housing situation, migration background, partnership, and education. All sample characteristics were measured by standardized single items.

**Screening of mental health.** Mental health was assessed with the “Mental Health Inventory” (MHI-5), a brief 5-item screening instrument to identify depressive symptoms (e.g., “How many times in the last month have you felt so down that nothing could cheer you up?”) and anxiety symptoms (e.g., “How often in the last month have you been nervous?”) in the last four weeks (Berwick et al., 1991). Items can be answered on a 5-point Likert-scale with a range from 1 (“never”) to 5 (“always”). In a general population study, the MHI-5 showed good performance, in particular for identifying mood disorders (Rumpf, Meyer, Hapke, & John, 2001).

**Screening of health behaviors.** Participants’ general health behaviors were screened by assessing their fruit and vegetable intake, physical activity, and substance-related risk behaviors. In line with the WHO recommendation, the fruit and vegetable intake were assessed with four items (e.g., “How many days per week do you typically eat vegetables?”). Physical activity was assessed with the Godin Leisure-Time-Questionnaire (Godin, 2011) that consists of four items (e.g., “How often are you regularly physical active in your free time so long that you are sweating?”). Furthermore, smoking was assessed with two-item Heaviness of Smoking Index (Heatherton, Kozlowski, Frecker, Rickert, & Robinson, 1989) as a short form of the Fagerström test for nicotine dependence (FTND; Fagerström & Schneider, 1989) assessing the time to first cigarette and cigarettes per day. Alcohol consumption was assessed with the Alcohol Use Identification Test - Consumption Questions (AUDIT-C; Bush, Kivlahan, McDonnell, Fihn, & Bradley, 1998) on three items (e.g., “How often did you have 6 or more drinks on one occasion in the past year?”). Data on mental health and general health-related behavior were not analyzed in this paper but they were included in multiple imputations in cases of missings (see section “statistical analyses”).

**Screening for IUD.** The CIUS was used as a screening instrument to identify problematic and disordered behavior on the Internet (Meerkerk et al., 2009). The 14 items represent the following criteria for compulsive Internet use (CIU): Salience, withdrawal, loss of control, conflict, and coping with an unpleasant mood. All questions could be answered on a

5-point Likert scale, ranging from “never” (0) to “very often” (4). Participants scoring at least 21 points in the CIUS were defined as having at least elevated levels of Internet use and an increased risk for IUD. This sensitive cut-off is below the recommendation by Meerkerk et al. (2009) and was chosen to include all individuals with potentially problematic Internet use behavior. In previous studies, a good internal reliability of the CIUS was found with Cronbach’s  $\alpha$  ranging from 0.88 to 0.90 (Meerkerk et al., 2009). A stable one-factor solution of the questionnaire was found among different samples (Meerkerk et al., 2009).

### Assessments in the telephone-based baseline and follow-up interviews

**In-depth diagnostic of IUD.** In the baseline and both follow-up interviews, IUD were assessed using the structured, clinical interview “Internet related disorders-Clinical Assessment Tool (I-CAT)”. I-CAT was developed by the project team and is structurally based on the Munich Composite International Diagnostic Interview (M-CIDI; Wittchen et al., 1995). The M-CIDI is a fully standardized diagnostic interview to identify mental disorders following the ICD-10 diagnostic criteria for research (DCR). In previous studies, a good retest reliability for most of the assessed psychiatric symptoms and disorders was found (Wittchen et al., 1995). Independent from the time spent on the Internet, I-CAT covers all nine criteria for IUD according to the DSM-5 diagnostic criteria of IGD. To include all probable forms of Internet use, the wording “gaming” was replaced by “Internet activities”. The criteria were assessed by 27 items with dichotomous answer categories, ranging from one (e.g., “giving up other activities”) to nine (e.g., “continuation despite problems”) items per criterion.

**Screening of participants’ readiness and self-efficacy for behavioral changes.** Participants’ readiness to change (“On a scale ranging from 1 to 10, how important is it for you to change your Internet use behavior?”) and their self-efficacy to change (“On a scale ranging from 1 to 10, how confident are you to be able to change your Internet use behavior?”) were assessed with an adopted version of the readiness ruler by Heather, Smailes, and Cassidy (2008) using a 10-point Likert-scale.

**Screening of impairments caused by dysfunctional Internet use.** To assess impairments in daily life caused by dysfunctional Internet use, participants were asked to rate possible changes in daily life that are associated with their Internet use behavior. The following domains were addressed: Relationship to other family members (item 1), general well-being (item 2), health and fitness (item 3), eating behavior (item 4), ability to fulfill daily obligations (item 5), mental health (item 6), leisure activities (item 7), and contact to real-life friends (item 8). All items were phrased as follows: “Due to my Internet use, my [...] has [...]”. All items could be answered on a 5-point Likert scale, ranging from “become better” to “become worse”.



## Power analysis

In brief intervention studies, small to medium effects can be expected. Based on an assumed effect size of  $d = 0.30$  and a statistical power of 0.80, 139 participants per group are needed to identify significant differences between the control group and the intervention group (5% probability of error). To reach a final sample of 280 participants (140 per group), 7,000 screening data are needed. Assuming a mean prevalence rate of 10% for problematic Internet use, 700 individuals need be asked to participate in the study. It is assumed that about 65% are willing to take part in an in-depth diagnostic interview. It is further assumed that 90% of the eligible individuals agree to participate in the further study and 70% take part in follow-up interviews. The power analyses were conducted with GPower.

## Statistical analyses

Data for both the intervention and control group were analyzed at four times (screening, baseline, and five- and ten-months follow-ups). Multiple imputations were conducted to avoid potential bias caused by a loss to follow-up (Schafer & Graham, 2002). Missing values were multiple imputed by considering participants' sociodemographic variables (sex, migration background, age), health-related variables (fruit and vegetable intake, physical activity, smoking, and alcohol consumption), and the time spent on the Internet. It was assumed that the occurrence of missings was random and that multiple imputations were unbiased. Fifty data sets were imputed across all assessments via chained regressions using the predictive mean matching method as implemented in the STATA procedure (StataCorp 2017). Analyses were repeated on all imputed datasets and pooled according to Rubin's rule. The main outcome analysis was conducted following the Intention-to-Treat (ITT) principle (confirmatory part). All randomized participants were analyzed regardless of whether they received the intended intervention. To analyze changes between the baseline assessment and both follow-ups, we fitted random intercept (Stata procedure mixed) models including dummy variables for each follow-up and the related two interaction terms with time. We adjusted all outcome analyses for age, sex, migration background, mental health, baseline IUD criteria, readiness to change, and self-efficacy to change. In addition to the ITT analyses, we estimated the complier average causal effect (CACE) of the intervention as an explorative approach (Twisk et al., 2018). The CACE analysis measures intervention effects of those who received the intervention as intended by the original group allocation and potential compliers of the control group (Connell, 2009; Jo, 2002). Therefore, we fitted mixture models with Mplus Version 7 for each follow-up and outcome measure (Muthén & Muthén, 1998–2015). As the dependent variable, we used change-scores adjusted for the baseline score. It was assumed that participants in the control group had the same probability of non-compliance compared to individuals in the intervention group. Using dichotomous compliance data

(“attending at least one counseling” vs. “do not attend any counseling”), it was assumed that the causal effect of  $d$  sessions is not proportional to the number of sessions. This was done based on previous univariate analyses that showed that the treatment effect was not linearly related to the number of counseling sessions but rather to attending at least one counseling session at all. In addition, we estimated associated Bayes Factors to test whether non-significant results support a null hypothesis (H0) versus an alternative hypothesis (H1) or whether the data are just insensitive (Dienes, 2014). Bayes Factors are interpreted as follows:  $B < 1/3$  = strong/substantial evidence for H0;  $B > 1/3$  and  $B < 3$  = inconclusive data/weak/anecdotal evidence, and  $B > 3$  = strong/substantial evidence for H1 (Dienes, 2014). The level  $p \leq 0.05$  was defined as statistically significant. All data analyses were performed using IBM SPSS Statistics 25, STATA, and Mplus Version 7.

## Ethics

The study procedure was carried out according to the Declaration of Helsinki and was approved by the ethics committee of the University of Lübeck on 15th December, 2017 (File reference 17–339). Prior to the recruitment, applications were submitted to the Ministries of Education in the German federal states Schleswig-Holstein and Hamburg. The informed consent of all participants was obtained. In cases of underaged individuals, the parental informed consent was additionally obtained.

## RESULTS

### Sample characteristics

Table 1 shows the characteristics of the sample before randomization.

### Compliance overview

Full compliance was defined as attendance of all three telephone-based consultation sessions. Of 240 participants randomized to the intervention group, 94 (39.17%) attended three sessions and were fully compliant, 34 (14.17%) attended two sessions, and 25 (10.42%) attended one session. The remaining 87 participants (36.25%) did not attend any session.

### Intervention effects

**Primary outcome.** In the confirmative ITT analyses, both groups reduced their initial number of IUD criteria recorded in the baseline interview (T0) but we could not prove an intervention effect (Table 2). Bayes factor analyses showed that the results were inconclusive for both follow-ups (T1  $B = 0.54$ ; T2  $B = 1.05$ ). In the additional explorative CACE analysis (Table 3), individuals in the intervention group who participated at least in one counseling session ( $n = 153$ ; 63.75%) were compared with potential compliers of the

Table 1. Characteristics of the randomized sample ( $N = 497$ )

	Total ( $N = 497$ )	Intervention group ( $n = 240$ )	Control group ( $n = 257$ )
<b>Sociodemographic variables</b>			
Age, $M$ ( $SD$ )	20.45 (3.21)	20.21 (2.90)	20.67 (3.46)
Sex (male), $n$ (%)	203 (40.85)	105 (43.75)	98 (38.13)
Housing situation			
Alone, $n$ (%)	48 (9.66)	19 (7.91)	29 (11.28)
With parents/grand-parents, $n$ (%)	369 (74.12)	188 (78.33)	181 (70.43)
With partner, $n$ (%)	37 (7.44)	14 (5.83)	23 (8.95)
With a single parent, $n$ (%)	9 (1.81)	3 (1.25)	6 (2.33)
Shared flat, $n$ (%)	3 (0.60)	3 (1.25)	0 (0.00)
Assisted living group, $n$ (%)	32 (6.48)	14 (5.83)	18 (7.00)
Partnership, $n$ (%)	192 (38.63)	94 (39.17)	98 (38.13)
<b>Internet-related variables</b>			
Number of IUD criteria			
2 IUD criteria, $n$ (%)	160 (32.19)	82 (34.22)	78 (30.35)
3–4 IUD criteria, $n$ (%)	223 (44.87)	102 (42.50)	121 (47.08)
5–9 IUD criteria, $n$ (%)	114 (22.94)	56 (23.33)	58 (22.56)
Impairments caused by dysfunctional Internet use, $M$ ( $SD$ )	23.34 (3.18)	23.05 (3.17)	23.60 (3.17)
Main activity on the Internet			
Social Networks, $n$ (%)	290 (58.35)	144 (60.00)	146 (56.81)
Games, $n$ (%)	94 (18.91)	50 (20.83)	44 (17.12)
YouTube and other video platforms, $n$ (%)	99 (19.92)	39 (16.25)	60 (23.35)
Shopping, $n$ (%)	6 (1.21)	4 (1.67)	2 (0.79)
Other, $n$ (%)	8 (1.61)	3 (1.25)	5 (1.95)
Time on the Internet for private issues			
Hours spent on the Internet during the week, $M$ ( $SD$ )	3.91 (2.02)	3.95 (1.86)	3.86 (2.16)
Hours spent on the Internet on weekends, $M$ ( $SD$ )	5.29 (2.85)	5.25 (2.76)	5.32 (2.93)
Maximum hours spent online per day, $M$ ( $SD$ )	8.58 (4.98)	8.28 (4.11)	8.85 (5.67)
Readiness to change, $M$ ( $SD$ )	5.23 (2.36)	5.41 (2.33)	5.06 (2.39)
Self-efficacy to change, $M$ ( $SD$ )	6.16 (2.24)	6.02 (2.17)	6.28 (2.29)

Notes:  $n$  = valid numbers,  $M$  = mean,  $SD$  = standard deviation, IUD = Internet use disorders.

Table 2. ITT regression analyses

	Coefficient	Standard error	$t$	$p$	95% CI
<b>Primary outcome</b>					
IUD criteria					
Time: Follow-up 1 (T1)	−0.48	0.13	−3.61	0.000	−0.74; −0.21
Time: Follow-up 2 (T2)	−0.64	0.13	−4.88	0.000	−0.90; −0.38
Intervention* Time: Follow-up 1 (T1)	−0.13	0.17	−0.78	0.433	−0.47; 0.20
Intervention* Time: Follow-up 2 (T2)	−0.30	0.20	−1.45	0.149	−0.71; 0.11
<b>Secondary outcomes</b>					
Readiness to change					
Time: Follow-up 1 (T1)	−0.31	0.08	−3.87	0.000	−0.47; −0.15
Time: Follow-up 2 (T2)	−0.68	0.13	−5.15	0.000	−0.94; −0.42
Intervention* Time: Follow-up 1 (T1)	0.09	0.11	0.81	0.420	−0.13; 0.32
Intervention* Time: Follow-up 2 (T2)	−0.21	0.21	−1.00	0.317	−0.63; 0.20
Self-efficacy to change					
Time: Follow-up 1 (T1)	0.11	0.08	0.13	0.190	−0.06; 0.29
Time: Follow-up 2 (T2)	−0.64	0.17	−3.84	0.000	−0.96; −0.31
Intervention* Time: Follow-up 1 (T1)	−0.01	0.12	−0.16	0.876	−0.26; 0.22
Intervention* Time: Follow-up 2 (T2)	0.21	0.24	0.86	0.393	−0.27; 0.68

(continued)



Table 2. Continued

	Coefficient	Standard error	<i>t</i>	<i>p</i>	95% CI
Impairments					
Time: Follow-up 1 (T1)	0.37	0.11	3.39	0.001	0.16; 0.59
Time: Follow-up 2 (T2)	0.74	0.22	3.34	0.001	0.31; 1.18
Intervention* Time: Follow-up 1 (T1)	0.13	0.15	0.83	0.407	−0.17; 0.43
Intervention* Time: Follow-up 2 (T2)	0.26	0.32	0.83	0.408	−0.36; 0.88

Notes: ITT = Intention-to-Treat, IUD = Internet use disorders, Time T1 = Follow-up after five months; T2 = Follow-up after ten months; CI = confidence interval. The analysis was adjusted for age, sex, migration background, self-efficacy to change, readiness to change, and the baseline score of each outcome.

Table 3. CACE analyses

Outcomes	Time	Estimated effect	Standard error	Estimated standard error	<i>p</i>
<i>Primary outcome</i>					
IUD criteria	T1	−0.23	0.30	−0.77	0.444
IUD criteria	T2	−0.63	0.50	−1.27	0.205
<i>Secondary outcomes</i>					
Readiness to change	T1	−0.07	0.32	−0.23	0.818
Readiness to change	T2	0.14	0.35	0.40	0.690
Self-efficacy to change	T1	0.79	0.37	2.10	0.036
Self-efficacy to change	T2	−0.16	0.34	−0.48	0.633
Impairments	T1	0.46	0.48	0.95	0.341
Impairments	T2	0.42	0.51	0.81	0.416

Notes: CACE = Complier Average Causal Effect, IUD = Internet use disorders, Time T1 = Follow-up after five months; T2 = Follow-up after ten months. All outcomes were adjusted for age, sex, migration background, mental health (MHI-5), IUD criteria in the baseline telephone interview, readiness to change, and self-efficacy to change.

control group. As displayed in Table 2, compliant participants of the intervention group and potential compliers in the control group did not differ in the reduction of the initial IUD criteria after five months (T1) and ten months (T2).

**Secondary outcomes.** In ITT analyses (Table 2), we could not prove an intervention effect for the assessed secondary outcome parameters. Bayes factor analyses showed inconclusive results for participants' readiness to change (T1  $B = 0.41$ ; T2  $B = 0.70$ ), self-efficacy to change (T1  $B = 0.33$ ; T2  $B = 0.69$ ), and impairments caused by dysfunctional Internet use (T1  $B = 0.53$ ; T2  $B = 0.75$ ). In the additional CACE analysis, compliant individuals of the intervention group showed an improved self-efficacy expectation compared to potential compliers in the control group after five months (T1; Table 3). However, this finding could not be replicated after ten months (T2; Table 3).

## DISCUSSION

The randomized-controlled iPIN-study aimed to investigate the efficacy of motivational brief interventions for AYA with problematic or disordered Internet use. The primary outcome was the reduction of IUD criteria recorded in the baseline interview. Secondary outcomes were the improvement of participants' readiness and self-efficacy to change

their Internet use behavior as well as the reduction of impairments caused by dysfunctional Internet use.

As the main finding of this trial, we could not prove intervention effects for primary and secondary outcome parameters but Bayes Factors were inconclusive. This is in contrast to our a priori hypotheses and previous MI-based pilot studies in the context of IUD (Bottel et al., 2021; Su et al., 2011). The ITT analyses showed that taking part in additional MI-based counseling sessions was not beneficial compared to simply taking part in diagnostic assessments and receiving a brochure on responsible Internet use. Based on the low participation rate in the intervention group and the inconclusive Bayes Factor analysis, we additionally estimated explorative CACE analyses. We found that compliers in the intervention group compared to potential compliers in the control group improved their self-efficacy expectation to change their Internet use behavior at the first follow-up after five months. However, these findings could not be replicated after ten months.

Our findings might be explained by several reasons. First and most important, a large number of eligible participants assigned to the intervention group did not take part in the offered counseling sessions. Despite numerous attempts (e.g., by systematically varying calling times, changing interviewers and counselors, and using heterogeneous contact options via emails and by post) only 63.75% individuals in the intervention group participated at least in one counseling



session. These findings indicate that a significant part of the intervention group saw no need or no perceived benefits for participation. Besides, the telephone-based format might not be perceived as an attractive counseling approach. Overall, these low participation rates have led to statistically underpowered analyses, which is highlighted by inconclusive findings of the Bayes Factor analyses. On average, 1.2 counseling sessions out of three possible counseling sessions were carried out. This is below the average counseling rate of 2.9 sessions in the iPIN pilot study (Rumpf et al., 2021). It should be noted that participants of the iPIN pilot study were slightly older ( $M = 26.3$ ,  $SD = 8.1$ ) and were living in different life circumstances compared to those in the present trial (Rumpf et al., 2021). In the planning of further studies, it should be considered to test other intervention formats which might be more attractive for young individuals and match their needs and interests. For example, telemedical approaches via videoconferencing are usually well accepted by AYA (Grist, Porter, & Stallard, 2017) and may provide a more authentic form of communication and a closer relationship with the counselor. To the best of our knowledge, to date, only one MI-based brief intervention study for young individuals with IUD is yet published (Bottel et al., 2021). Further research is required. In addition, mobile Health (mHealth) interventions via apps or short text messages are usually well accepted by AYA. Their feasibility has already been tested in the prevention of addictive behaviors (Kazemi, Li, Levine, Auten, & Granson, 2021) or for improving young individuals' general health behavior (Badawy & Kuhns, 2017). In addition to the "typical" individual interventions, it should be considered to address environmental risk factors (e.g., the peer group; Lee, Kim, & Lee, 2019). Group elements might also be well accepted and were found to be particularly effective in a non-randomized pilot study aimed to reduce the severity of IGD in young individuals aged 18–29 years (Männikkö, Mustonen, Tanner, Vähänikkilä, & Kääriäinen, 2021). Nevertheless, further robust and methodically good studies evaluating the efficacy of such interventions in the context of IUD are needed (Grist et al., 2017). Offering counseling sessions for individuals with IUD via mHealth approaches may sound paradoxical at first. However, those affected usually spend a lot of time online, which facilitates the initial contact in a low-threshold way.

A second potential reason for the lacking prove of evidence may rely on the low inclusion criteria. In the present trial, participants fulfilling at least two IUD criteria in the baseline interview were randomized to the intervention or control group. This sensitive cut-off was consciously chosen to include all individuals with problematic or even disordered Internet use. However, this procedure could have led to the inclusion of participants whose Internet use does not impair their daily life. Thus, several participants assigned to the intervention group might have not seen the need for taking part in the counseling. Furthermore, these findings further highlight currently existing difficulties when analyzing validity criteria of existing screening and diagnostic procedures for IUD. Recent research found that some commonly used screening instruments tend to overpathologize daily behavior

patterns of young individuals that do not necessarily have a negative impact on daily life (King, Billieux, Carragher, & Delfabbro, 2020). Moreover, the DSM-5 approach has been criticized to include criteria that are not of clinical relevance and, thus, may lead to overpathologization of daily behavior patterns (Billieux, Flayelle, Rumpf, & Stein, 2019; Brand, Rumpf, King, Potenza, & Wegmann, 2020; Castro-Calvo et al., 2021).

Finally, also the control group received a comprehensive assessment including a proactive screening in the classroom via tablet, an in-depth diagnostic interview, and two follow-up interviews after five and ten months. Besides, the control group received a brochure on responsible Internet use. Despite not taking part in any counseling session, participants in the control group decreased significantly the IUD criteria over time. The inducted thoughtful examination of the own Internet use behavior as part of intensive diagnostic assessments may have already led to behavioral changes. This phenomenon is also known as the "Hawthorne effect" (Sedgwick & Greenwood, 2015). Besides, this finding is in line with a previous meta-analysis highlighting the impact of comprehensive assessments in the process of health-related behavioral changes, particularly among young individuals (McCambridge & Kypri, 2011). All of these potential explanations for the lacking prove of evidence still need to be tested in a separate randomized-controlled trial with a sufficient powered sample.

### Limitations and strengths

Several limitations should be addressed. Based on the inconclusive Bayes Factors, it can be assumed that the ITT analysis was statistically underpowered due to the low participation rate in the intervention group. Therefore, an explorative CACE analysis was additionally performed. However, it should be noted that the methodological strength of a randomized-controlled trial is limited. The results of the CACE analysis should be regarded as non-randomized, observational comparisons. Besides, the individual steps and the change of modes in the study process (face-to-face and tablet in the classroom, telephone for the in-depth interview, the intervention, and both follow-ups) might have led to losses and reduced acceptance. A more uniform mode of communication might offer several advantages. Despite a broad selection of different locations, the inclusion of both rural and urban vocational schools, different focal points of the vocational schools, and different grades and branches, it cannot be guaranteed that it is a representative selection of all vocational school students in Schleswig-Holstein and Hamburg. Despite a school cluster effect cannot be fully ruled out, the intervention took part at the individual level and was independent of the school context. Despite the above-mentioned limitations and to the best of our knowledge, this is the first study worldwide analyzing the efficacy of a low-threshold prevention approach for AYA with problematic or disordered Internet use with an evidence-based counseling approach in a randomized-controlled design.

## Conclusion

To date, studies on brief interventions for individuals with IUD are rare and limited by several methodical problems (e.g., lacking control groups or insufficient follow-ups). Therefore, the iPIN study aimed to investigate the efficacy of motivational brief interventions for vocational students with IUD in a randomized-controlled trial. As the main finding, we conclude that a brief telephone-based approach seems inappropriate to address AYA with IUD. Low participation rates in the intervention group caused statistically underpowered analyses. Low inclusion criteria, intensive assessments, and the brochure in the control group may have further contributed to the lacking proof of efficacy. In the light of inconclusive results of Bayes factor analyses, the efficacy of such brief interventions under the condition of higher participation rates and sufficiently powered sample sizes cannot be fully ruled out. In general, brief interventions aim to lower the costs of treatment and barriers for seeking help. In addition, such preventive interventions via telemedical or mHealth approaches may help to reach individuals in a low-threshold manner, which could strengthen particularly the outreach to those living in structurally weak areas. Further studies might consider to test other forms of communication. Besides, inclusion criteria should be set higher. This might help to avoid possible ground effects and underpowered statistical analyses caused by low participation rates. To provide information on how to improve brief interventions and how to tailor them to individual needs, qualitative studies of non-responders in the intervention group or comparable samples might be helpful. Following the controversial discussion on the conceptual framework (IUD as an umbrella construct versus problematic use of specific Internet applications), it should be investigated whether there is a need for specific interventions, dependent on the main Internet activity. To increase the acceptance, the target group should already be involved in the development of such brief interventions and may continuously support the implementation process. Under consideration of the limitations and implications of this study, further studies are needed to improve brief intervention approaches for AYA with IUD.

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and interpretation of the findings, supervision of the MI-intervention, revision of the manuscript. BB, SO: Study concept and design, conduction of telephone-based diagnostic interviews, revision of the manuscript. AT: Recruitment of vocational schools, data gathering in vocational schools, conduction of MI-based interventions, revision of the manuscript. SS, SB: Conceptual support, revision of the manuscript. HJR: Principal investigator, study concept and design, obtained the conduction of the study, statistical analyses and interpretation of findings, revision of the manuscript.

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