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Systematic reviews and meta-analyses of treatment interventions for Internet use disorders: Critical analysis of the methodological quality according to the PRISMA guidelines

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REVIEW ARTICLE



ABSTRACT

Rationale: As a result of concerns about predominantly online behavioral addictions, an increasing number of systematic reviews and meta-analyses (SRMA) of treatment interventions for internet use disorders (IUD) are being recorded. This review was designed to (a) systematically identify the evidence base of SRMA and to (b) critically appraise the quality of reporting according to the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)* guidelines. **Methods:** Four databases were searched until August 2022 to systematically identify SRMA. PRISMA indicators were evaluated on a three-level response format to obtain an overall score operationalizing the quality of reporting (score range: 0–84). Additionally, the percentage of adherence to the PRISMA indicators was calculated. **Results:** Reporting quality of 23 SRMA, comprising 12 systematic reviews and 11 meta-analyses was evaluated. Quality scores ranged from 25 to 77 (M: 52.91; SD: 17.46). Results of the critical appraisal revealed deviations from the PRISMA indicators, including missing information on (a) registration of a study protocol, (b) statistical synthesis methods (c) evaluation of certainty of evidence, and (d) risk of bias assessment. Eleven (47.83%) of the SRMAs partially adhered, and twelve (52.17%) completely adhered to the PRISMA indicators. **Conclusion:** This first critical appraisal on the reporting quality of SRMA on treatment interventions for IUD highlights limitations of the evidence base. Inadequate reporting compromises the practical utility and validity of SRMA and may complicate ongoing efforts of consensus on evidence-based interventions for IUD. Future research should focus on sufficient and transparent reporting of the methodological approach.

KEYWORDS

Internet use disorder, SRMA of treatment intervention for IUD, evaluation of reporting quality

INTRODUCTION

Digital features and technologies may constitute the development of behavioral addictions, which can lead to significant impairments of psychosocial functioning and widespread negative consequences (Geisel, Lipinski, & Kaes, 2021; Paschke et al., 2020). Although pathological internet use is not a separate clinical entity in the *International Classification of Diseases 11th Revision (ICD-11)* and the 5th version of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*, excessive behaviors with pathological character were explicitly included in the latest editions of the diagnostic classification systems (American Psychiatric

The headings of Table 1. were rectified at the time of issue publication.

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Association, 2013; World Health Organization, 2019). In DSM-5, the previous section ‘*substance-related disorders*’ was expanded to incorporate behavioral addictions and related disorders. This section includes disorders due to exclusively or predominantly online behaviors, as well as exclusively or predominantly offline behavioral addictions. Further, based on expert appraisal, *Internet Gaming Disorder (IGD)* was included in Section III of the DSM-5 in 2013 as a condition warranting further clinical research (American Psychiatric Association, 2013). The DSM-5 criteria of IGD are: An extensive engagement with online video/computer games, progressive inability to control usage accompanied by development of tolerance and withdrawal symptoms, increasing prioritization of gaming to the neglect of alternative activities, anhedonia, continued overuse despite presence of aversive consequences, deception of others regarding the (temporal) scope, playing online video/computer games to relieve aversive emotions, and significant impairment of functioning in personal, occupational, and socio-familial contexts, respectively (Falkai, Wittchen, & Döpfner, 2018). Despite, behavioral addictions related to online shopping, online pornography, and social networking platforms (Müller et al., 2019) appear to be of comparable clinical relevance (Brand, 2021; Montag, Wegmann, Sariyska, Demetrovics, & Brand, 2021). To summarize behavioral addictions that refer predominantly to online use patterns, the umbrella term *Internet use disorders (IUD)* has been proposed (Rumpf et al., 2021). Although, diagnostic criteria for other manifestations of IUD are lacking to date (American Psychiatric Association, 2013; World Health Organization, 2019), the inclusion of IGD in the clinical nomenclature emphasizes the recognition of predominantly online behavioral addictions as a public health concern for which evidence-based treatment interventions are required (Kuss & Billieux, 2017; Rumpf et al., 2021; World Health Organization, 2019).

As a result of concerns about widespread impairments associated behavioral addictions related to the use of internet applications, there has been an increasing amount of research activity regarding treatment interventions. Systematic reviews and meta-analyses (SRMA) are an indispensable tool of evidence-based medicine, they should serve as a helpful resource for the development of treatment guidelines and should provide a robust, valid synthesis of the empirical evidence on a specific health care topic according to established methods (Ioannidis, 2016; Shea et al., 2017). Regardless of the methodological claims, some of the available evidence syntheses of psycho-social interventions appear redundant, misleading or inadequate in terms of reporting quality, especially regarding to completeness, objectivity, and transparency (Ioannidis, 2017). A deficient quality of reporting diminishes the practical utility and the assessment of the validity of SRMA (Niforatos, Weaver, & Johansen, 2019; Shea et al., 2017; Stevens, King, Dorstyn, & Delfabbro, 2019), as systematic reporting is essential to prevent the dissemination of unclear data and avoid inappropriate conclusions. Even though evidence syntheses could have profound implications for intervention implementation and evaluation of systematic approaches

largely dependents on transparent and complete reporting, the quality of reporting among SRMA has rarely been analyzed (Niforatos et al., 2019; O’Kelly, DeCotiis, Aditya, Braga, & Koyle, 2020). This represents a gap in research which may hamper ongoing efforts to reach consensus on evidence-based intervention modalities for the treatment of IUD.

OBJECTIVE

Given the increasing number of SRMA and the potentially inadequate quality of reports, there is an urgent need to critically appraise the condensed evidence base of treatment interventions for IUD. The objectives of this review are therefore to

- (a) systematically identify SRMA of treatment interventions for IUD in order to
- (b) evaluate the quality of reporting according to the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)* guidelines (Page et al., 2021).

Conducting a critical analysis, capturing limitations related to the quality of reporting, provides important insights for research on treatment interventions for IUD. In addition, the systematic review of pertinent SRMA provides an opportunity to highlight existing heterogeneities in outcome measures, treatment modalities, and types of intervention studies included, and to examine which manifestations of IUD require further research. Note that this review did not aim to investigate the effectiveness of treatment interventions for IUD.

METHODS

Study design

The methodological-scientific procedure was designed in accordance with the *PRISMA Extension Guideline (PRISMA-ScR)* (Page et al., 2021; Tricco et al., 2016; Tricco et al., 2018), and the checklist is provided in [Figure S1 in Supplementary Material 1](#). A review protocol that includes title, objective, search strategies, study selection criteria, type of synthesis and data extraction was registered a priori on the PROSPERO platform (PROSPERO-ID: CRD42022313035).

Eligibility criteria and study selection

To systematically identify SRMA of treatment interventions for IUD the following inclusion and exclusion criteria were defined a priori (Higgins & Green, 2008).

Population: SRMA on treatment interventions for IUD, including subclinical manifestations (excessive/problematic/pathological behaviors), were incorporated, applying search terms such as internet addiction, without restrictions regarding age and gender of those affected. Based on the proposal of Rumpf et al. (2021), the following other specified disorders due to addictive behaviors were included along



with IGD: Social networking use disorder (online), pornography use disorder (online), and shopping disorder (predominantly online). Rationale for this is the variety of terms used internationally to describe online behavioral addictions and the synonymous definition of IUD and IGD in the research literature (Chang, Chang, Yang, & Tzang, 2022; Rumpf et al., 2021). Although, it should be noted that IUD is not an established diagnosis and therefore the term ‘diagnosis’ used in this review is an abbreviation in full recognition of its provisional status and not an assumption or endorsement of its legitimacy. SRMAs focusing on participants diagnosed with behavioral addiction unrelated to the use of an internet application (e.g. offline gaming) or participants with other manifestations of addictions (e.g. substance-related disorders).

Intervention(s): Treatment intervention was defined as the provision of one of the services specified below to participants diagnosed with IUD or subclinical manifestations. The following treatment interventions in the outpatient/(partial) inpatient setting in an offline or an online format were incorporated, with no restrictions on context or country of implementation: Therapy, treatment, guided self-help, cognitive behavioral therapy, pharmacology, psychoanalytic, psychodynamic, interpersonal psychotherapy, training, program. SRMAs were excluded if they involved mainly preventive approaches, they did not primarily address IUD, or they included predominantly neurocognitive interventions.

Comparison: SRMA including primary studies with and without control conditions (randomized/non-randomized controlled trials, randomized/non-randomized cluster trials, prospective cohort studies with/without control groups, prospective cross-sectional studies with/without control groups and pre-post-intervention trails with/without control groups) were integrated, as no restrictions were determined.

Outcome: SRMA assessing effects of interventions on the severity of IUD symptomatology and/or subclinical manifestations primarily using validated survey methods and instruments were incorporated.

Study design: SRMA fulfilling a minimum of mandatory criteria and reporting the following information were included: Research question, sources that were searched, reproducible search strategy, inclusion and exclusion criteria, selection (screening) methods, data analysis methods and type of synthesis (Krnjic Martinic, Pieper, Glatt, & Puljak, 2019). Non-systematic approaches without plausible methodology (e.g. primary studies, opinions, commentaries, letters or editorials, dissertations, theses, policy papers, or institutional reports) were excluded, as were study protocols, since these do not contain any data.

Literature search

The lack of consistent diagnostic classification criteria for manifestations of IUD has led to taxonomic problems, synonymous definitions and inconsistencies in research literature (Kuss & Billieux, 2017; Montag et al., 2021; Rumpf et al., 2021). Behavioral addictions in the context of the use of internet applications were frequently described under the

term *Internet Addiction*, which was introduced for over 20 years by Young (1998) and Griffiths, respectively (1998). Subsequently, a variety of terms for IUD have been used internationally. Considering this heterogeneity, a comprehensive search strategy was developed based on key words identified in a scoping search of pertinent SRMA. The syntax is presented in Table S1 in Supplement Material 2. The search strategy was then tailored to each database. A computer database search of PubMed, PubPsych, PSYINDEX, and MEDLINE was conducted. The first search was performed on January to May 2022, to maximize the chances that all relevant reviews are included, search was re-run on August, 2022. Supplemental reference lists of the included SRMA were manually consulted. Search and selection processes were not blinded and were limited to peer-reviewed studies published in German or English, while no restrictions were defined regarding the year of publication.

Identified SRMA were screened for relevance in a two-stage, criterion-guided evaluation process consisting of an initial assessment based on title and abstract and an in-depth review with full-text analysis. One reviewer conducted the selection process in its entirety (LB), and three independent reviewers checked the decisions (HS, KW, MD). Inconsistencies and ambiguities were resolved through discussion with the three independent reviewers. SRMA not meeting the inclusion criteria were excluded.

Data extraction

Data extraction was performed using a predefined coding scheme to maintain consistent extraction of accurate data across the included SRMA (Büchter, Weise, & Pieper, 2020). The primary studies included in the SRMA were reviewed for relevance, but no data were extracted from the original studies. The full texts of the included SRMA served as foundation for data extraction. The following data deemed relevant to the review question were extracted: First author, date of publication, primary study characteristics (publication date range, number of primary studies included, number of Databases searched), objective, sample characteristics (number of participants included, age range, and sex ratio of subjects), intervention characteristics (type of intervention(s), assignment, and type of approach), type of synthesis, and results. Data extraction was performed by one reviewer (LB), a review of the extracted data was performed by the three independent reviewers (HS, KW, MD). If data were considered insufficient, supplement files and appendices were reviewed. Extracted data were summarized in table form, but no attempt of quantitative synthesis was made.

Quality appraisal and data synthesis

For the critical appraisal on the reporting quality of SRMS the expanded checklist of the PRISMA guidelines was applied (Page et al., 2021). The PRISMA statement was published in 2009 in order to provide a reporting guidance for systematic reviewers (Liberati et al., 2009; Moher, Eastwood, Olkin, & Rennie, 2000). Due to advances in the



systematic review methods used to identify, select, evaluate, and synthesize primary studies, a required update was published in 2020. The PRISMA 2020 statement include an explanation and elaboration, a flow diagram as well as a checklist comprising 7 sections with 27 indicators, of which some include sub-items (Liberati et al., 2009; Page et al., 2021). Information on the methodological approach according to the PRISMA guidelines promote transparent, complete, and accurate reporting quality as a basis for valid, evidence-based decision making (Page et al., 2021). To measure the quality of reporting, each item of the 27 PRISMA indicators was evaluated on a three-level response format (the assessed criterion is not met completely = 0 points, the assessed criterion is partially met = 1 point, the assessed criterion is explicitly met = 2 points). The assignment of 0–2 points for each of the 42 items resulted in a sum score that ranged from 0 to 84 points. In cases where a criterion is not considered due to inherent limitations of the study design the criterion was scored as 0 points. One reviewer evaluated the SRMA to be included (LB) with the help of three independent reviewers (HS, MD, KW). Disagreements were resolved through discussion. Scores of the critical appraisal were synthesized as follows: For each review, the single scores of the 42 items of the PRISMA indicators were summed up to calculate an overall score. This score operationalizes the quality of reporting, with a higher score indicating higher compliance with the methodical standards of the PRISMA guidelines. Further, the percentage of adherence to the PRISMA indicators was calculated for each of the PRISMA items and for each of the included SRMA. Adherence to PRISMA indicators was classified as complete ($\geq 90\%$ of PRISMA items were fully reported) or partial ($\leq 60\%$ of PRISMA items were fully reported), based on the categorization proposed in a recent review by Frost, Hróbjartsson, and Nejtgaard (2022).

Changes from protocol

Due to the ongoing controversial debate on the taxonomy of predominantly online behavioral addictions, a subsequent adjustment of the terminology used in this review was made. *Internet-related disorders* have been renamed to *Internet use disorders* in order to in order to promote a homogeneous nomenclature for online behavioral addictions (Rumpf et al., 2016, 2021; World Health Organization, 2019). Criteria for inclusion or exclusion of SRMA were expanded to maximize the chances that all relevant reviews are identified in this analysis. Consequently, the search strategy has been adapted to expand the syntax.

Ethical approval

Ethical approval was not required as no individual patient data were collected.

RESULTS

A summary of the search and selection process is visualized in Fig. 1. A total of 80 citations were identified on PubMed,

while 187 citations were registered searching the databases PubPsych, PSYINDEX, and MEDLINE. The update of the database search on 08/2022 led to 2 further inclusions, and additionally 8 records were found searching reference lists of relevant SRMA and the S1 core data set for the development of practical treatment guidelines. The identified records were exported in Microsoft Excel[®] for further steps and duplicates ($k = 87$) were removed. Based on screening titles and abstracts ($k = 188$ studies), incorporate records were excluded ($k = 76$), while 4 records were excluded due to the language. The full-texts of 108 articles were assessed for eligibility. During full-text review, 85 records were excluded for various reasons. The three most common reasons were that the studies (a) analyzed (psychopathological) correlates of IUD ($k = 26$), (b) had a deviant focus in terms of content ($k = 15$), and (c) focused on deviant (behavioral) addictions ($k = 14$ studies). A reference list of excluded records is presented in Table S5 in Supplementary Material 3.

Executive summary of the included studies

Considering a priori defined inclusion and exclusion criteria, 23 SRMA were incorporated for the evaluation of the quality of reporting. These include 12 systematic reviews and 11 meta-analyses of treatment interventions for IUD. Studies that conducted both a descriptive and meta-analytic synthesis were categorized as meta-analyses (e.g. Kim & Noh, 2019). An average of 3.83 databases (SD: 2.20) were searched in the respective systematic reviews (range: 1–6), while meta-analytic approaches browsed an average of 5.91 platforms (SD: 2.50; range: 3–11). Systematic reviews reporting on 333 primary studies, while a series of 352 primary studies were meta-analytic synthesized. Characteristics of SRMA included are provided in Table 1, a comprehensive display of the data extracted is provided in Table S2 in Supplementary Material 2, as a narrative overview would go beyond the scope of this review. Data related to the research question (population, intervention, comparison, outcome, and study design) are presented below.

Participants

The population considered in this review were individuals with IUD or subclinical manifestations. Along with IGD, the following other specified disorders due to addictive behaviors were included: Social networking use disorder (online), pornography use disorder (online), and shopping disorder (predominantly online).

Among the systematic reviews a total of 16,487 participants were included, while sample sizes ranged from 115 (Lam & Lam, 2016) to 5,525 participants (Kuss & Lopez-Fernandez, 2016). Participants age ranged from 8 years to a maximum of 67 years. Four systematic reviews reported data on the percentage of female participants in the sample. Kuss et al. (2021) reported for participants diagnosed with generalized internet addiction a range of 10.3–60.9% percent, while 0–20% percent of the participants with an IGD and 0% of participants with an online pornography addiction were female. The percentage of women was also



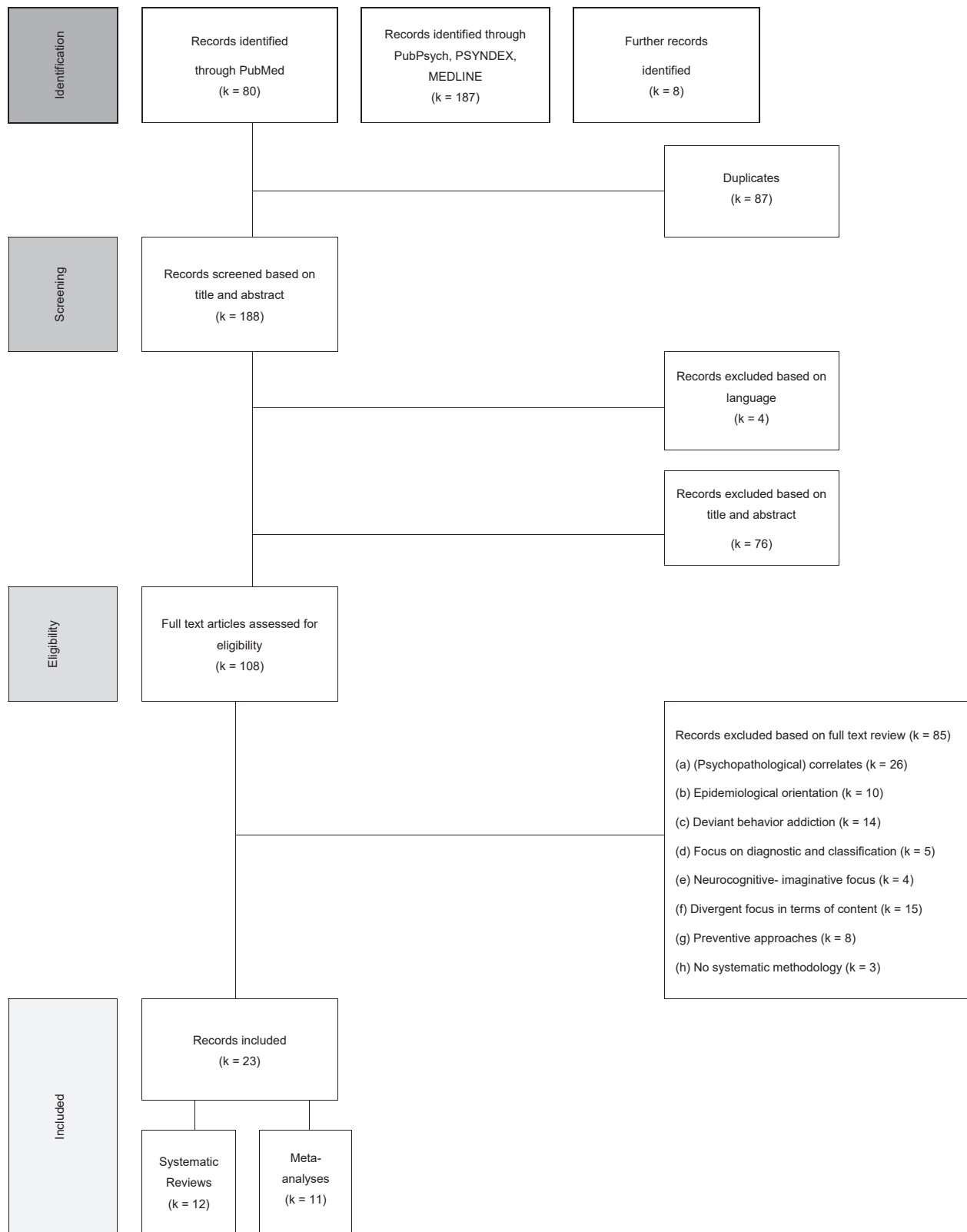


Fig. 1. PRISMA flow chart of the literature search and selection process

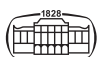




Table 1. Characteristics of systematic reviews and meta-analyses

Year	Autor	Disorder	Studies	Study design	N	Age	Intervention	Studies	Outcome	Outcome measurement
Systematic reviews										
2011	King, D. L.	IA/IGD	8	No restrictions	435	adolescents – adults	CBT MI PM RT MCP O	2 1 2 1 1 1	IA/IGA status	BASIS-32; CIAS; IAT; IOSRS; K-IAS; OTIS; YDQ; YIAS; YIAS-K; DSM-IV
2014	King, D. L.	IGD	36	No restrictions	412	adolescents – adults	CBT CTM	3 5	Cognitions related to IA	K-IAS; YIAS; YDQ; YIAT; OGCSBDQ; IOSRS; CDS
2014	Lemos, I. L.	IA/IGD	23 *13	No restrictions	541	adolescents – adults	CBT CBT-based	10 3	IA/IGD status	IAT; LSAS; IAD; CIAS; OTIS; PVGPS; SCID: The Structured Clinical Interview for DSM-IV
2016	Kuss, D. J.	PIU/IA	46 * 21	No restrictions	5,525	children – adults	PM PT CHT	5 10 6	IA status	CIAS; CIU; DC-IA-C; IAT; K-IAS; OCS; QGU-B; SCID; YIAS; YIAS-K; AICA-C; AICA-S; IA criteria from Young (1998)
2016	Lam, L. T.	PIU/IA	3	No restrictions	115	university students – adults	O	3	PIU/IA status	YDQ; YIAS; K-SAS
2017	Zajac, K.	IA/IGD	26	Randomized or non-randomized or pretest-posttest trials	1,307	children – adults	CBT CBT-based Other types PM FT	4 6 7 6 3	Severity of IA/IGA, duration of gaming/ internet use	AICA-C; AICA-S; APIUS; BDQ; CIA; IA; IADQ; IAT; IC-IUD-YBOCS; IOSRS; K-IAS; OCS; SKYPSA;
2017	King, D. L.	IA/IGD	30	No restrictions besides exclusion of case report studies	1,880	children – adults	PT O PM Other types	21 3 5 1	IA/IGA status	IAT; YDQ; AICA-S; APIUS; CIAS; CBS; IC-IUD-YBOCS; IGAT; IOSRS; IUHDS; K-IAS; KSAPS; OGCAS; OTIS; YIAS; YBOCS; YIAS-K
2019	Costa, S.	IGD	28 * 18	No restrictions	640	n.r.	CBT-based PM Other types	6 5 7	IGD status	IAT; CIAS; AICA-S; GASA; PVGPS; CERV; IGD-20 Test; C-VAT 2.0; VAT; IGDS-SF; IGD checklist; IGWS; semi-structured clinical interviews with the nine proposed DSM-5 criteria

(continued)

Table 1. Continued

Year	Autor	Disorder	Studies	Study design	N	Age	Intervention	Studies	Outcome	Outcome measurement
Systematic reviews										
2019	Zajac, K.	IGD	22	Randomized or non-randomized or pretest-posttest trials	888	children – young adults	CBT-based	8	IGD symptom severity, time spend online	CIAS; DQVMIA; GASA; GAST; IAS; OGCAS; PVP; YIAS; SCID-I
				No restrictions	1,976	children – adults	PM	7		
							PT	7		
2021	Kuss, D. J.	GIA/IGA/OGA/OPA/OA	64 * 23	No restrictions	1,976	children – adults	MP	5	no outcome variable defined for narrative synthesis	APIUS; IAT; YDQ; K-Scale
							CBT	10		
							Other types	1		
							ACT	1		
							PM	1		
							Combined I	2		
							MFB	2		
							ABMET	1		
2021	Xu, L. X.	IA	31	Randomized or non-randomized or pretest-posttest trials	1,652	children – adults	CBT	9	IA symptom severity	AICA-C; AICA-S; APIUS; CIAS; DQVMIA; DSM-5; GAS; IAD-DQ; IADQ; IAS; IAS- CR; IAT; K-scale; POGUS; YDQ; YIAS
							FT	3		
							RT	2		
							CBT-based	1		
							CBI	4		
							Combined I	10		
2022	Lampropoulou, P.	IGD	16	No restrictions besides exclusion of studies with sample sizes <10	1,116	children – adults	CBT	3	IGD symptom severity	APIUS; CIAS; CIUS; CSAS-PR; CSAS-SR; DQVMIA; GASA; GAST; IAS- CR; KSAPS; OGCAS; SKYPSA; YIAS
							CBT-based	2		
							FT	5		
							PT	4		
							PM	2		
Meta-analyses										
2013	Winkler, A.	IA	16	Randomized-controlled trials, intergroup comparison and intragroup change designs, observational studies	670	children – adults	CBT	4	IA status, time spend online	CIAS; YDQ; IC-IUD-YBOCS; IOSRS; YIAS; YIAS-K; CFPS; IAS; K-IAS; OTIS; CIUS; IASS
							ACT	1		
							MCP	7		
							RT	1		
							PT	3		
2016	Yeun, Y. R.	IA	37	Randomized-controlled trials, non-randomized controlled trials and controlled before-after studies	1,490	school-age children	CBT	2	IA status	K-Scale; YIAS; IGAS
							CBT-based	1		
							AT	3		
							MT	1		
							GCP	8		
							SCI	5		
							Family-based	2		
							RT	2		
							IT-based	10		
							MI	1		
							Other types	2		

(continued)





Table 1. Continued

Year	Autor	Disorder	Studies	Study design	N	Age	Intervention	Studies	Outcome	Outcome measurement
2017	Chun, J.	IA	70	Experimental studies with pre- and post-test analyses and control groups	n.r.	adolescents	CBT RT AT MI IT-based SFT Other types n.r.	12 8 6 4 4 2 7 27	Severity of IA	n.r.
2017	Liu, J.	IA	58	Randomized-controlled trials	2,871	adolescents – adults	GCP CBT-based Sport-based	30 15 13	Severity of IA	YIAS; YDQ; CIAS-R; CIAS; KIAS; APIUS; IOSR; IAS
2019	Liu, S.	SA	9	Randomized-controlled trials	1,582	young adults	E CE	3 6	SA status	MPATS; MPAI; SAS-C
2019	Kim, S.	IA/IGD	11	A least quasi-experimental design	658	young adolescents – adults	CBT Family-based CP	6 2 3	Severity of IA	IOSRS; YIAS; K-IAS; OGSC; APIUS; CIAS; AICA-S; CIUS; IADC; IAT
2019	Malinauskas, R.	IA/SA	6	Randomized-controlled trials	305	adolescents	CBT-based Other types MP	3 1 2	Severity of IA-related symptoms (incl. IGD and SA)	IOSRS, YIAS; PIUS; SAS; IAS; BSMAS
2019	Stevens	(I)GD	12	At least (quasi-) experimental design	580	young adolescents – adults	CBT-based	12	(I)GB status	AICA-S; CIAS; IAS; IAT; IOSRS; PLC-J; YDQ; YIAS
2020	Goslar, M.	IA	91	Randomized, or quasi-randomized-controlled trails	IA : 2,427.00	young adults	CBT-based PT PM Combined I	24 19 6 6	Severity of IA, frequency	AICA; APA; APIUS; CIA-G; CIA-Y; CIAS; CIAS-R; CIUS; DQVMIA; GASA; GAST; IADQ; IAT; IC-IUD-YBOCS; IOSRS; IRQ; IASS; K-IAS; KSAPS; MSA; OCS; PIUQ; PIUS; PVGPS; S-MAT; YDQ; YIAS; YIAS-K
2021	Augner, C.	PIU/PSU	13	At least (quasi-) experimental trials with control groups	1,439	adolescents – adults	CBT-based SIA MFB EP	5 5 2 2	PIU-/PSU-related symptom severity	MPIAS; SAPS-A, K-SAPS; Korean Smartphone Addiction Proneness Scale; BSMAS; CIAS; IOSRS; APIUS; K-Scale; CIUS; K-IAS; YDQ; IAS-A

(continued)

Table 1. Continued

Year	Autor	Disorder	Studies	Study design	N	Age	Intervention	Studies	Outcome	Outcome measurement
2022	Chang, C.-H.	IA/IGD	29	Randomized-controlled trails	5,601	children – young adults	CBT-based SFT PM MCP Combined I Others	8 1 4 5 8 4	Severity of IA, time spent online	CIAS; CIAS-R; CGAI; AICA-C; IC-IUD-YBOCS; IAD; IADQ, YDQ; YIAS-K; IOSRS; CIUS, SIUS; IAT; APIUS; TMDS; SI

Assignment EC: Experimental Group; CG: Control Group.

Approaches I: Individual approach; G: Group approach; I/G: Combined group/individual approach; Singl. I: Single-type intervention approach; Two type I: Two type Intervention approach.

Treatment model ACT: Acceptance and Commitment Therapy; ABMET: Group activity-based Motivational Enhancement Therapy; AT: Art Therapy; CBI: Craving Behavioral Intervention; CBT: Cognitive Behavioral Therapy; CE: Combined Exercise Intervention; CHT: Comprehensive Therapy; Combined I: Combined Intervention; CP: Counseling Program; CTM: Cognitive Therapy based Module; E: Exercise Intervention; EP: Educative Programs; FT: Family Therapy; GCP: Group Counseling Program; IT: Integrative Therapy; MCP: Multi-level Counseling Program; MP: Multi-behavior/-level Program; MFB: Mindfulness-based intervention; MI: Motivational Interviewing; MT: Music Therapy; O: Online Intervention; PM: Pharmacotherapy; PT: Psychological Therapy; RT: Reality Therapy; SCI: Self Control Intervention; SFT: Solution-focused therapy; SIA: Systemic Intervention.

Internet use disorders IA: Internet Addiction; GIA: Generalized Internet addiction; IGD: Internet Gaming Addiction; IUD: Internet Use Disorder; SA: Smartphone Addiction; OPA: Online Pornography Addiction; OSA: Online Social Media Addiction; CB: Compulsive buying; OGA: Online Gambling Addiction.

Outcome measurements AICA-C: Checklist for the assessment of internet and computer game addiction; AICA-S: Scale for the assessment of internet and computer game addiction; APIUS: Adolescent Pathological Internet Use Scale; BASIS-32: Behavioral and Symptom Identification Scale; BDQ: Beard's Diagnostic Questionnaire for Internet Addiction; BSMAS: Bergen Social Media Addiction Scale; C-VAT: Clinical Video game Addiction Test; CBS: Cyber Behavior Scale; CDS: Cognitive Distortions Scale; CERV: Video Game-Related Experiences Questionnaire; CFPS: craving to play Starcraft (self-report on a 7-point analogue scale); CIA-G: Chinese version of the assessment tool based on Goldberg's framework; CIA-Y: Chinese version of Young's Internet Addiction Scale; CIAS: Chinese Internet Addiction Scale; CIAS-R: Chinese Internet Addiction Scale, revised; CIUS: Compulsive Internet Use Scale; CGAI: Computer Gaming Addiction Intervention; DC-IA-C: Diagnostic criteria of internet addiction for college students; DQVMIA: Diagnostic Interview for video games, mobile phone, or Internet Addiction (based on the DSM-5 criteria for Internet Gaming Disorder); GASA: Game Addiction Scale for Adolescents; GAST: Game Addiction Screening Test; HOSC = Healthy Online Self-Helping Center; IA = Internet Addiction; IAD: Internet Addiction Disorder self-rating scale; IADQ: Internet Addiction Diagnostic Questionnaire; IAS-A: Adolescent Internet Addiction Scale; IASS: Internet addiction self-rating scale; IAT: Young Internet Addiction Test; IC-IUD-YBOCS; Impulsive-compulsive Internet usage disorder Yale-Brown Obsessive Compulsive Scale; IGAT: Internet Game Addiction Test; IOSRS: Internet Overuse Self-Rating Scale; IGD: Internet Gaming Disorder Checklist; IGD-20 Test: Internet Gaming Disorder Test; IGDS-SF: Internet Gaming Disorder Scale-Short Form; IGWS: Internet gaming withdrawal scale; IRQ: Internet related questionnaire; IUHDS: Internet Use Habit Diagnosis Scale; Korean Version; K-IAS: Korean-Internet Addiction Scale; K-Scale: Korean Internet addiction self-diagnosis test; K-SAPS: Korean Smartphone Addiction Proneness Scale; MSA: Mobile Phone Internet Addiction Scale; MPATS: Smartphone addiction tendency scale; MPIAS: Mobile Phone Internet Addiction; Scale MPAL: Smartphone addiction index scale; SAS-C: Smartphone addiction scale for college students; OCS: Online Cognition Scale; OGCS: Online Gaming Cognition Scale; OTIS: Orzack time intensity survey; PIUQ: Problematic Internet Use Questionnaire; PIUS: Problematic Internet Use Scale; PSU: The Korean Smartphone Addiction Proneness Scale; PVGPS: Problem Video Game Playing Scale; QGU-B: Questionnaire on gaming urge-belief; SAS: Youth Smartphone Addiction Self-report Scale; SCID: The Structured Clinical Interview for DSM-IV; SI: Severity of internet use; SIUS: Self-Rating Internet Use Scale; SKYPSA: Scale of Korean Youth Proneness to Smartphone Addiction; S-MAT: Social Media Addiction Test; SAPS-A: Smartphone Addiction Proneness Scale for Adults; TMDS: Time Management Disposition Scale VAT: Video Game Addiction Test; YDQ: Young's Diagnostic Questionnaire for Internet Addiction; YIAS: Young's Internet Addiction Scale; YIAS-K: Young's Internet Addiction Scale, Korean version; YIAT: Young's Internet Addiction Test.

Additional measurement tools Proposed Internet addiction criteria from Young (1999) and Beard (2001); semi-structured clinical interviews with the nine proposed DSM-5 criteria.

Other terms*: treatment condition; n.r.: Not reported.



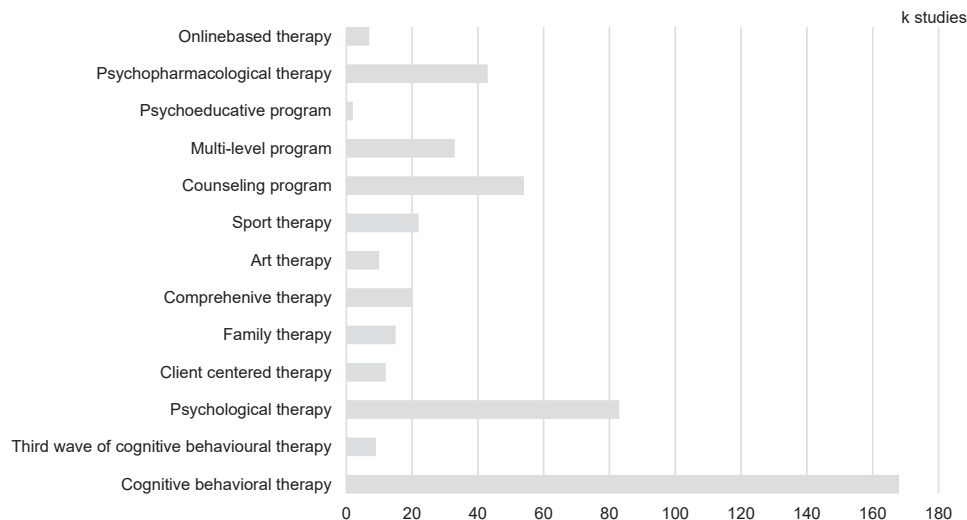


Fig. 2. Distribution of primary research by intervention type and theoretical alignment

less than 50% in the remaining research studies that provide data (King et al., 2011; King et al., 2017; Lam & Lam, 2016).

Across meta-analytic syntheses, a total of 18,727 participants¹ were included with sample sizes ranging from 305 (Malinauskas & Malinauskiene, 2019) to 5,601 participants (Chang et al., 2022). The age of participants ranged from 8 years to 56 years, with 5 studies examining a particular age cohort such as young adults aged 18–22 years (Liu, Xiao, Yang, & Loprinzi, 2019). Meta-analyses also provided insufficient information on the proportion of female participants, with 5 syntheses reporting less than 50% female (Goslar, Leibetseder, Muench, Hofmann, & Laireiter, 2020; Kim & Noh, 2019; Malinauskas & Malinauskiene, 2019; Stevens et al., 2019; Winkler, Dörsing, Rief, Shen, & Glombiewski, 2013).

Intervention

Treatment interventions for IUDs were incorporated, with no restrictions on setting, context or country of implementation. In most of the SRMA included multiple forms of interventions were synthesized. Among the systematic reviews, 2 researches focused on cognitive behavioral therapy (CBT) interventions (King & Delfabbro, 2014; Lemos, Abreu, & Sougey, 2014), while Lam and Lam (2016) focused on online interventions for problematic internet use. Setting information was reported in 11 systematic reviews, of which 115 were individual approaches, 87 were group approaches, and 9 were combined approaches with individual and group elements.

Regarding the meta-analyses, Stevens et al. (2019) focused on the effectiveness of CBT-based intervention exclusively, while Liu et al. (2019) investigated the effects of exercise-based interventions. In terms of the setting, 101 individual and 104 group approaches were found as well as 4 combined approaches offering individual and group elements.

¹Total number of participants reported in 10/11 studies.

Additionally, 14 selective and 23 universal approaches were synthesized in one meta-analysis (Yeun & Han, 2016).

As evident in the description of the interventions reviewed, treatment modalities varied substantially, and there was considerable overlap of primary studies across the SRMA. Hence the distribution of primary research by intervention type and theoretical alignment is shown in Fig. 2. The most commonly found treatment modality was Cognitive Behavioral Therapy (CBT), as in 168 primary studies CBT-based interventions were applied. Psychological interventions ($k = 83$ studies) were the second most frequent type of treatment, followed by counseling programs ($k = 54$ studies). Due to no standardized categorization scheme for psychological interventions, this category was defined as follows: Interventions that integrate a combination of psychological and/or counseling therapies as part of a broader treatment program alongside interventions that could not be clearly assigned to any of the other categories (King & Delfabbro, 2014).

Comparison

This review included SRMA of intervention studies with and without control groups, as no restrictions were determined. Regarding the study design of primary studies, 25.00% of the systematic review's inclusion criteria referred to multiarmed studies or pretest-posttest designs (Xu et al., 2021; Zajac, Ginley, Chang, & Petry, 2017; Zajac, Ginley, & Chang, 2019). In the remaining systematic reviews, no restrictions were defined with regard to the design of the primary studies, so methodological limitations such as the absence of a control condition did not mandatorily justify exclusion. In the systematic reviews in which data regarding the assignment of participants to control and experimental groups were provided (8/12) 5,309 participants were allocated to an experimental condition and 1,842 participants were assigned to a control condition

In the meta-analytic studies, more stringent criteria were formulated regarding study design, requiring at least a quasi-



experimental trial. Although, primary studies with different designs were incorporated for inclusion, e.g. Winkler et al. (2013) considered intervention studies using a randomized-controlled design, an intragroup change design as well as an intergroup comparison design and observational studies. Among the meta-analyses, 36.36% included solely randomized-controlled trials. There was a lack of information on the distribution of participants among the meta-analyses. In 7/11 articles, in which data on the distribution of participants were reported, 4,784 participants were in an experimental group, while 4,057 participants were assigned to a control condition.

Outcome measurement

SRMA observing the severity of IUD symptomatology and subclinical manifestations as outcome variables were reviewed. A distinct heterogeneity was observed in terms of diagnosis and measurement of IUD among the SRMA reviewed, which will be summarized subsequently. A detailed description of outcome variables and survey instruments used in the SRMA is provided in Table 1.

Internet addiction severity was the most common outcome variable, which was measured using a variety of different psychometric tools, partially combined with structured clinical diagnostic instrument (e.g. AICA-SKI: IBS; Müller & Wölfling, 2018). Most of the psychometric measures captured self-report information, such as the *Young Internet Addiction Test (IAT; Young, 1998)*. Furthermore, not only the survey methods but also the determination of cut-off values for the classification of a disorder varied across studies included. Objective measurements (e.g. tracking software to capture time of use) to verify participants' self-report data were applied barely, nor was the use of structured clinical interviews explicitly reported (Costa & Kuss, 2019; Lemos et al., 2014; Xu et al., 2021).

Study design

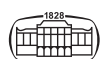
SRMA following a systematic approach and fulfilling a minimum of mandatory criteria were included. As a result, 12 descriptive syntheses and 11 meta-analyses of the empirical research were reviewed. Some of the authors justify the conduction of a narrative synthesis due to a significant heterogeneity of primary studies in terms of study design, methods applied for selection and assignment of participants, as well as variations in the number of participants included (Lemos et al., 2014; Zajac et al., 2017) while other authors aimed for a comprehensive overview of intervention studies from a holistic perspective (e.g. Kuss & Lopez-Fernandez, 2016). With regard to the meta-analyses, random-effect-models were employed for all of the pooled effect size analyses as tests for homogeneity indicated heterogeneous effect sizes ($P \leq 0.1$ and $I^2 \geq 50\%$) of the included studies (e.g. Augner, Vlasak, Aichhorn, & Barth, 2021). Statistical tests for heterogeneity comprised Cochran's Q, which calculates the weighted sum of squared differences between primary study effects and pooled effect sizes among studies, Higgins' & Thompsons' I^2 , which measure the percentage of differences between studies due to

heterogeneity rather than chance, and Inter-study variance T^2 , which captures the variability between studies independent of the study size (Schmucker, Nothacker, Möhler, Kopp, & Meerpohl, 2017). Standardized mean differences and Hedge's g were selected as effect sizes for the meta-analyses. Additionally, sensitivity and subgroup analyses were carried out to further investigate the heterogeneity of effect sizes, and meta-regressions were conducted regarding potential moderating effects if there was a sufficient data basis (e.g. Stevens et al., 2019).

Results of the reporting quality appraisal

An overall score to operationalizes the reporting quality of SRMA was generated. The scoring method was tested for validity and consistency. Interrater reliability was calculated for a subset of the SRMA included as a measure of concordance between the reviewers' ratings. Results of the calculation of interrater reliability can be found in Table S3 in Supplementary Material 2. Cohen's kappa values indicated an almost perfect strength of interrater agreement (M: 0.928; SD: 0.049; Altman, 1999; Landis & Koch, 1977). Results of the reporting quality appraisal are displayed in Table 2. To measure reporting quality, the 42 items of the 27 PRISMA indicators were evaluated on a three-level response format. The scores of each item were summarized to an overall score of reporting quality, which ranged from 25 to 77 points (M: 52.91; SD: 17.46). In addition, mean and standard deviation of the scores were calculated for each of the 42 items. The evaluation of the SRMA revealed deviations from methodological standards of the PRISMA guidelines. Main limitations include missing information on (a) registration of a study protocol, (b) statistical synthesis methods and methods used to display results (c) evaluation of certainty of evidence, and (d) risk of bias assessment.

- (a) The lowest level of compliance was found in relation to the a priori registration of a study protocol (item 24a - 24c). In particular, information on amendments to data provided at registration or in the study protocol were completely missing. Further, information that the study was not registered (item 24a M: 0.21; SD: 0.58) were rarely, along with information on where the study protocol can be accessed (item 24b M: 0.06; SD: 0.40) were almost completely missing, as only 2 SRMA provided any information on the prospective registration of the research activity (Augner et al., 2021; Costa & Kuss, 2019). Several databases offer authors of SRMA a register for the registration of study protocols in, e.g. PROSPERO, founded by the Centre for Reviews and Dissemination (CRD). Objectives of prospective registration include promotion of high methodological standards, ensuring transparency of the review process and avoiding duplication of effort (Schiavo, 2019).
- (b) Further reporting deficiencies referred to missing information on statistical synthesis methods and the display of the results including the following aspects: Description of method(s) used to for sensitivity analyses to assess the robustness of the summarized results



($k = 2$ studies). Regarding the study design of primary studies, 25.00% of the systematic review's inclusion criteria referred to multiarmed studies or pretest-posttest designs (Xu et al., 2021; Zajac et al., 2017, 2019), while 36.36% of the meta-analyses included solely randomized-controlled trials.

Embedded in the critical analysis was a systematic summary of the evidence base of SRMA on treatment intervention for IUD, which contributes significantly to the research literature by highlighting under-researched manifestations of IUD and existing heterogeneities among the SRMA reviewed. Previous research has focused on pathological use of online video respectively computer games (Lindenberg & Holtmann, 2022; Rumpf et al., 2018), while other manifestations of addictive online behaviors, including social networking use disorder (online), pornography use disorder (online), shopping disorder (predominantly online), have been comparatively less investigated. A distinct heterogeneity was observed in terms of diagnosis and measurement of IUD, along with substantial variation in terms of intervention modalities. Among the SRMA, divergent self-report questionnaires were applied, while there was a lack of homogeneous cut-off values for the classification of a disorder as well as structured clinical diagnostic tools and objective surveys to verify self-reported data. These inconsistencies highlight the ongoing debate among classification and taxonomy of behavioral addictions related to the internet use (Montag et al., 2021; Rumpf et al., 2021). Further, the absence of common psychopathological criteria for manifestations of IUD reflects the lack of recognition as independent disorders. Considering the clinical relevance of dependent behaviors associated with online shopping, online pornography, and social networks (Brand, 2021; Montag et al., 2021) the definition of diagnostic criteria is strongly justified (Laskowski, Trotzke, de Zwaan, Brand, & Müller, 2021; Van den Eijnden, Lemmens, & Valkenburg, 2016). Following a descriptive diagnostic approach, operationalizations of disorders in terms of uniform psychopathological criteria would advance research activities to establish valid diagnostic instruments and treatment interventions for those affected. The promotion of a standardized diagnostic and classification is of great importance, especially since treatment interventions for IUD also varied considerably among the SRMA. The lack of uniformity in diagnostic, measurement, and intervention approaches for IUD treatments hinders the comparability of research activities conducted. Further, the variety of types of interventions being considered as treatments for IUD demonstrates the high level of research interest in this area and the demand for evidence-based treatment approaches. Consequently, consensus on diagnosis and measurement based on nosological concepts is required to minimize heterogeneities and to improve the development of guidelines for the diagnosis and treatment of IUD. The summary of the evidence base of different manifestations of IUD conducted as part of this critical analysis may be a helpful resource in this regard.

Scores operationalizing the quality of reporting ranged from 25 to 77 (M: 52.91; SD: 17.46). In terms of adherence for each SRMA, 47.83% of the systematic approaches

showed a partial adherence ($\leq 60\%$ of PRISMA items were fully reported), while 52.17% adherent completely to the PRISMA indicators ($\geq 90\%$ of PRISMA items were fully reported). Results of the critical appraisal revealed deviations from methodological standards of the PRISMA guidelines, while the main limitations include (a) a lack of data regarding the registration of a study protocol, (b) missing information on statistical synthesis methods and the display of the results (c) inadequate evaluation of the certainty of evidence, and (d) insufficient information about the risk of bias assessment. Deficiencies in reporting represent an important limitation regarding the evidence base of SRMA on treatment interventions for IUD highlighted in this review. Insufficient completeness, detail, and transparency in reporting complicates examining the appropriateness of the methods used, critically assessing the validity of results, and ensuring the replicability of the research (Page et al., 2021; Schmucker et al., 2017).

Guidelines such as PRISMA were developed to ensure complete and transparent reporting, as researchers and policy makers rely on systematic analysis of primary studies to develop guidelines and derive conclusions about evidence-based treatments for IUD. Because systematic reporting is essential to prevent the dissemination of unclear data and to avoid inappropriate conclusions, identifying deviations from PRISMA indicators could be useful not only to readers but also to clinicians, reviewers, and journal editors. The limited quality of reporting highlighted in this analysis was also found in a critical appraisal of SRMA on prevention and harm reduction interventions for gambling disorders. McMahon, Thomson, Kaner, and Bambra (2019) aimed to synthesize SRMA to support the development and dissemination of evidence-based interventions for gambling disorders. The quality of reporting among the systematic articles ($k = 10$ studies) was considered to be in need of improvement, and the evidence syntheses were also characterized by heterogeneous primary research in terms of intervention modalities and study designs (McMahon et al., 2019). This emphasizes that research on behavioral addictions appears to be a complex field, in which there is still considerable contradiction and debate. Therefore, conclusions that can be drawn from SRMA are limited in terms of the methodological robustness of the evidence for treatment interventions for IUD. Even beyond behavioral addictions research, there appears to be a need for overarching research to assess the available evidence base of SRMA. For example, O'Kelly et al. (2020) presented a manuscript in which they appraised the methodological quality and the quality of reporting of clinical systematic reviews and meta-analyses in pediatric medicine. The 3 most common deviations from PRISMA indicators were lack of a registration number and/or registry name (85.1%), lack of an assessment of risk of bias (61.4%), and lack of reference to the presence or absence of study funding (33.7%). The largely consistent methodological shortcomings and gaps in reporting underscore the importance of critically analyzing the quality of SRMA reporting to address limitations in the evidence base and to promote improvements in reporting. Further, authors



of systematic reviews should aim for transparent and complete reporting to ensure that evidence syntheses can be used as a helpful tool for establishing evidence-based interventions. Ad interim, it may be useful for researchers to differentiate between the manifestations of IUD and to separately evaluate effects of divergent treatment modalities. This would allow for a well-defined examination of treatment effects on specific behavioral addictions and minimize the risk of drawing illegitimate conclusions.

Limitations

This review critically appraised the reporting quality of SRMA on treatment interventions for IUD. The reliance on SRMA as the unit of analysis, offers the opportunity to synthesize the extensive evidence of the collected research literature in a resource-efficient manner. The method of overarching reviews is a relatively new approach to synthesizing research findings, which presents unique methodological challenges and limitations (Peters et al., 2022; Pollock, Campbell, Brunton, Hunt, & Estcourt, 2017). Challenges encountered within this review arose from a substantial heterogeneity and methodological limitations among the primary studies, as evidence syntheses largely depend on the quality of the included studies (Gough, 2021; Niforatos et al., 2019; Pollock et al., 2017). Further, the partial lack of reporting information in the SRMAs reviewed made it difficult to reliably assess the results and derive implications for clinical practice (Pollock et al., 2017). Therefore, conclusions that can be drawn should be considered preliminary. Authors of SRMAs should be transparent about potential shortcomings of primary studies, not only so that these can be properly considered when interpreting results, but also to avoid selective reporting (Gough, 2021; Ioannidis, 2016). In consequence, overestimation of beneficial effects or underestimation of harmful effects of treatment interventions for Internet use disorder may occur if information on adverse effects are not reported in sufficient detail (Piontek & Hannich, 2019).

Given the limited methodological quality of intervention studies highlighted in previous research (King et al., 2017), the evaluation of reporting quality according to the PRISMA guidelines may have resulted in an overly rigorous assessment of the SRMA's evidence base. Consequently, reporting quality may be limited by the quality of the methodological approach and the sophistication of primary research (Pollock et al., 2017). Supplementary, scoring zero points for missing information due to inherent limitations of the study design may also have led to an inappropriately stringent overall assessment of report quality, particularly as some authors justified conducting a narrative synthesis based on the substantial heterogeneity of the primary studies (e.g., Zajac et al., 2017). A further limitation of this work stems from the fact that, although the included primary studies were reviewed for their relevance to the overarching research question, data were extracted exclusively from SRMA and relevant supplementary materials. Detailed analysis of primary studies included in the SRMA is beyond the scope of this review.

Last, it should be noted that this work did not aim to identify the most effective treatment intervention for IUD. The interventions that were implemented were only evaluated in terms of meeting the methodological standards of the PRISMA indicators for reporting quality. Highlighting SRMA in which the methodological scientific approach is transparently reported advances the evaluation of effective treatment interventions for IUD. Similarly, limitations of the reporting quality identified in this work serve as a helpful resource for the development of further research activities.

CONCLUSION

Concerns about the widespread impairments associated with behavioral addictions related to the internet use and the resulting increase in systematic articles in this research area led to the objective of systematically summarizing the scientific evidence base of treatment interventions for IUD and assessing the quality of reporting. Results of the critical analysis revealed partial adherence to PRISMA indicators in nearly half of the SRMA included, which may affect the validity of the systematic approaches and thus compromising the strength of their evidence. In addition, readers cannot adequately assess potential implications for findings of evidence syntheses when information about the methodological, scientific approach is missing. Based on our findings, we suggest that future research should strive for sufficient and transparent reporting of the methodological approach by authors providing information on all PRISMA indicators when choosing to adhere to the guidelines. Further, we suggest that journals should consider establishing a priori criteria based on checklists before publishing manuscripts to ensure the highest possible quality of reporting in future research.

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Author's contribution: LB conducted the systematic literature search, reviewed articles for inclusion and extracted data. HS, and KW checked the searches as well as extraction forms, and helped with the implementation. LB evaluated the SRMA included, with the help of HS, KW and MD. LB drafted the manuscript with input from BR, HS, KW and MD. The authors take responsibility for the integrity of the data as well as the accuracy of the data analysis and have approved the final manuscript.

Conflicts of interest: The authors declare no conflicts of interest.

SUPPLEMENTARY MATERIAL

Supplementary data to this article can be found online at <https://doi.org/10.1556/2006.2022.00087>.



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Appendix

Search strategy

Search query	Keywords (searched within titles, abstracts)
1	(Internet use disorder OR problematic internet use OR internet addiction OR excessive internet use OR problematic internet use OR compulsive internet use OR online addict* OR internet gaming disorder OR internet gaming OR video game addiction OR online game addict* OR videogame addict* OR computer game addiction OR smartphone addiction OR mobile phone addiction OR social media addiction OR online sex* addiction OR online sex* disorder OR online pornography OR hypersex* OR online shopping addiction OR compulsive online shopping)
2	(treatment OR therapy OR intervention OR counselling OR guided self-help OR self-help OR CBT OR cognitive behavioral therapy OR cognitive behavioral intervention OR pharmacological OR psychoanalytic OR psychodynamic OR interpersonal OR intervent* OR psychotherapy OR training OR program)
3	(systematic review OR meta-analysis OR meta-regression OR systematic overview OR „pooled effect OR systematic*)
Syntax	1 AND 2 AND 3
Year of publication:	First available – 2022.

