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Title page

Long-term effects of psychosocial interventions on Internet-related disorders: A meta-analysis

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Abstract

Previous meta-analytic reviews show that psychosocial interventions targeting Internet addiction and gaming disorder have positive effects on improving the addiction severity, time spent online, and some mental health symptoms. However, the impacts on other outcomes such as psychosocial competence and well-being, and the sustainability of the intervention effects are unclear. This meta-analysis aims to provide a comprehensive analysis of available evidence on the effectiveness of intervention on these broader range of intervention outcomes. A systematic search retrieved relevant studies published before 31 March 2022. A total of 34 studies (N = 2218) met the inclusion criteria, yielding a significant intervention effect with a large pooled effect size (Cohen's d = 1.790; 95% CI [1.365, 2.214], p < .001) on addiction severity and the effect sustained during a 6-month follow up period, although the effect size slightly decreased at 1-month. The interventions also had positive effects on a wide range of outcomes, such as time spent online, inattentiveness or impulsivity, anxiety, depression, internalizing and externalizing problems, general health, relationship quality, social competence, peer or social problems, and life satisfaction or quality of life. The moderator analyses revealed various study and intervention characteristics that influenced the effect sizes.

Keywords: Internet addiction, gaming disorder, meta-analysis, intervention

Highlights

- Psychosocial interventions had positive and sustainable effect (six months) on severity of Internet-related disorders.
- Psychosocial interventions had positive effects on various outcomes of health and psychosocial competence and well-being.
- Interventions were effective regardless of which theoretical approach was adopted.

There is an increased public health concern regarding excessive Internet use and gaming, with particular attention to Internet-related disorders, including Internet addiction and gaming disorder. Internet addiction refers to preoccupied and uncontrolled Internet use resulting in negative consequences in different aspects of functionalities (Kuss et al., 2014). Another related condition, gaming disorder, is characterized by a persistent pattern of impaired control in online or offline gaming, priority given to gaming over other activities, and continuation or escalation of gaming despite its negative consequences and is formally recognized by the World Health Organization (2022) as a health diagnosis. While there are different views regarding the conceptualization of Internet addiction and gaming disorder, this study views Internet addiction as a generalized addictive use of the Internet whereas gaming disorder as a specific form of Internet addiction. A recent meta-analysis of 113 studies reported pooled prevalence of Internet addiction and gaming disorder were 7.02% and 2.47%, respectively (Pan, Chiu, & Lin, 2020).

Longitudinal evidence has illustrated the negative impacts of Internet addiction and gaming disorder. The mental health impacts were highlighted in some longitudinal studies, showing that adolescents who used the Internet and gamed excessively, compared to those who did not, were at higher risk of developing depression, anxiety and social phobia (Gentile, 2009; Lam & Peng, 2010; Yen et al., 2018). Apart from the influences on mental health, Internet addiction and gaming disorder were found to reduce individuals' social competence and other psychosocial well-being such as self-esteem and social support (Teng et al., 2020; Van den Eijnden et al., 2018). These negative consequences in mental health and psychosocial competence and well-being may in turn serve as a motive for further engagement in problematic Internet use and gaming, as an attempt to escape from or reduce such negative

feelings and impacts, hence creating a vicious cycle difficult for the affected person to cope with.

In view of the negative impact of Internet addiction and gaming disorder, evidence-based prevention and treatment responses are much needed to address these (potential) new disorders. Several meta-analyses have summarized the evidence of relevant interventions, but they vary in the types of interventions, outcomes, target groups, and cultural contexts examined. Being the first published meta-analysis, Winkler et al. (2013) found large intervention effects for Internet addiction severity (Hedges' g = 1.61), time spent online (g = 0.94), depression (g = 0.90), and anxiety (g = 1.25). Subsequent meta-analyses obtained similar findings. For example, a meta-analysis of interventions for Internet addiction conducted in South Korea obtained a large effect size for addiction severity (g = 1.838) (Chun et al., 2017). Furthermore, Liu et al. (2017) evaluated the effectiveness of various types of interventions on Internet addiction in East Asian countries, and found large effect sizes for addiction severity, as well as moderate-to-large effects on reducing a range of mental health outcomes such as depression, anxiety, aggression, and psychotic symptoms (Liu et al., 2017). Additionally, Goslar et al. (2020) showed psychological, pharmacological, and combined treatments were effective in improving Internet addiction, with Hedges's g ranged between 1.13 and 2.51. Besides, it was reported that psychological interventions including cognitive-behavioral therapy (CBT) and educational programs had large effects on reducing Internet/smartphone addiction severity in adolescents (Malinauskas & Malinauskiene, 2019). Thus far, Stevens et al. (2018) is only one meta-analysis focusing on gaming disorder, showing that CBT interventions were effective in reducing symptoms of gaming disorder (g = 0.92), depression (g = 0.80), and anxiety (g = 0.55).

Previous reviews clearly show that individuals with Internet addiction and gaming disorder have benefited from existing interventions. However, there are several limitations in these reviews that are yet to be addressed. First, these reviews have a narrow focus on intervention outcomes in terms of Internet addiction severity, time spent online, and some mental health outcomes. Although clinical symptoms and time spent online are important indicators of change, intervention outcomes should be assessed more broadly such as taking into consideration of individuals' change in participation in hobbies or interests, quality of family and social relationships, and overall functioning (King & Delfabbro, 2013). Second, among the very few studies (Goslar et al., 2020; Stevens et al., 2018; Winkler et al., 2013) that examined treatment effect on severity of Internet addiction/gaming disorder at follow-up, they did not provide details about whether the effect size changes across different follow-up time-points. Examining the sustainability of intervention effects is crucial, as current evidence on long term intervention effects is mixed, having some studies reporting intervention effects remained at three to nine months after the intervention (Deng et al., 2017; Liu et al., 2015; Uysal & Balci, 2018), while other studies obtained inconsistent findings on sustained intervention effects (Lan et al., 2018). Finally, it is important to note that the findings of some of the previous meta-analyses (e.g., Stevens et al., 2018; Winkler et al., 2013) derived from studies mainly of single group pre-test post-test design, which may have affected the quality of the evidence. In light of the limitations of the previous reviews, the present meta-analysis aimed at 1) providing pooled effect sizes of intervention effects on the severity of Internet-related disorders at post-intervention and follow up; 2) computing pooled effect sizes of intervention effects on different outcomes; and 3) identifying study and intervention characteristics (moderator variables) that may contribute to a promising intervention.

Method

Study selection

This meta-analysis adhered to the PRISMA guidelines (Page et al., 2021) to identify studies and report the findings. This study covered publications in electronic databases, including PubMed, Medline, PsycInfo, Embase, Web of Science, ERIC, and Cochrane Clinical Trials Library. Relevant publications were systematically searched in titles, keywords, and abstracts, using the following list of keywords which were developed based on previous review studies: (1) gaming addiction, gaming disorder, Internet addiction, gaming, pathological Internet use, cyber addiction, computer addiction, online addiction, facebook addiction, social networking addiction, social media addiction; and (2) intervention, treatment, program, therapy, training. The two groups of keywords were combined with the Boolean "AND," and the synonymous terms were combined with the Boolean "OR." The search strategy for PsycInfo can be found in Supplementary 1. Publications published up to February 2020 were searched, and an updated search was conducted in March 2022. A trained research staff carried out the search and screening process based on the inclusion and exclusion criteria. The first author reviewed the selected and non-selected studies and resolved discrepancies around selection after discussion with the research staff. Grey literature was searched for in Google Scholar using the keywords: Internet addiction, gaming disorder, intervention. The first 10 pages of the search results were reviewed and no additional publications were identified. Conference abstracts were searched to identify related published articles and the authors contacted for relevant publications when the corresponding information was available, and one additional publication (n=1) was identified. The full texts of the articles were then reviewed to obtain the eligible studies, and the reference lists of the selected articles were reviewed to identify additional publications. No additional studies were identified. Finally, the reference lists of the systematic and meta-analytic reviews of similar topics were searched for relevant studies (King et al., 2011; King et al., 2017; Stevens et al., 2018; Winkler et al., 2013; Zajac et

al., 2017), and no additional studies meeting the inclusion criteria of this study were obtained. As this study involved secondary data analysis, ethical approval was not required.

Inclusion criteria

Studies were included if they (1) adopted an experimental or quasi-experimental design of psychosocial interventions for Internet addiction or gaming disorder, (2) included at least one health and psychosocial outcome measure related to changes in the participants, (3) used quantitative methods to evaluate outcome measures, or provided sufficient statistical information to calculate the effect sizes, (4) included participants identified as having an Internet addiction or gaming disorder, or as having problems due to excessive Internet use or gaming, and (5) included a comparison group. In the current study, psychosocial interventions were defined as any intervention that addresses psychological or social factors (Forsman et al., 2011), regardless of whether it is delivered in group, individual, or other formats. Studies with a mix of participants with and without Internet addiction or gaming disorder were included if at least 50% of the participants were considered to have Internet addiction or gaming disorder. However, studies involving a healthy control group were excluded, even if over 50% of the total study participants had an Internet-related disorder. Studies were also excluded if they (1) did not provide quantitative evidence regarding program effects, (2) involved or partly involved pharmacological intervention; (3) were non-English, or (4) had a sample size less than 10 (for each arm).

Data extraction

Relevant data was extracted from the selected studies. A standardized coding sheet was created to extract study characteristics and outcomes, and recorded the following information: basic publication information (e.g., year of publication and country of origin); study

methodological characteristics (including study design, sampling method, sample size, and sample type); types of measures used to assess gaming disorder/Internet addiction; intervention characteristics (content, duration, frequency, and attrition rate); participants' characteristics (e.g., mean age, gender, ethnicity, and socioeconomic status).

Quality assessment

The quality of each eligible study was assessed using the 25-item CONSORT checklist (Schulz et al., 2010). Each item was rated 1 = *information present*, 0.5 = *present, but with limitations*, or 0 = *absent*. The highest possible score was 25 for a study meeting all the checklist criteria. Two reviewers (trained research staff with experience conducting systematic reviews) coded and evaluated each of the studies independently. The intraclass correlation coefficient (ICC) was calculated to test for the degree of agreement between the two reviewers' ratings on the methodological quality of each study. In this review, the study quality assessment scores ranged from 10 to 23, with an average of 14.35 across the studies (Supplementary 2). There was a high level of agreement between the two raters (ICC = 0.977; 95% CI [0.954, 0.989]). Disagreements were resolved by discussing the issues with the first author until agreement had been reached.

Data analysis

To examine the effectiveness of the interventions, effect sizes were calculated in terms of Cohen's *d*, referring to a standardized difference in means, standardized by change in standard deviation (SD). Raw data including pre-test and post-test mean and SD, number of participants in each group, and correlation (*r*) between pre-test and post-test scores were extracted from each study. If the correlation is not reported, *r* was estimated as 0.5 (Borenstein et al., 2011). Cohen's *d* was then calculated using the formula: $= \frac{\bar{X}_{Diff,Treatment} - \bar{X}_{Diff,Control}}{SD_{change,pooled}}$, where

$\bar{X}_{Diff,Treatment} - \bar{X}_{Diff,Control}$ refers to the difference between treatment group mean difference and control group mean difference,

$SD_{\text{change,pooled}} = \sqrt{\frac{(n_1-1)SD_{change,Treatment}{}^2+(n_2-1)SD_{change,Control}{}^2}{n_1+n_2-2}}$, and

$SD_{\text{Change}} = \sqrt{SD_{pre}{}^2 + SD_{post}{}^2 - 2 \times r \times SD_{pre} \times SD_{post}}$. For studies reporting other data format, such as F for difference between changes, the effect sizes were converted to Cohen's *d* using the software *Comprehensive Meta-analysis* (CMA; Borenstein et al., 2005). Table S1 (Supplementary 3) lists all the intervention outcomes investigated by the selected studies. This study only conducted analyses for intervention outcomes that had been examined by at least four studies, a principle to avoid arriving at conclusions based on small sample sizes (Bakermans-Kranenburg et al., 2005; Vonderlin et al., 2020). Due to the different features of the interventions' contents and participants, a random effects model was used. For interventions involving multiple intervention groups but only one control group, only the key intervention group was selected so that one study contributed only one effect size for each intervention outcome. *Q* statistic and I^2 statistic were used to estimate heterogeneity. Subgroup analyses to examine potential moderators that could influence program effects on addiction severity were conducted. Studies were categorized into subgroups based on various study and intervention characteristics (including study design, study sample, type of control group, study quality, theoretical approach, inclusion of family members or not, and intervention format), and *Q* statistic was used to examine potential moderating effects. For the intervention effects at follow-up time-points, this study pooled effect sizes for the follow-up intervals that had been examined by at least four studies, the same principle applied to examining other treatment outcomes as described above. Studies with a follow-up assessment were grouped into four categories of time points: posttest, 1-month follow-up, 3-month follow-up, 6-month follow-up or more. To make use of the available data as far as possible, if a follow-up occurred at an

intermediate time point (e.g., 6-week follow up), the effect size was assigned to the nearest follow-up interval (i.e., 1-month follow-up). This method has been used in a previous meta-analytic review examining long-term intervention effects (Rith-Najarian et al., 2019). Funnel plots and the Egger test were used to estimate potential publication bias. An asymmetry funnel plot and statistical significance of the Egger test indicate possible publication bias (Egger et al., 1997). As potential publication bias was detected in the current study, the Duval and Tweedie's trim-and-fill method (Duval & Tweedie, 2000) was used to estimate how many studies it would take for the funnel to be symmetrical and to calculate the adjusted pooled effect size after imputing the missing studies. This method served as a sensitivity analysis for a comparison between the adjusted effect size and the original estimate. All the analyses were conducted using CMA. A p-value < .05 was considered statistically significant.

[Insert Figure 1 about here]

Results

Studies' characteristics and participants

Figure 1 shows the process of the studies selection. The systematic search identified 34 studies meeting the inclusion criteria, the characteristics of which are presented in Table 1. The selected studies in this meta-analysis were published between 2005 and 2022 and involved 2218 participants, with a mean age ranging from 12.46 to 33.51 years old. The percentage of male participants ranged from 0 to 100%. About half of the studies were conducted in East Asian countries, including China (n = 11) and South Korea (n = 5). Of the selected studies, 26 adopted a randomized controlled design, while 8 were non-randomized controlled studies.

[Insert Table 1 about here]

Intervention characteristics

In terms of theoretical approach, CBT was the most commonly used approach, which was examined in ten studies (Agbaria, 2022; Alavi et al., 2021; Du et al., 2010; Ede et al., 2021; Han et al., 2019; Hou et al., 2019; Kim et al., 2012; Li & Wang, 2013; Wölfling et al., 2019; Zhou et al., 2021). Mindfulness training used in some intervention programs was examined, including two studies on mindfulness-based cognitive therapy (Lan et al., 2018; Shadbad, 2017) and one study on mindfulness-oriented recovery (Liu et al., 2017). Six interventions were based on an integrative approach (Besser et al., 2022; Bong et al., 2021; Hong et al., 2020; Liu et al., 2021; Pornnoppadol et al., 2018; Torres-Rodriguez et al., 2018), and three interventions involved family therapy (Liu et al., 2015; Nielson et al., 2021; Zhong et al., 2011). Other theoretical approaches were also used, including craving behavioral intervention (Deng et al., 2017), reality therapy (Kim, 2008; Odacı & Çelik, 2017), motivational interviewing (Dicle, 2021; Manwong et al., 2018), psychoeducation (Celik, 2016; Su et al., 2011), positive psychology intervention (Khazaei et al., 2017), social cognitive approach (Uysal & Balci, 2018), and attention bias modification (Liu et al., 2020). One study did not report use of any specific theoretical approach.

Majority of the intervention programs were group-based (n = 23). One study was a web-based self-help program (Su et al., 2011) and another intervention involved a residential camp with a parent management training (Pornnoppadol et al., 2018). Four studies investigated individual therapy, counseling, or training (Besser et al., 2022; Liu et al., 2020; Torres-Rodriguez et al., 2018; Zhou et al., 2021). Of the eight studies that involved family members in the intervention, four of them were family-based therapy delivered in a group or individual family format. Additionally, one intervention involved a mixed group and an individual program (Wölfling et al., 2019). Interventions were mostly on a weekly basis, lasting from one week to six months, and numbers of interventions ranged from 1 to 23 sessions, with an average of 10sessions.

Synthesis of effect sizes

Table 2 represents the pooled effect sizes of different intervention outcomes. Thirty-two studies reported a total of 33 effect sizes on addiction severity, yielding a large effect size (Cohen's d = 1.790; 95% CI [1.365, 2.214], p < .001). The heterogeneity test obtained a significant result (Q = 532.095, df = 31, p < .001), suggesting a wide spread of variation in the selected studies. I^2 statistics indicated that 94.17% of the heterogeneity could be attributed to study variation. After excluding studies that adopted a non-randomized controlled design, the pooled effect size remained large (Cohen's d = 1.821; 95% CI [1.317, 2.324], p < .001). With respect to the different types of addiction, the effect size of the 19 studies that targeted Internet addiction was 2.376 (95% CI [1.722, 3.030], p < .001). A large effect size was also found in the nine studies focusing on gaming disorder (Cohen's d = 1.498; 95% CI [.808, 2.187], p < .001). The three interventions addressing smartphone addiction and the two interventions targeting social media addiction yielded non-significant effects.

As shown in Figure 2, post-intervention effects on addiction severity remained relatively stable during the 6-month follow up period. Specifically, among the 15 studies that included a follow-up assessment, the pooled intervention effect was large (Cohen's d = 1.56; 95% CI [0.097, 2.170], p < .001) at post-intervention. The intervention effect then slightly dropped to Cohen's d = 1.227 (95% CI [0.302, 2.153], p = 0.009), then increased to Cohen's d = 1.314 (95% CI [0.641, 1.987], p < .001) at 3-month post-intervention and Cohen's d = 1.411 (95% CI [0.598, 2.224], p = 0.001) at 6-month or more post-intervention.

The interventions helped to reduce participants' time spent online, with a moderate effect size for time spent online per day (d = 0.508; 95% CI [0.168, 0.848], p = .003) and a large effect size for time spent online per week (d = 2.671; 95% CI [1.058, 4.284], p = .001).

In regard to health outcomes, ten studies reported an effect size on anxiety of .648 (95% CI [0.386, 1.042], p < .001), twelve studies showed a moderate effect size on depression (Cohen's d = 0.459; 95% CI [0.198, 0.719], p = .001), and eleven studies yielded a similar effect on internalizing problems (Cohen's d = 0.530; 95% CI [0.305, 0.755], p < .001). Four interventions yielded a small effect size on externalizing problems (Cohen's d = 0.351; 95% CI [0.028, 0.673], p < .033). Seven studies reported an effect size on inattentiveness/impulsivity of 0.265 (95% CI [0.026, 0.504], p = .029). Additionally, the interventions brought significant general health and functioning benefits to the participants (Cohen's d = 1.956; 95% CI [0.863, 3.049], p < .001).

Some studies examined the influence of interventions on psychosocial competence and well-being. The interventions were associated with self-esteem/ self-concept (Cohen's d = 0.471; 95% CI [0.025, 0.917], p = .038) and life satisfaction/ quality of life (Cohen's d = 0.857; 95% CI [0.349, 1.365], p = .001). There was also a significant impact on improvement in social life, with five studies showing a large effect on social competence (Cohen's d = 1.647; 95% CI [0.397, 2.898], p = .010), relationship quality (Cohen's d = 1.220; 95% CI [0.327, 2.114], p = .007), and reduction in peer/social problems (Cohen's d = 0.811; 95% CI [0.170, 1.451], p = .013).

[Insert Table 2 about here]

[Insert Figure 2 about here]

Moderator analyses

We examined seven factors that could affect the effectiveness of the intervention using moderator analyses of study design, study sample, control group type, study quality, theoretical approach, whether family members were included in the intervention, and intervention format. As shown in Table 3, study sample (Q_b= 11.049, df = 1, p = .001) and control group type (Q_b= 11.485, df = 1, p = .001), study quality (Q_b= 9.884, df = 1, p = .002), involvement of family members (Q_b= 6.273, df = 1, p = .012), and intervention format (Q_b= 9.979, df = 3, p = .019) had significant between-group Q values. However, results on two other moderators, study design (randomized vs. non-randomized controlled) and theoretical approach, were non-significant.

[Insert Table 3 about here]

Publication bias

Finally, we examined the publication bias using a funnel plot and an Egger's test. Figure 3a illustrates that the studies tend to cluster around the top of the figure, while some studies are distributed outside the plot. The biased distribution of the studies indicates potential publication bias. The Egger's test quantified the bias captured by the funnel plot. In the current study, the significant result of the Egger's test ($p < .001$) implicates presence of publication bias. Figure 3b is a funnel plot that includes additional imputed studies (on the left side of the plot) using the Duval and Tweedie's trim-and-fill method. The adjusted pooled effect size for addiction severity remained significant, although it was reduced to a moderate effect (Cohen's d = 0.67, 95% CI [0.205, 1.144]).

[Insert Figure 3 about here]

Discussion

Overall, the psychosocial interventions yielded a large effect on improving severity of Internet-related disorders, a finding in alignment with research of previous meta-analyses (Chun et al., 2017; Winkler et al., 2013). While the intervention effects were sustained during a 6-month follow up period, an interesting pattern of effect sustainability also emerged, with the most salient effect on addiction severity immediately following intervention, followed by a slight decrease at 1-month, then increases at 3-month and 6-month follow ups. It is understandable that participants reported relief from addiction immediately after the intervention that had provided the support they needed. This finding is consistent with previous meta-analyses on the effectiveness of psychological interventions, which revealed large pre-post effect sizes for symptom reduction (Gutermann et al., 2017). When this support faded out, the participants would have had to cope with the condition on their own, which could result in increased reporting or re-occurrence of addiction symptoms. The drop in the effect size in the first month after intervention may also be an indication that Internet addiction and gaming disorder are relapsing conditions (Kuss et al., 2014). Furthermore, it may take time for the participants to consolidate, reflect on, and practice what they had learned during the intervention and to build up competence in coping with the condition, perhaps explaining why the intervention effects catch up in later months. Given that only a small subset of the studies examined follow-up treatment effects, the current study is unable to delineate if the results will remain the same across different modalities and study characteristics. For instance, a meta-analytic study of interventions for substance use found that follow-up effects varied across treatment modalities and types of substances (Sayegh et al., 2017).

Although the included studies yielded a large effect on improving addiction severity in general, looking the studies focusing on smartphone and social media addiction specifically resulted in non-significant pooled effect sizes. The non-significant results could be explained by the interventions not being effective enough to change the participants' addiction severity, or the analysis not being able to detect the effect due to the small overall sample sizes (n = 223 for smartphone addiction and n = 348 for social media addiction). Another possible reason to explain the finding is that smartphone and social media addictions are relatively new conditions and consensus regarding their definitions is lacking, which in turn may have affected the development of effective interventions (Kuss & Griffiths, 2017). The finding of the differential intervention effects on addiction severity for different addiction types corroborates the idea that generalized Internet addiction and specific Internet-related disorders (e.g., gaming disorder) are related, but not necessarily the same (Griffiths & Pontes, 2014; Montag et al., 2015). It also suggests that interventions should be tailored both for different types of Internet-related disorders.

To address the limitations of previous reviews primarily emphasizing the benefits of interventions on improving a small section of outcomes, including addiction severity, time spent online and some aspects of mental health, this study synthesized the intervention effects on a wide range of outcomes of health and psychosocial competence and well-being, varying in terms of magnitude of the pooled effect sizes. Specifically, there were small to moderate effects on inattentiveness or impulsivity, anxiety, depression, internalizing and externalizing problems, time spent online (h/d), and self-esteem or self-concept. Large effect sizes were observed in outcomes such as time spent online (h/wk), social competence, peer or social problems, relationship quality, general health and functioning, and life satisfaction or quality

of life. This finding suggests that improvements in these areas, not just addiction severity, are important indictors of change and of intervention effects. The finding is also consistent with the conceptualization of addictive behavior as a manifestation of underlying vulnerability factors (Lee et al., 2017; Shaffer et al., 2004), and that treating symptoms of addiction or time spent online per se may not result in long-lasting effects without addressing the underlying factors and improving overall psychosocial competence and well-being. Hence, evaluation of intervention effectiveness should go beyond measuring behavioral symptoms, such as time spent online or addiction severity, to encompass changes in different psychosocial and health indicators. Apart from a comprehensive measurement, future interventions should actively address the outcomes they are targeting and to tease out the active ingredients underpinning effective interventions.

The results of the moderator analyses reveal smaller effects in studies involving a clinical sample than in those involving a non-clinical sample. One explanation for this result is that participants in clinical samples may suffer from other difficulties or comorbidities, which will increase the complexity of the addiction issue and hinder treatment response (Block, 2008). Even among non-clinical samples of individuals with Internet addiction or gaming disorder, high comorbidities with mental and psychological conditions have been documented in previous reviews (Carli et al., 2013; Ostinelli et al., 2021), suggesting specialized interventions to address these difficulties.

Some previous meta-analytic studies showed that studies with rigorous study design and better methodology tend to obtain larger effect sizes (Hesser et al., 2011; Tanner-Smith & Wilson, 2013). However, the current meta-analysis found that the effect sizes obtained from studies with randomized and non-randomized controlled studies did not differ significantly.

Additionally, the results of the moderator analyses showed that studies with lower study quality scores and those with an inactive control group tended to yield larger effects.

Furthermore, in contrast to a previous review showing that interventions adopting an integrative therapy approach yielded larger effects (Chun et al.;2017), the results of the moderator analyses showed that theoretical orientation was not a significant moderator, indicating that interventions were effective regardless of which theoretical approach was adopted. A possible reason for this finding is that individuals with Internet addiction and gaming disorder are not a homogenous group and they may vary in various aspects, such as in their presentation of psychological symptoms and motives for usage (Jeong et al., 2020; Kim et al., 2018; Park et al., 2016). Individuals with differing characteristics and backgrounds may benefit from interventions of different theoretical orientations. Although the literature generally supports the importance of family involvement in treatment for Internet addiction and gaming disorder, particularly for adolescents (King et al., 2020; Lo et al., 2021; Sim et al., 2021), the moderator analysis of this study showed that interventions with a family component had smaller effects than those without involvement of family members. Similarly, the results indicate that intervention format moderates the intervention effect, with interventions adopting a group-based format having larger effects than those that are family-based, individual, or mixed formats. It is important to note that the results should not be interpreted in a way that family involvement in interventions for Internet-related disorders is unfavored. Instead, dedicated care and careful engagement of family members in interventions are needed to address any family dynamics related to the addiction condition (Lo et al., 2021). Family involvement in treatment is thus an important area that would benefit from further study.

Limitations

The findings of this study should be interpreted within its limitations and in the light of potential publication bias. Although previous reviews have consistently pointed out the methodological limitations of existing interventions, including small sample sizes, lack of control groups, and lack of randomization (King et al., 2011; Zajac et al., 2017), the rigorousness of intervention has not improved much during the past decade. Some of the studies included in this review were challenged by methodological limitations such as small sample size and lack of randomization, which may undermine the quality of this meta-analysis. While the inclusion of studies of non-randomized controlled design may affect the rigorousness of this meta-analysis, the studies provided useful information regarding the long-term effects of the intervention and different intervention outcomes. Another limitation is regard to the examination of the follow-up effects. Combining the follow-up data was challenging, as only a small number of studies conducted follow-up assessments and they tended to use inconsistent follow-up periods.

Implications for research and practice

This study's findings highlight some future research directions on this topic. Additional intervention studies on Internet addiction and gaming disorder should adopt a rigorous study design in testing intervention effectiveness, as current best evidence is limited. Apart from the rigorousness of research design, carefully designed intervention that directly addresses particular outcomes and involves corresponding assessment of the intended outcomes would be desirable. Although this review provides support for the idea that existing psychosocial interventions were effective in improving various outcomes, there is limited understanding of the active ingredients that made these interventions work. Further investigation into the potential mediating factors of the intervention effects on different outcomes and possible differential impacts of intervention on different subgroups of individuals is warranted. Given

the relative stability of internet-related disorders over time (Wartberg et al., 2019), additional studies with longer-term evaluation of intervention effects should be prioritized. Lastly, it is suggested that the focus of interventions for Internet addiction and gaming disorder should be extended from reducing addiction symptoms to targeting other aspects of well-being in the individuals involved.

In terms of practice, practitioners working with individuals with Internet addiction and gaming disorder are recommended tailor interventions for clinical vs. non-clinical groups, as they are different in terms of treatment needs and other comorbid conditions and difficulties. More attention should be given to relapse prevention, as the present study show a slight reduction of intervention effect at 1-month follow up. Given that the current literature is uncertain about which treatment modality is more effective than others, practitioners are also encouraged to develop useful treatments to address the issues to help improve our understanding of this topic.

References

Affouneh, S., Mahamid, F. A., Berte, D. Z., Shaqour, A. Z., & Shayeb, M. (2021). The efficacy of a training program for social skills in reducing addictive Internet behaviors among Palestinian university students. *Psicologia: Reflexão e Crítica*, *34*(19). https://doi.org/10.1186/s41155-021-00185-w

Agbaria, Q. (2022). Cognitive behavioral intervention in dealing with Internet addiction among Arab teenagers in Israel. *International Journal of Mental Health and Addiction*, 1-15. https://doi.org/10.1007/s11469-021-00733-6

Alavi, S. S., Ghanizadeh, M., Mohammadi, M. R., Jannatifard, F., Esmaili Alamuti, S., & Farahani, M. (2021). The effects of cognitive-behavioral group therapy for reducing symptoms of internet addiction disorder and promoting quality of life and mental health. *Trends in Psychiatry and Psychotherapy*, *43(*1*)*, 47-56. http://doi.org/10.47626/2237-6089-2020-0010

Bakermans-Kranenburg, M. J., van IJzendoorn, M. H., & Bradley, R. H. (2005). Those who have, receive: The Matthew effect in early childhood intervention in the home environment. *Review of Educational Research*, *75*(1), 1-26. https://doi.org/10.3102/00346543075001001

Besser, B., Bischof, G., Bischof, A., Brandt, D., Orlowski, S., Hoffmann, H., & Rumpf, H. J. (2022). Pilot study of a brief intervention to treating Internet use disorders. *Sucht*, *68*(1), 41-49. https://doi.org/10.1024/0939-5911/a000746

Block, J. J. (2008). Issues for DSM-V: Internet addiction. *American journal of Psychiatry*, *165*(3), 306-307.

Bong, S. H., Won, G. H., & Choi, T. Y. (2021). Effects of Cognitive-behavioral therapy based music therapy in Korean adolescents with smartphone and internet

addiction. *Psychiatry Investigation*, *18*(2), 110-117. https://doi.org/10.30773/pi.2020.0155

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2005). *Comprehensive meta-analysis: A computer program for research synthesis*. Biostat.

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2011). *Introduction to meta-analysis*. John Wiley & Sons.

Carli, V., Durkee, T., Wasserman, D., Hadlaczky, G., Despalins, R., Kramarz, E., Wasserman, C., Sarchiapone, M., Hoven, C. W., Brunner, R., & Kaess, M. (2013). The association between pathological internet use and comorbid psychopathology: a systematic review. *Psychopathology*, *46*(1), 1-13.

Celik, C. B. (2016). Educational intervention for reducing Internet addiction tendencies. *Addicta - the Turkish Journal on Addictions*, *3*(3), 375-386. https://doi.org/10.15805/addicta.2016.3.0021

Chun, J., Shim, H., & Kim, S. (2017). A meta-analysis of treatment interventions for Internet addiction among Korean adolescents. *Cyberpsychology, Behavior, and Social Networking*, *20*(4), 225-231. https://doi.org/10.1089/cyber.2016.0188

Deng, L. Y., Liu, L., Xia, C. C., Lan, J., Zhang, J. T., & Fang, X. Y. (2017). Craving behavior intervention in ameliorating college Internet game disorder: A longitudinal study. *Frontiers in Psychology*, *8*(12), Article 526. https://doi.org/10.3389/fpsyg.2017.00526

Dicle, A. N. (2021). An educational approach for decreasing Internet addiction: Motivational interviewing psycho-education program. *Eurasian Journal of Educational Research (EJER)*, (94), 25-48. https://doi.org/10.14689/ejer.2021.94.2

Du, Y.S., Jiang, W., & Vance, A. (2010). Longer term effect of randomized, controlled group cognitive behavioural therapy for Internet addiction in adolescent students in Shanghai. *Australian and New Zealand Journal of Psychiatry*, *44*(2), 129-134.

https://doi.org/10.3109/00048670903282725

Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot–based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, *56*(2), 455-463.

Ede, M. O., Okeke, C. I., Igbo, J. N., & Aye, E. (2021). Testing the efficacy of group cognitive-behavioural therapy on pathological Internet use among undergraduate in Nigeria. *Trends in Psychiatry and Psychotherapy*. http://doi.org/10.47626/2237-6089-2021-0348

Egger, M., Smith, G. D., Schneider, M., Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ*, *315*(7109), 629-634. https://doi.org/10.1136/bmj.315.7109.629

Forsman, A. K., Nordmyr, J., Wahlbeck, K. (2011). Psychosocial interventions for the promotion of mental health and the prevention of depression among older adults. *Health Promotion International*, *26*(1), i85–i107. https://doi.org/10.1093/heapro/dar074

Gentile, D. (2009). Pathological video-game use among youth ages 8 to 18: A national study. *Psychological Science*, *20*(5), 594-602. https://doi.org/10.1111/j.1467-9280.2009.02340.x

Goslar, M., Leibetseder, M., Muench, H. M., Hofmann, S. G., & Laireiter, A. R. (2020). Treatments for internet addiction, sex addiction and compulsive buying: A meta-analysis. *Journal of Behavioral Addictions*, *9*(1), 14-43. https://doi.org/10.1556/2006.2020.00005

Griffiths, M. D., & Pontes, H. M. (2014). Internet addiction disorder and Internet gaming disorder are not the same. *Journal of Addiction Research and Therapy, 5*(4), e124. https://doi.org/10.4172/2155- 6105.1000e124

Gutermann, J., Schwartzkopff, L., & Steil, R. (2017). Meta-analysis of the long-term treatment

effects of psychological interventions in youth with PTSD symptoms. *Clinical Child and Family Psychology Review*, *20*(4), 422–434. https://doi.org/10.1007/s10567-017-0242-5

Han, J., Seo, Y., Hwang, H., Kim, S. M., & Han, D. H. (2020). Efficacy of cognitive behavioural therapy for Internet gaming disorder. *Clinical Psychology & Psychotherapy*, *27*(2), 203-213. https://doi.org/10.1002/cpp.2419

Hong, J. S., Kim, S. M., Kang, K. D., Han, D. H., Kim, J. S., Hwang, H., Min, K. J., Choi, T. Y., & Lee, Y. S. (2020). Effect of physical exercise intervention on mood and frontal alpha asymmetry in Internet gaming disorder. *Mental Health and Physical Activity*, *18*, 100318. https://doi.org/10.1016/j.mhpa.2020.100318

Hou, Y. B., Xiong, D., Jiang, T. L., Song, L. L., & Wang, Q. (2019). Social media addiction: Its impact, mediation, and intervention. *Cyberpsychology-Journal of Psychosocial Research on Cyberspace*, *13*(1), Article 4. https://doi.org/10.5817/cp2019-1-4

Jeong, H., Yim, H. W., Jo, S. J., Lee, S. Y., Lee, H. K., Gentile, D. A., Son, H. J., Han, H. H., Kweon, Y. S., & Bhang, S. Y. (2020). Gaming patterns and related symptoms in adolescents using cluster analysis: Baseline results from the Internet User Cohort for Unbiased Recognition of Gaming Disorder in Early Adolescence (iCURE) study. *Environmental Research*, *182*, 109105. https://doi.org/10.1016/j.envres.2019.109105

Khazaei, F., Khazaei, O., & Ghanbari-H, B. (2017). Positive psychology interventions for internet addiction treatment. *Computers in Human Behavior*, *72*, 304-311. https://doi.org/10.1016/j.chb.2017.02.065

Kim, B., Lee, S., Doh, Y. Y., & Gweon, G. (2018). Classification of problematic Internet usage types by motives and contexts with elementary and secondary school-aged counseling clients. *Journal of Behavioral Addictions*, *7*(3), 644-653. https://doi.org/10.1556/2006.7.2018.90

Kim, J.U. (2008). The effect of a R/T group counseling program on the Internet addiction level and self-esteem of Internet addiction university students. *International Journal of Reality Therapy*, *27*(2), 4-12.

Kim, S. M., Han, D. H., Lee, Y. S., & Renshaw, P. F. (2012). Combined cognitive behavioral therapy and bupropion for the treatment of problematic on-line game play in adolescents with major depressive disorder. *Computers in Human Behavior*, *28*(5), 1954-1959. https://doi.org/10.1016/j.chb.2012.05.015

King, D. L., & Delfabbro, P. H. (2013). Video-gaming disorder and the DSM-5: Some further thoughts. *Australian and New Zealand Journal of Psychiatry*, *47*(9), 875-876. https://doi.org/10.1177/0004867413495925

King, D. L., Delfabbro, P. H., Griffiths, M. D., & Gradisar, M. (2011). Assessing clinical trials of Internet addiction treatment: A systematic review and CONSORT evaluation. *Clinical Psychology Review*, *31*(7), 1110-1116. https://doi.org/10.1016/j.cpr.2011.06.009

King, D. L., Delfabbro, P. H., Wu, A. M. S., Doh, Y. Y., Kuss, D. J., Pallesen, S., Mentzoni, R., Carragher, N., & Sakuma, H. (2017). Treatment of Internet gaming disorder: An international systematic review and CONSORT evaluation. *Clinical Psychology Review*, *54*, 123-133. https://doi.org/10.1016/j.cpr.2017.04.002

King, D. L., Wölfling, K., & Potenza, M. N. (2020). Taking gaming disorder treatment to the next level. *JAMA Psychiatry*, *77*(8), 869-870. https://doi.org/10.1001/jamapsychiatry.2020.1270

Kuriala, G. K., & Reyes, M. E. S. (2020). Efficacy of the acceptance and cognitive restructuring intervention program (ACRIP) on the Internet gaming disorder symptoms of selected Asian adolescents. *Journal of Technology in Behavioral Science*, *5*(3), 238-244. https://doi.org/10.1007/s41347-020-00132-z

Kuss, D. J., & Griffiths, M. D. (2017). Social networking sites and addiction: Ten lessons learned. *International Journal of Environmental Research and Public Health*, *14*(3), 311. https://doi.org/10.3390/ijerph14030311

Kuss, D. J., Griffiths, M. D., Karila, L., & Billieux, J. (2014). Internet addiction: A systematic review of epidemiological research for the last decade. *Current Pharmaceutical Design*, *20*(25), 4026-4052.

Kuss, D. J., Shorter, G. W., van Rooij, A. J., Griffiths, M. D., & Schoenmakers, T. M. (2014). Assessing internet addiction using the parsimonious internet addiction components model—a preliminary study. *International Journal of Mental Health and Addiction*, *12*(3), 351-366.

Lam, L. T., & Peng, Z. W. (2010). Effect of pathological use of the internet on adolescent mental health: A prospective study. *Archives of Pediatrics & Adolescent Medicine*, *164*(10), 901-906. https://doi.org/10.1001/archpediatrics.2010.159

Lan, Y. K., Ding, J. E., Li, W., Li, J., Zhang, Y. F., Liu, M. B., & Fu, H. (2018). A pilot study of a group mindfulness-based cognitive-behavioral intervention for smartphone addiction among university students. *Journal of Behavioral Addictions*, *7*(4), 1171-1176. https://doi.org/10.1556/2006.7.2018.103

Lee, S. Y., Lee, H. K., & Choo, H. (2017). Typology of Internet gaming disorder and its clinical implications. *Psychiatry and Clinical Neurosciences*, *71*(7), 479-491. https://doi.org/10.1111/pcn.12457

Liu, D., Lu, N., He, J. F., Tang, H., & Zhou, L. J. (2013). Effects of internet addiction group counseling on internet using and study management in college students. *Chinese Mental Health Journal*, *27*(7), 496-501.

Liu, J., Nie, J., & Wang, Y. (2017). Effects of group counseling programs, cognitive behavioral therapy, and sports intervention on Internet addiction in East Asia: A systematic review

and meta-analysis. *International Journal of Environmental Research and Public Health*, *14*(12), 1470. https://doi.org/10.3390/ijerph14121470

Liu, Q. X., Fang, X. Y., Yan, N., Zhou, Z. K., Yuan, X. J., Lan, J., & Liu, C. Y. (2015). Multi-family group therapy for adolescent Internet addiction: Exploring the underlying mechanisms. *Addictive Behaviors*, *42*, 1-8. https://doi.org/10.1016/j.addbeh.2014.10.021

Liu, X., Jiang, J., & Zhang, Y. (2021). Effects of logotherapy-based mindfulness intervention on internet addiction among adolescents during the COVID-19 pandemic. *Iranian Journal of Public Health*, *50*(4), 789-797.

Liu, X., Wang, S., Zhou, J., & Cai, H. (2020). Attention bias training for reducing smartphone addiction in Chinese college students. *Journal of Evidence-Based Psychotherapies*, *20*(1), 1-24.

Lo, C. K. M., Yu, L., Cho, Y. W., & Chan, K. L. (2021). A qualitative study of practitioners' views on family involvement in treatment process of adolescent Internet addiction. *International Journal of Environmental Research and Public Health*, *18*(1), 86. https://doi.org/10.3390/ijerph18010086

Malinauskas, R., & Malinauskiene, V. (2019). A meta-analysis of psychological interventions for Internet/smartphone addiction among adolescents. *Journal of Behavioral Addictions*, *8*(4), 613-624. https://doi.org/10.1556/2006.8.2019.72

Manwong, M., Lohsoonthorn, V., Booranasuksakul, T., & Chaikoolvatana, A. (2018). Effects of a group activity-based motivational enhancement therapy program on social media addictive behaviors among junior high school students in Thailand: A cluster randomized trial. *Psychology Research and Behavior Management*, *11*, 329-339. https://doi.org/10.2147/prbm.s168869

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., Stewart, L. A., Thomas, J., Tricco, A. C., Welch, V. A., Whiting, P., & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Systematic Reviews,* 10, 89 https://doi.org/10.1186/s13643-021-01626-4

Montag, C., Bey, K., Sha, P., Li, M., Chen, Y. F., Liu, W. Y., Zhu, Y. K., Li, C. B., Markett, S., & Keiper, J. (2015). Is it meaningful to distinguish between generalized and specific Internet addiction? Evidence from a cross-cultural study from Germany, Sweden, Taiwan and China. *Asia-Pacific Psychiatry*, *7*(1), 20-26. https://doi.org/10.1111/pcn.12457

Nielsen, P., Christensen, M., Henderson, C., Liddle, H. A., Croquette-Krokar, M., Favez, N., & Rigter, H. (2021). Multidimensional family therapy reduces problematic gaming in adolescents: A randomised controlled trial. *Journal of Behavioral Addictions*, *10*(2), 234-243. https://doi.org/10.1556/2006.2021.00022

Odacı, H., & Çelik, Ç. B. (2017). Group counselling on college students' internet dependency and life satisfaction. *Journal of Psychologists and Counsellors in Schools*, *27*(2), 239-250. https://doi.org/10.1017/jgc.2017.9

Ostinelli, E. G., Zangani, C., Giordano, B., Maestri, D., Gambini, O., D'Agostino, A., Furukawa, T. A., & Purgato, M. (2021). Depressive symptoms and depression in individuals with internet gaming disorder: A systematic review and meta-analysis. *Journal of Affective Disorders*, *284*, 136-142.

Pan, Y. C., Chiu, Y. C., & Lin, Y. H. (2020). Systematic review and meta-analysis of epidemiology of internet addiction. *Neuroscience & Biobehavioral Reviews, 118*, 612-622. https://doi.org/10.1016/j.neubiorev.2020.08.013

Park, J. H., Han, D. H., Kim, B.-N., Cheong, J. H., & Lee, Y.-S. (2016). Correlations among social anxiety, self-esteem, impulsivity, and game genre in patients with problematic online game playing. *Psychiatry Investigation*, *13*(3), 297. https://doi.org/10.4306/pi.2016.13.3.297

Pornnoppadol, C., Ratta-apha, W., Chanpen, S., Wattananond, S., Dumrongrungruang, N., Thongchoi, K., Panchasilawut, S., Wongyuen, B., Chotivichit, A., Laothavorn, J., & Vasupanrajit, A. (2018). A comparative study of psychosocial interventions for internet gaming disorder among adolescents aged 13–17 years. *International Journal of Mental Health and Addiction, 18*, 932–948.

Rith-Najarian, L. R., Mesri, B., Park, A. L., Sun, M., Chavira, D. A., & Chorpita, B. F. (2019). Durability of cognitive behavioral therapy effects for youth and adolescents with anxiety, depression, or traumatic stress: A meta-analysis on long-term follow-ups. *Behavior Therapy*, *50*(1), 225-240.

Sayegh, C. S., Huey Jr, S. J., Zara, E. J., & Jhaveri, K. (2017). Follow-up treatment effects of contingency management and motivational interviewing on substance use: A meta-analysis. *Psychology of Addictive Behaviors*, *31*(4), 403.

Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 statement: Updated guidelines for reporting parallel group randomised trials. *BMJ, 340*. https://doi.org/10.1136/bmj.c332

Shadbad, N. R. (2017). The effectiveness of mindfulness-based group therapy on reducing internet addiction and increasing the general health of adolescent girls. *Indian Journal of Public Health Research and Development*, *8*(4), 44-48.

https://doi.org/10.5958/0976-5506.2017.00311.4

Shaffer, H. J., LaPlante, D. A., LaBrie, R. A., Kidman, R. C., Donato, A. N., & Stanton, M. V. (2004). Toward a syndrome model of addiction: Multiple expressions, common etiology. *Harvard Review of Psychiatry*, *12*(6), 367-374.

Sim, T., Choo, H., Low-Lim, A., & Lau, J. (2021). Adolescents and parents' perspectives: A gaming disorder intervention in Singapore. *Family Relations*, *70*(1), 90-103. https://doi.org/10.1111/fare.12474

Stevens, M. W. R., King, D. L., Dorstyn, D., & Delfabbro, P. H. (2018). Cognitive–behavioral therapy for Internet gaming disorder: A systematic review and meta-analysis. *Clinical Psychology & Psychotherapy*, *26*(2), 191-203. https://doi.org/10.1002/cpp.2341

Su, W. L., Fang, X. Y., Miller, J. K., & Wang, Y. Y. (2011). Internet-based intervention for the treatment of online addiction for college students in China: A pilot study of the healthy online self-helping center. *Cyberpsychology Behavior and Social Networking*, *14*(9), 497-503. https://doi.org/10.1089/cyber.2010.0167

Teng, Z., Pontes, H. M., Nie, Q., Xiang, G., Griffiths, M. D., & Guo, C. (2020). Internet gaming disorder and psychosocial well-being: A longitudinal study of older-aged adolescents and emerging adults. *Addictive Behaviors*, *110*, 106530. https://doi.org/10.1016/j.addbeh.2020.106530

Torres-Rodriguez, A., Griffiths, M. D., Carbonell, X., & Oberst, U. (2018). Treatment efficacy of a specialized psychotherapy program for Internet gaming disorder. *Journal of Behavioral Addictions*, *7*(4), 939-952. https://doi.org/10.1556/2006.7.2018.111

Uysal, G., & Balci, S. (2018). Evaluation of a school-based program for Internet addiction of adolescents in Turkey. *Journal of Addictions Nursing*, *29*(1), 43-49. https://doi.org/10.1097/JAN.0000000000000211

Van den Eijnden, R., Koning, I., Doornwaard, S., Van Gurp, F., & Ter Bogt, T. (2018). The

impact of heavy and disordered use of games and social media on adolescents' psychological, social, and school functioning. *Journal of Behavioral Addictions*, *7*(3), 697-706. https://doi.org/10.1556/2006.7.2018.65

Vonderlin, R., Biermann, M., Bohus, M., & Lyssenko, L. (2020). Mindfulness-based programs in the workplace: A meta-analysis of randomized controlled trials. *Mindfulness*, *11*(7), 1579-1598. https://doi.org/10.1007/s12671-020-01328-3

Wartberg, L., Kriston, L., Zieglmeier, M., Lincoln, T., & Kammerl, R. (2019). A longitudinal study on psychosocial causes and consequences of Internet gaming disorder in adolescence. *Psychological Medicine, 49*(2), 287-294.

Winkler, A., Dörsing, B., Rief, W., Shen, Y., & Glombiewski, J. A. (2013). Treatment of Internet addiction: A meta-analysis. *Clinical Psychology Review*, *33*(2), 317-329. https://doi.org/10.1016/j.cpr.2012.12.005

Wölfling, K., Beutel, M. E., Dreier, M., & Müller, K. W. (2014). Treatment outcomes in patients with internet addiction: A clinical pilot study on the effects of a cognitive-behavioral therapy program. *BioMed Research International*, *2014,* 425924. https://doi.org/10.1155/2014/425924

Wölfling, K., Müller, K. W., Dreier, M., Ruckes, C., Deuster, O., Batra, A., Mann, K., Musalek, M., Schuster, A., & Lemenager, T. (2019). Efficacy of short-term treatment of internet and computer game addiction: A randomized clinical trial. *JAMA Psychiatry*, *76*(10), 1018-1025. https://doi.org/ 10.1001/jamapsychiatry.2019.1676

World Health Organization. (2022). *ICD-11 (Mortality and Morbidity Statistics)*. https://icd.who.int/dev11/l-m/en

Wu, X.S., Zhang, Z.H., Zhao, F., Wang, W.J., Li, Y.F., Bi, L., Qian, Z.Z., Lu, S.S., Feng, F., & Hu, C.Y. (2016). Prevalence of Internet addiction and its association with social support and other related factors among adolescents in China. *Journal of Adolescence*,

52, 103-111. https://doi.org/10.1016/j.adolescence.2016.07.012

Yen, J. Y., Yeh, Y. C., Wang, P. W., Liu, T. L., Chen, Y. Y., & Ko, C. H. (2018). Emotional regulation in young adults with internet gaming disorder. *International Journal of Environmental Research and Public Health*, *15*(1), 30. https://doi.org/10.3390/ijerph15010030

Zajac, K., Ginley, M. K., Chang, R., & Petry, N. M. (2017). Treatments for Internet gaming disorder and Internet addiction: A systematic review. *Psychology of Addictive Behaviors*, *31*(8), 979-994. https://doi.org/10.1037/adb0000315

Zhong, X., Zu, S., Sha, S., Tao, R., Zhao, C., Yang, F., Li, M., & Sha, P. (2011). The effect of a family-based intervention model on Internet-addicted Chinese adolescents. *Social Behavior and Personality*, *39*(8), 1021-1034. https://doi.org/10.2224/sbp.2011.39.8.1021

Zhou, X., Rau, P. L. P., Yang, C. L., & Zhou, X. (2021). Cognitive behavioral therapy-based short-term abstinence intervention for problematic social media use: Improved well-being and underlying mechanisms. *Psychiatric Quarterly*, *92*(2), 761-779. https://doi.org/10.1007/s11126-020-09852-0

Figure 1

Study identification and selection process according to PRISMA guidelines

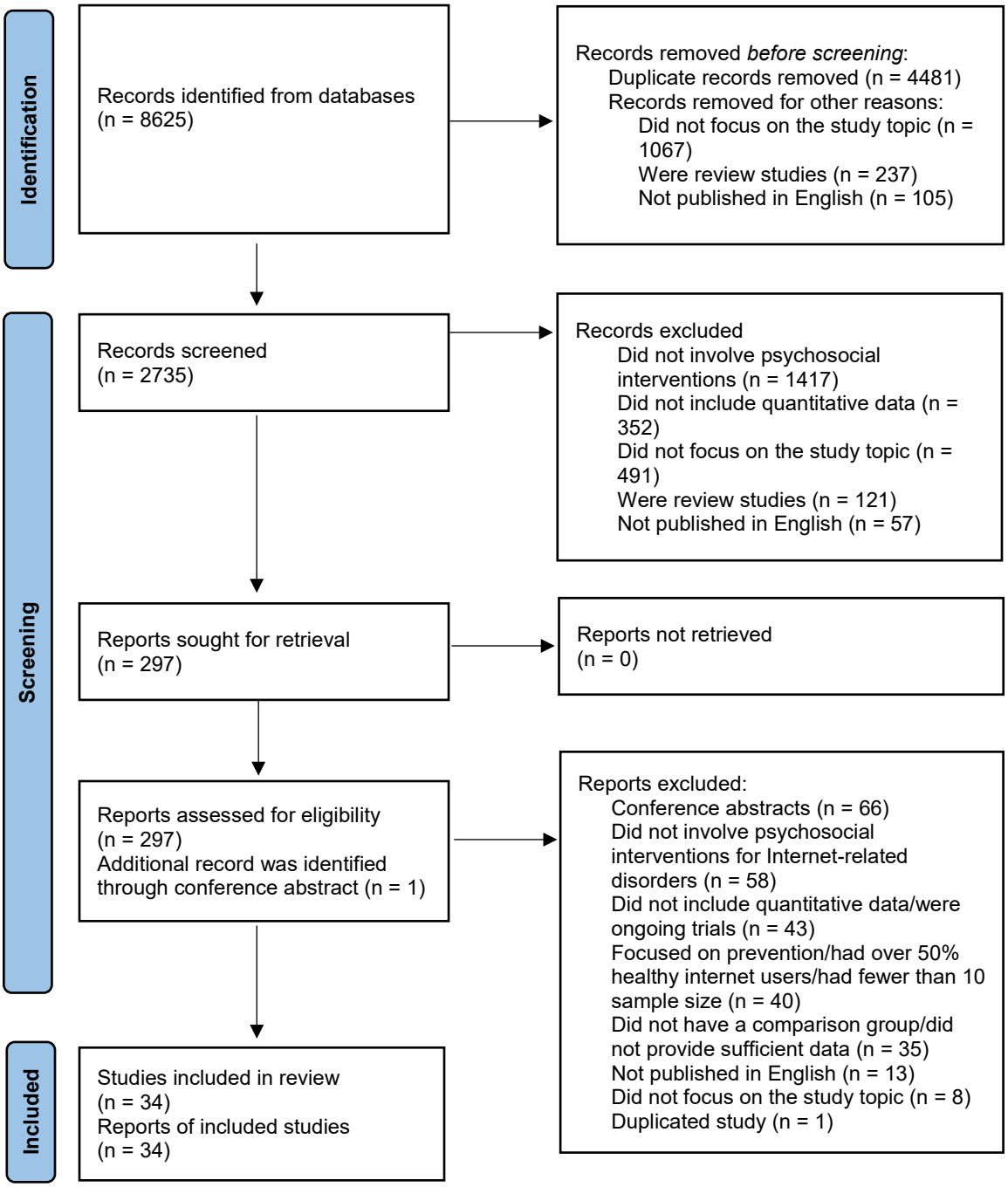
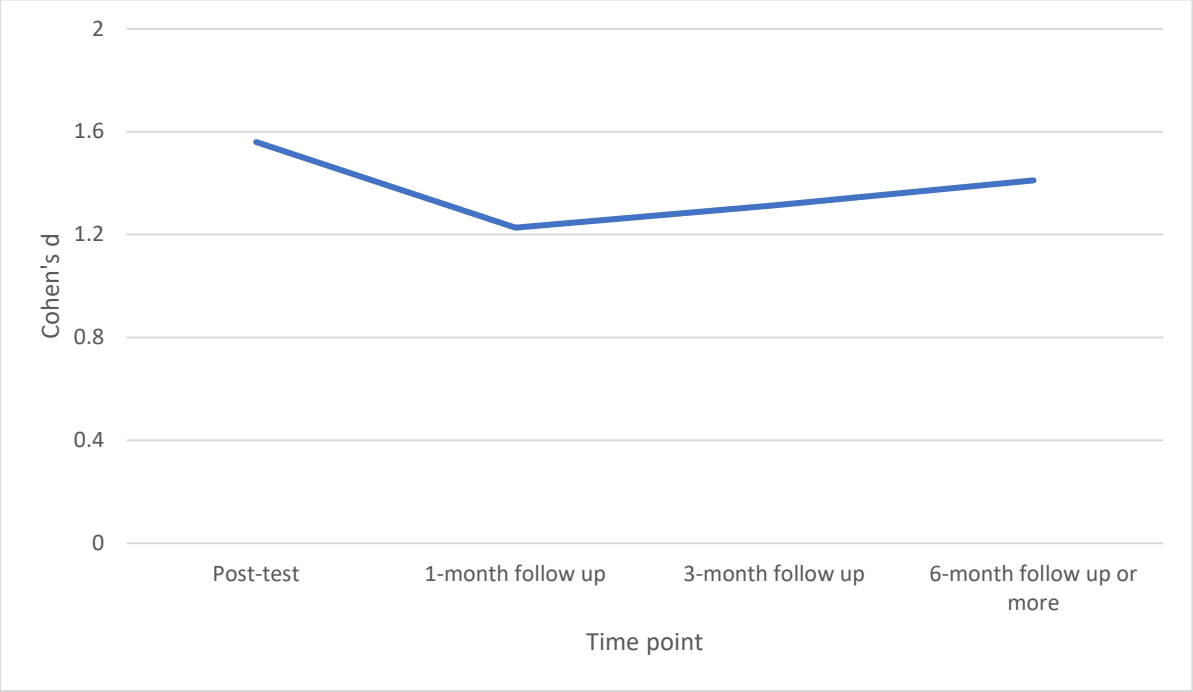


Figure 2

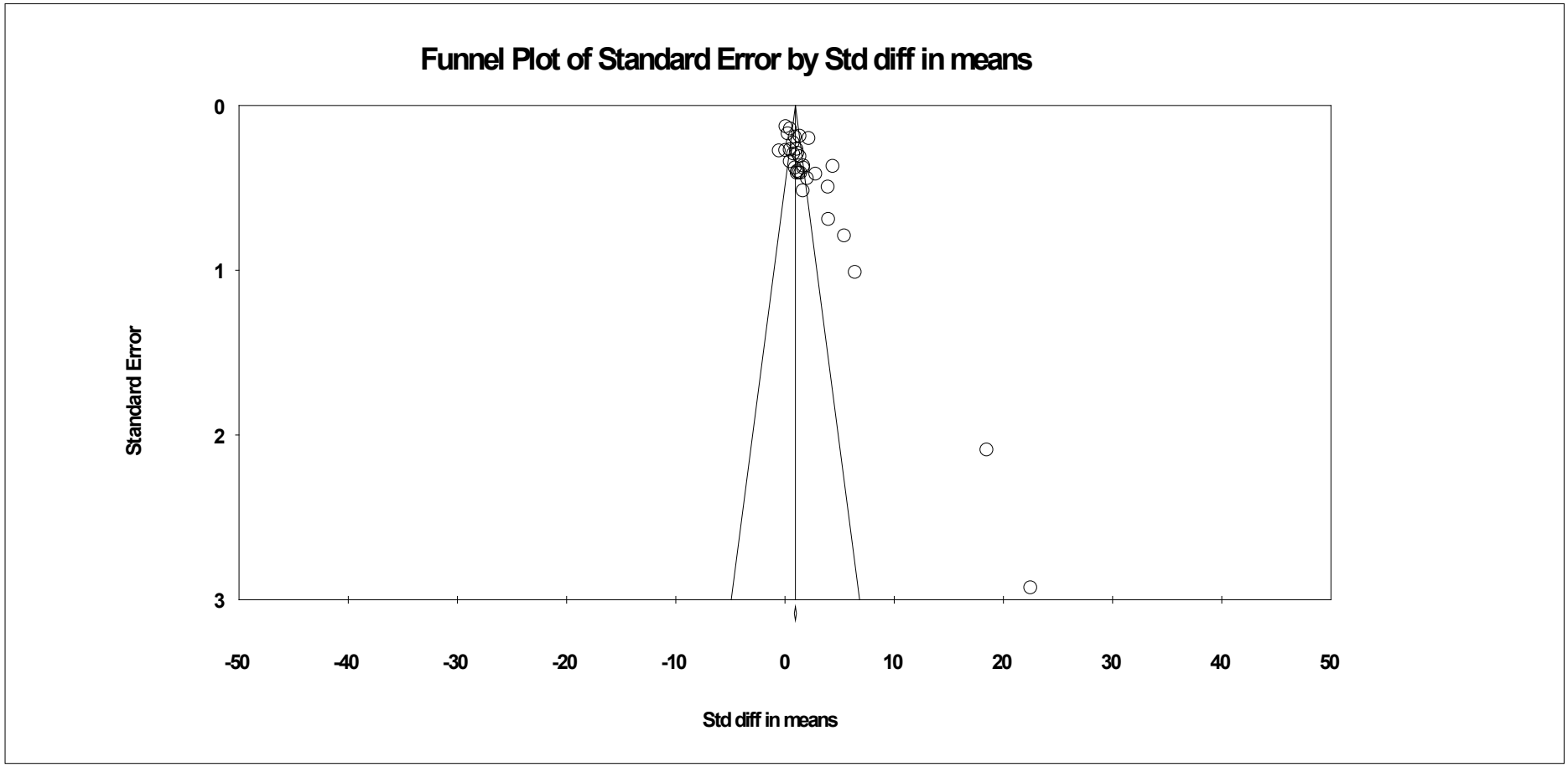
Intervention effects on addiction severity at post-test, 1-month, 3-month, and 6-month follow up or more



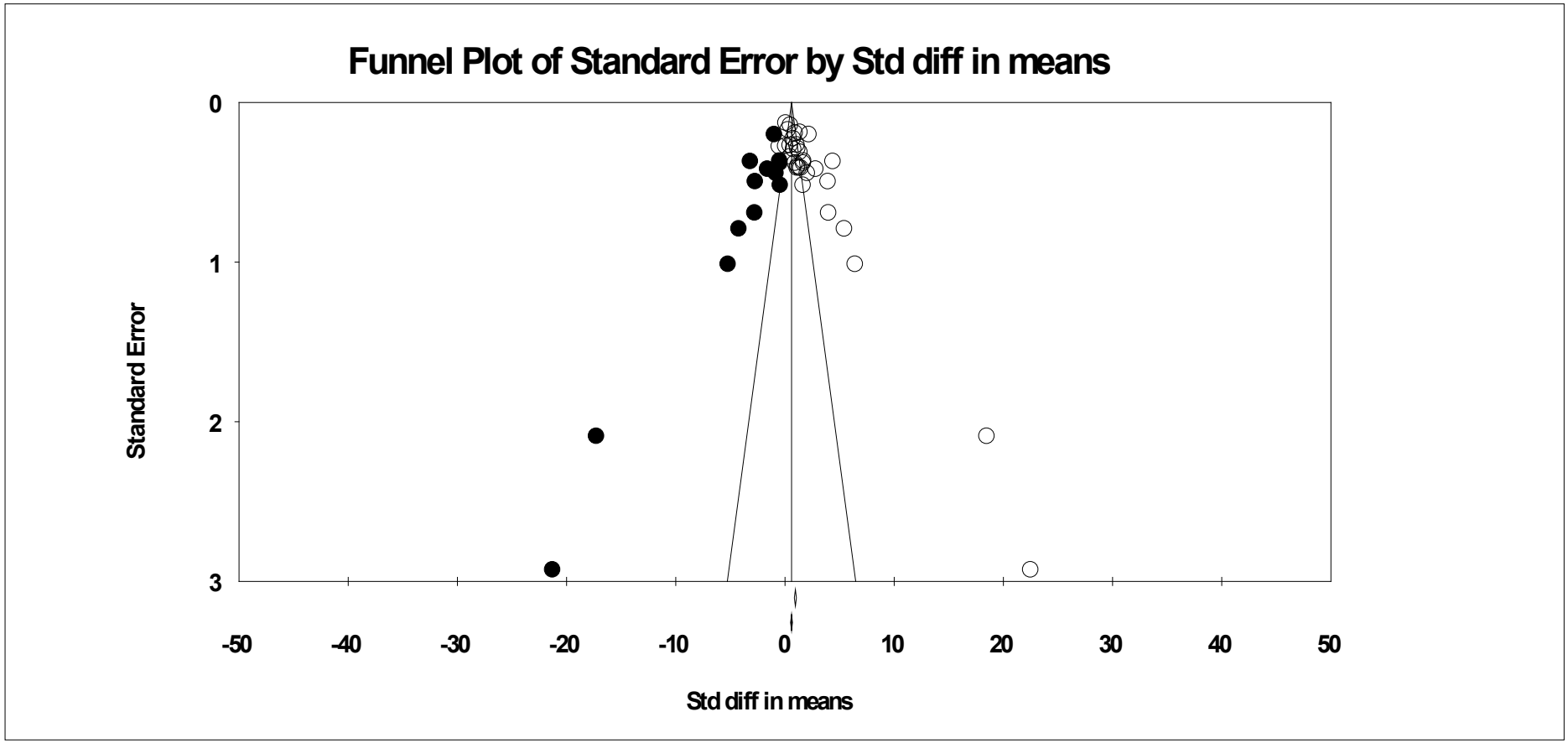
	k	*d*	95% CI	p-value
Post-test	15	1.56	0.097, 2.170	<.001
1-month follow up	6	1.227	0.302, 2.153	0.009
3-month follow up	6	1.314	0.641, 1.987	<.001
6-month follow up or more	7	1.411	0.598, 2.224	0.001

Figure 3

a. Funnel plot showing distribution of the included studies



b. Funnel plot showing distribution of the included studies and the imputed studies by the trim-and-fill method



The open circles are observed studies and the solid circles are imputed studies

Table 1

Characteristics of the included studies

Study	Country	Theoretical approach	Study quality score	Study design	Addiction type	Sample size (IG/CG)	Sample type	Intervention format	Control group type	Duration	Frequency	No. of sessions	Involvement of family	Mean age
Affouneh et al. (2021)	Palestine	Unclear	14	Randomized Controlled	Internet addiction	15/15	Non-clinical	Group-based program	No intervention	8 weeks	Weekly	8	No	Not reported
Agbaria (2022)	Israel	Cognitive behavioral therapy	12	Randomized Controlled	Internet addiction	80/80	Non-clinical	Group-based program	Active control	12 weeks	Weekly	12	No	<18
Alavi et al., (2021)	Iran	Cognitive behavioral therapy	15	Randomized controlled	Internet addiction	18/23	Non-clinical	Group-based program	Active control	15 weeks	Weekly	15	No	≥18
Besser et al., (2022)	Germany	Motivational interviewing + Cognitive behavioral therapy	14	Randomized controlled	Internet use disorder	20/16	Non-clinical	Individual counseling	No intervention	8 weeks	Varied	4	No	≥18
Bong et al., (2021)	South Korea	Cognitive behavioral + music therapy	13	Randomized controlled	Smartphone addiction and Internet addiction	67/71	Non-clinical	Group-based program	Active Control	8 weeks	Weekly	8	No	<18
Celik (2016)	Turkey	Psycho educational	10.5	Randomized controlled	Internet addiction	15/15	Non-clinical	Group-based program	No intervention	5 weeks	Weekly	5	No	Not reported
Deng et al. (2017)	China	Craving behavioral intervention	15	Non-randomized controlled	Internet gaming disorder	40/18	Non-clinical	Group-based program	No intervention	6 weeks	Weekly	6	No	≥18
Dicle (2021)	Turkey	Motivational interviewing	14	Non-randomized cotrolled	Internet addiction	15/15	Non-clinical	Group-based program	No intervention	5 weeks	Twice a week	10	No	≥18
Du et al. (2010)	China	Cognitive behavioral therapy	15.5	Randomized controlled	Internet addiction	32/24	Non-clinical	Family-based group therapy	No intervention	8 weeks	Weekly	8	Yes	<18
Ede et al., (2021)	Nigeria	Cognitive behavioral therapy	19	Randomized controlled	Pathological Internet use	20/20	Non-clinical	Group-based program	No intervention	8 weeks	Weekly	8	No	≥18
Han et al. (2020)	South Korea	Cognitive behavioral Therapy	17	Non-randomized controlled	Internet gaming disorder	101/104	Clinical	Group-based program	Active control	8 weeks	1-2 times per week	14	No	≥18
Hong et al. (2020)	South Korea	Physical exercise + cognitive behavioral therapy	15	Randomized controlled	Internet gaming disorder	25/25	Clinical	Group-based program	Active control	14 weeks	Weekly	14	No	<18

Hou et al. (2019)	China	Cognitive behavioral therapy	14	Randomized controlled	Social media addiction	21/17	Non-clinical	Group-based program	No intervention	1 week	Not reported	Not reported	No	≥18
Khazaei et al. (2017)	Iran	Positive psychology	13	Randomized controlled	Internet addiction	24/24	Non-clinical	Group-based program	No intervention	Not reported	Not reported	10	No	Not reported
Kim (2008)	South Korea	Reality therapy	10	Randomized controlled	Internet addiction disorder	13/12	Non-clinical	Group-based program	No intervention	5 weeks	Twice a week	10	No	≥18
Kim et al. (2012)	South Korea	Cognitive behavioral therapy	15	Randomized controlled	Excessive online game play	32/33	Clinical	Group-based program	Active control	8 weeks	Weekly	8	Yes	<18
Kuriala et al., (2020)	Philippines	Cognitive behavioral + mindfulness therapy	8	Randomized Controlled	Internet gaming disorder	50/50	Non-clinical	Group-based program	No intervention	5 weeks	Twice a week	8	No	Not reported
Lan et al. (2018)	China	Mindfulness-based cognitive therapy	13	Non-randomized controlled	Smartphone addiction	27/27	Non-clinical	Group-based program	No intervention	8 weeks	Weekly	8	No	≥18
Li & Wang (2013)	China	Cognitive behavioral therapy	13	Randomized controlled	Online game addiction	14/14	Clinical	Group-based program	Active control	6 weeks	Twice a week	12	No	Not reported
Li et al. (2017)	US	Mindfulness-oriented recovery enhancement	18.5	Randomized controlled	Internet gaming disorder	15/14	Non-clinical	Group-based program	Active control	8 weeks	Weekly	8	No	≥18
Liu et al. (2015)	China	Family therapy	13	Non-randomized controlled	Internet addiction	21/25	Non-clinical	Family-based group therapy	No intervention	3 weeks	Once every 3 days	6	Yes	<18
Liu et al., (2021)	China	Logotherapy + Mindfulness	12.5	Randomized controlled	Internet addiction	60/61	Non-clinical	Group-based program	No intervention	8 weeks	Weekly	8	No	<18
Liu et al., (2020)	China	Attention bias modification	14	Randomized Controlled	Smartphone addiction	16/15	Non-clinical	Individual training	Active control	Not reported	Not reported	1	No	≥18
Manwong et al. (2018)	Thailand	Motivational enhancement therapy	18.5	Randomized controlled	Social media addiction	125/120	Non-clinical	Group-based program	No intervention	8 weeks	Weekly	8	No	Not reported
Nielson et al., (2021)	Switzerland	Family therapy	18.5	Randomized controlled	Problematic gaming	11/21	Clinical	Family-based therapy	Active control	24 weeks	Twice a week	Not reported	Yes	<18
Odacı & Çelik (2017)	Turkey	Reality therapy	11.5	Non-randomized controlled	Internet dependency	10/10	Non-clinical	Group-based program	No intervention	8 weeks	Weekly	8	No	≥18

Pornnoppadol et al. (2018)	Thailand	Integrative approach	17	Non-randomized controlled	Internet gaming disorder	26/30	Non-clinical	Residential camp + parent management training	Active control	7 days and 6 nights (Residential camp)	Not reported	Residential camp: 10 sessions; parent management training: 8 sessions	Yes	<18
Shadbad (2017)	Iran	Mindfulness-based cognitive therapy	10	Randomized controlled	Internet addiction	12/12	Non-clinical	Group-based program	No intervention	Not reported	Not reported	8	No	≥18
Su et al. (2011)	China	Psycho educational	15	Randomized controlled	Internet addiction	12/16	Non-clinical	Web-based individual self-help program	No intervention	4 weeks	Not reported	Not reported	No	Not reported
Torres-Rodriguez et al. (2018)	Spain	Integrative approach	13.5	Non-randomized controlled	Internet gaming disorder	16/15	Clinical	Individual psychotherapy	Active control	6 months	Not reported	22	Yes	<18
Uysal & Balci (2018)	Turkey	Social cognitive approach	13.5	Randomized controlled	Internet addiction	32/32	Non-clinical	Group-based program	No intervention	3 months	Not reported	8	Yes	<18
Wölfling et al. (2019)	Germany, Austria	Cognitive behavioral therapy	23	Randomized controlled	Internet and computer game addiction	72/71	Clinical	Mixed group and individual program	No intervention	15 weeks	Weekly	15 group sessions, 8 individual sessions	No	≥18
Zhong et al. (2011)	China	Family-based group therapy	16.5	Randomized controlled	Internet addiction	28/23	Clinical	Family-based group therapy	Active control	14 weeks	Weekly	14	Yes	≥18
Zhou et al. (2021)	China	Cognitive behavioral therapy	13	Randomized controlled	Problematic social media use	33/32	Non-clinical	Individual-based therapy	Active control	2 weeks	Four times a week	8	No	≥18

Table 2

Pooled effect sizes of different intervention outcomes

Outcomes	*k*	*d*	95% CI	*p*	Q	I^2
IA/GD/social media/smartphone addiction (randomized controlled studies only)	24	1.821	[1.317, 2.324]	0.000	425.812***	94.599
IA/GD/social media/smartphone addiction	32	1.790	[1.365, 2.214]	0.000	532.095***	94.174
Internet addiction	19	2.376	[1.722, 3.030]	0.000	347.396***	94.819
Gaming disorder	9	1.498	[0.808, 2.187]	0.000	104.836***	92.369
Social media addiction	2	0.833	[-0.737, 2.404]	0.298	16.115***	93.795
Smartphone addiction	3	0.294	[-0.122, 0.709]	0.166	3.951	49.380
Time spent online (h/d)	6	0.508	[0.168, 0.848]	0.003	14.665*	65.906
Time spent online (h/wk)	5	2.671	[1.058, 4.284]	0.001	85.181***	95.304
Inattentiveness/impulsivity	7	0.265	[0.026, 0.504]	0.029	13.967*	57.041
Anxiety	10	0.648	[0.386, 1.042]	0.000	26.519**	69.833
Depression	12	0.459	[0.198, 0.719]	0.001	43.826***	74.901
Internalizing problems	13	0.530	[0.305, 0.755]	0.000	37.412***	67.925
Externalizing problems	4	0.351	[0.028, 0.673]	0.033	5.653	46.931
General health and functioning	7	1.956	[0.863, 3.049]	0.000	186.832***	96.789
Self-esteem/self-concept	5	0.471	[0.025, 0.917]	0.038	16.564**	75.851
Peer/social problems	5	0.811	[0.170, 1.451]	0.013	34.361***	88.359
Social competence	5	1.647	[0.397, 2.898]	0.010	86.035***	95.351
Relationship quality	5	1.220	[0.327, 2.114]	0.007	67.940***	94.112
Life satisfaction/quality of life	6	0.857	[0.349, 1.365]	0.001	19.776**	74.717

k = number of studies; *d* = effect size; CI = confidence interval; Q = Q statistic; *p < .05. **p < .01. ***p < .001

Table 3

Moderator analyses

Moderator	Subgroup	*k*	*d* [95% CI]	Q_b	*df(Q)*	*p*
Study design	Non-randomized	8	1.781 [0.877, 2.685]	0.006	1	0.940
	Randomized	24	1.821 [1.317, 2.324]			
Study sample	Clinical	7	0.986 [0.602, 1.370]	11.049	1	0.001
	Non-clinical	25	2.154 [1.582, 2.726]			
Control group type	Active control	12	1.096 [0.692, 1.500]	11.485	1	0.001
	No intervention	20	2.494 [1.794, 3.194]			
Study quality score	≤14	18	2.409 [1.714, 3.103]	9.884	1	0.002
	>14	14	1.062 [0.590, 1.533]			
Theoretical approach	Cognitive behavioral	8	1.713 [0.853, 2.574]	1.619	3	0.655
	Family therapy	3	1.445 [0.087, 2.802]			
	Integrative approach	9	1.607 [0.782, 2.433]			
	Other (e.g., reality therapy, positive psychology, craving behavioral intervention, motivational enhancement therapy, social cognitive approach, mindfulness-based cognitive behavioral)	12	2.263 [1.401, 3.125]			
Involvement of family members	No	24	2.109 [1.575, 2.644]	6.273	1	0.012
	Yes	8	1.067 [0.450, 1.683]			
Intervention format	Group-based	22	2.236 [1.662, 2.809]	9.979	3	0.019
	Family-based	4	0.939 [-0.342, 2.220]			
	Individual	4	1.092 [0.467, 1.717]			
	Mixed	2	1.298 [0.992, 1.605]			

k = number of studies; *d* = effect size, Cohen's *d*; Q_b = between-group Q statistic