AKADÉMIAI KIADÓ

Journal of Behavioral Addictions

13 (2024) 2, 295–312

DOI:
10.1556/2006.2024.00015

META-ANALYSES

Family-based therapy for internet addiction among adolescents and young adults: A meta-analysis

HUI WANG[1*], XIANG LI[1], GRACE KA IN LOK[8], CHUNMEI MENG[2,3], YAHENG TAN[2,4], UN MAN LEE[2,5], LOUISA SOK MAN LEI[2,6] and NATALIA CHAN[2,7]

[1] Education Department, Kiang Wu Nursing College of Macau, Macao SAR, China

[2] Kiang Wu Nursing College of Macau, Macao SAR, China

[3] Guangzhou Red Cross Hospital, Macao SAR, China

[4] Public Health Clinical Center of Chengdu, Macao SAR, China

[5] Faculty of Medicine, Macau University of Science and Technology, Macao SAR, China

[6] Hong Kong Polytechnic University, Macao SAR, China

[7] Centre for Cognitive and Brain Sciences, University of Macau, Macao SAR, China

[8] Macao Polytechnic University, Peking University Health Science Center- Macao Polytechnic University Nursing Academy, Macao SAR, China

Received: July 4, 2023 • Revised manuscript received: October 14, 2023; February 27, 2024; March 7, 2024 • Accepted: March 17, 2024
Published online: April 17, 2024

ABSTRACT

Background and aims: Internet addiction (IA) has been identified as a major public health problem that is more prominent in adolescents and young adults. Some researchers have indicated certain advantages of family-based therapy over other treatments in participants with IA, but no conclusive evaluation has been reported. The present meta-analysis aims to review the efficacy of family-based therapy on Internet addiction in adolescents and young adults. *Methods:* Relevant articles published from 1996 to February 15th, 2024, were searched from 14 databases, including three Chinese databases. A total of 19,590 articles were identified using a combination of three sets of search terms (Internet addiction, family therapy, and adolescents). Only RCTs and nonrandomized controlled trials were included. *Results:* 18 studies, most of which were conducted in Asian countries, were included in the final data analysis. The overall severity of Internet addiction in the family-based therapy group was significantly lower than that in the control group. However, significant heterogeneity was detected. Subgroup analysis showed a beneficial effect of family-based therapy when compared with non-intervention and when added to another psychological or behavioural therapy in psychiatric patients with co-medication. Few studies have examined secondary outcomes or follow-up effects. *Discussion and Conclusions:* Family-based therapy is most effective in reducing the severity of Internet addiction when combined with other therapies, especially medication treatments in psychiatric patients. It might also be helpful to relieve depression and enhance family functions, which needs further evidence. More studies following up on the post-intervention effects are recommended in the future.

KEYWORDS

internet addiction, meta-analysis, adolescents, young adults, family-based therapy, treatment

*Corresponding author.
E-mail: wanghuins@gmail.com

INTRODUCTION

In recent years, the widespread use of computers and the Internet has caused a variety of health problems, including physical issues like vision and sleep disorders, as well as mental challenges such as depression, social phobia, and even suicidal behaviours (Nakshine, Thute,

Khatib, & Sarkar, 2022). Moreover, it is associated with changes to brain regions responsible for attention, impulse control, emotional competence and much more (Firth et al., 2019; Sun et al., 2023). That is why Internet addiction (IA) has been identified as a major public health problem, with an average prevalence of approximately 14.22% (Meng et al., 2022). The harm of Internet gaming disorder seems more severe, especially due to extreme time investment leading to adverse intrapersonal and interpersonal effects (King & Delfabbro, 2018). It has been identified as a type of addictive disorder diagnosis in the 11th International Classification of Diseases (ICD-11) (WHO, 2024).

The category of gaming disorder has been debated. Some studies addressed gaming addiction as one of the categories of Internet addiction since excessive use of the Internet is intently related to games and recreation (Taş, 2017; Young, Pistner, O'Mara, & Buchanan, 1999). Some other researchers argued that Internet gaming disorder is a sub-type of gaming disorder rather than Internet addiction (Griffiths, 2017). In fact, the mechanisms and risk factors for these addictive behaviours, such as Internet addiction, gaming disorder and social media addiction, seem quite similar (Dong, Yang, Lu, & Hao, 2020; Ferraro et al., 2020; Rho et al., 2018), and even pathophysiology changes in the brains seem similar to other addictive behaviours (Weinstein, Livny, & Weizman, 2017). Thus, most studies, including previous systemic reviews and meta-analyses on Internet addiction, have combined participants with generalized Internet addiction, gaming addiction and other digital device addiction (Meng et al., 2022; Pan, Chiu, & Lin, 2020).

An increasing trend of IA dramatically worsened during COVID-19 pandemic (Meng et al., 2022). Adolescents and young adults tend to have experienced IA more easily than any other age group, especially in Asian countries (Jorgenson, Hsiao, & Yen, 2016). Highly engaged gamers were primarily reported in the age group of 15–18, 19–24 and 25–29, much higher than those aged 30 and older (André, Broman, Håkansson, & Claesdotter-Knutsson, 2020). That is why some studies examining Internet addiction included not only adolescents aged 15 to19 or young adults (aged 15–24) as defined by World Health Organization (WHO) (2022).

According to previous studies, IA is characterized by impulsive behaviours and persistent engagement despite negative consequences because of a generalized hyperactive reward system in the brain (Xu et al., 2021). The cognitive behavioural model addresses individuals' problematic cognitions and behaviours related to maladaptive responses and psychological escape mechanisms (Malinauskas & Malinauskiene, 2019; Xu et al., 2021). Various psychological interventions may focus on desired changes in three areas: symptoms, activities including everyday functions, and well-being and recovery (Malinauskas & Malinauskiene, 2019). For instance, Cognitive Behavioural Therapy (CBT), which is the main treatment for IA except for pharmacotherapy, usually includes three phases of treatment: behaviour modification, cognitive restructuring, and harm reduction therapy (Xu et al., 2021; Zajac, Ginley, Chang, & Petry, 2017). However, the effects of CBT in treating IA also remain limited, and only short-term benefits have been reported (Stevens, King, Dorstyn, & Delfabbro, 2018; Zajac et al., 2017).

Apart from individual risk factors, family-related factors have consistently been associated with IA, including maladaptive parenting styles, family dysfunction, poor emotional support, and unhealthy parent-child relationships and communication, which implies the importance of a family-based approach in treatments for IA (Lo, Yu, Cho, & Chan, 2021). The family-based approach focuses not solely on adolescents and young adults with IA but on the foundation of positive family functions and relationships, e.g., strengthening parent-adolescent communication and fulfilling adolescents' psychological needs (Lo et al., 2021; Xu et al., 2021). This approach aligns with the systemic perspective, which views the family as an interconnected unit that can work together to create a more supportive and conducive environment for change (Dallos & Draper, 2015), leading to more effective outcomes on well-being and rehabilitation of adolescents and young adults experiencing IA (Lo et al., 2021). In previous systematic reviews, the number of related studies was too limited to reach a conclusive evaluation (Zajac et al., 2017). Considering the number of studies investigating family-based therapy has increased since 2017, we aimed to systematically review the evidence through a meta-analysis to investigate the effects of family-based intervention programs for IA among adolescents and young adults.

METHODS

Data search

A systematic search of research was conducted following the principles of PRISMA (Page et al., 2021) and Cochrane recommendations (Higgins et al., 2022). Relevant articles published from 1996 to February 15th, 2024, were searched from the following databases: PubMed, EMBASE, CINAHL, Cochrane Library, ProQuest, Web of Science, PsycINFO, Psychology and Behavioral Sciences Collection, EBSCOHost Academic Search Ultimate, APA PsycARTICLES, and ScienceDirect. Commonly used Chinese databases were also included: WANFANG, CNKI, and Airiti Library. Dissertations in those databases were also included to find any unpublished grey literature. Search terms included three sets of terms: "internet addiction" AND "adolescent" OR "child" AND "family therapy". Other terms used in the literature search were: (1) "youth", "teen*", "school", and "college"; (2) combination of "pathology", "problem*", "addict*", "compulsive", "dependen*", "overuse", AND "computer", "internet", "smartphone", "phone", "social media", "gaming", and "game"; and (3) combination of "family", "families", "parent*", "father*", "mother*", "home", AND "intervention*", "treatment*", "program*", "therapy", and "therapeutic". MESH terms, Emtree and subject headings were used in the databases if possible. Additionally, reference lists of review articles, meta-analyses, and original studies retrieved were reviewed thoroughly to identify any

eligible studies. A total of 19,590 articles were identified after the removal of duplicated studies (Fig. 1). Another 45 studies were screened from reference lists of key systematic reviews.

Study selection

Study selection was performed independently by two reviewers according to the inclusion and exclusion criteria below. The titles and abstracts of all records from the literature search were screened first, and full texts were retrieved and reviewed for all potentially eligible studies. The author was contacted for more information if only abstracts or limited information were available (e.g., conference abstract, registered trial online). Disagreements among reviewers were discussed with the principal investigator and resolved until consensus.

Inclusion criteria. Studies examining family-based interventions for IA among adolescents and young adults were considered for inclusion. The eligibility criteria were as follows: (1) The main participants were adolescents (aged 10–19) and youth (aged 15–24) with IA (World Health Organization, 2022), and their family members were involved in the family-based therapy group. Those studies that included adolescent participants aged beyond 24 were not excluded during data search and selection, as performed in the previous systemic review (Thomas, Baker, Thomas, & Lorenzetti, 2015). (2) Family-based intervention (including any components to change parenting behaviour, parental or sibling behaviour, or family communication and interaction) was used in the study (Thomas et al., 2015). (3) The study design was RCT or controlled experimental trials, and intervention in the comparison group could be no treatment, waiting list, or alternative care. (4) The language of the study was English or Chinese.

Exclusion criteria. Studies were excluded if (1) the study design was a case study or pre-post-test study. (2) The effects of family intervention could not be separated from the study (e.g. healthy participants without IA in control group or compared with another family-based therapy). (3) No sufficient data were reported for analysis, and no data was available after contacting authors.

Data extraction

Data extraction was performed by two reviewers using a structured data extraction form that was created and modified after pilot testing. For articles that needed full article retrieval, important characteristics of the study (e.g., country, year of publication, design of the study, setting of recruitment, intervention information) were recorded in the form, as well as the decision of inclusion and reasons for exclusion. Once the final decision of inclusion of the study was made, characteristics of participants (e.g., sample size, age, gender, education level, inclusive criteria, e.g., methods used to diagnose Internet addiction), intervention (composition of intervention in each group), as well as all outcome measures available (e.g., IA severity, anxiety and depression level) were included. If the article failed to report data for meta-analysis, authors were contacted to obtain more

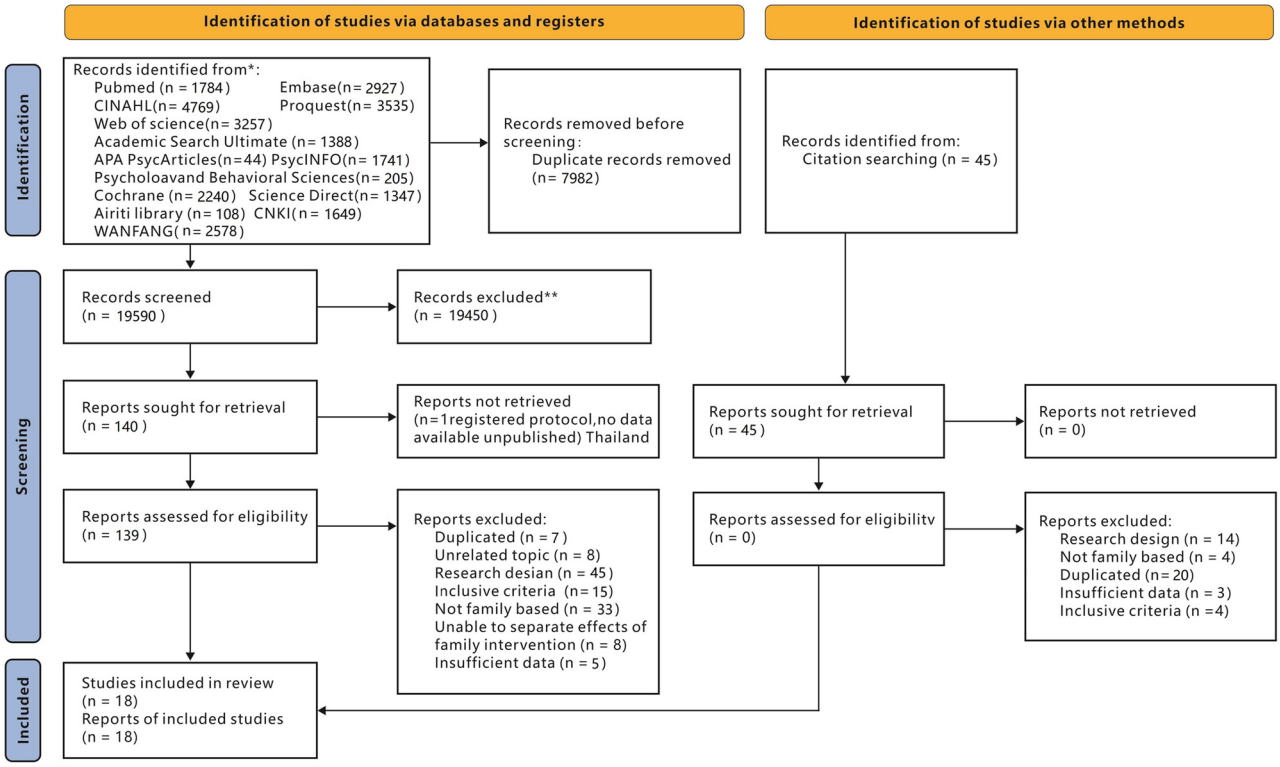

Fig. 1. PRISMA flow diagram of the study selection process

information if possible. Disagreement was resolved upon discussion and consensus with the principal investigator. To calculate the effect sizes of the intervention, the sample size, average, and standard deviations of the outcomes in the intervention and control groups were used. If multiple interventions were examined within a single study, the sample size of the shared group was divided according to the number of groups of interest according to the Cochrane Review Handbook (Higgins et al., 2022).

Risk of bias evaluation

The methodological quality of the included studies was assessed using the Cochrane risk of bias tool for randomized trials (Ro B 2.0) and ROBINS-I for nonrandomized studies. RoB 2.0 evaluates bias in five domains: randomization process, deviations from intended intervention, missing outcome data, outcome measurements, and selection of results reported. ROBINS-I covers bias from seven domains: confounding factors, selection of participants, classification of interventions, deviations from intended interventions, missing outcome data, outcome measurements, and selection of results reported (Sterne et al., 2016). ROBINS-I evaluates the risk of bias in relation to a hypothetical randomized trial, which makes it possible to synthesize the results of randomized and nonrandomized trials in a single meta-analysis (Sterne et al., 2016). Two researchers independently assessed each study and determined the global score. Disagreements were resolved after a discussion with the principal investigator. Interrater reliability was determined using the kappa statistic. Funnel plot asymmetry was applied to assess public bias.

Outcomes measurement

The severity of IA or the rate of IA was the primary outcome to be evaluated. All results were included for data analysis if an outcome was measured using different instruments (refer to Table 1). For instance, widely used instruments assessing IA are Young's Diagnostic Questionnaire and Young's Internet Addiction Test (IAT). Some studies might focus on participants with gaming disorders using the Game Addiction Screening Test (GAST) or other specific questionnaires. All other outcomes showing effects of IA-related mental health problems (anxiety, depression, et al.) were included as secondary outcomes, including Zung Self-Rating Anxiety Scale (SAS), Screen for Child Anxiety-Related Disorders (SCARED), Zung Self-Rating Depression Scale (SDS), Hamilton Depression Rating Scale (HAMD), and more. Some studies discussed family function (e.g., Family Assessment Device, FAD), family communication and relationships (e.g., Parent-Adolescent Communication Scale, PACS; Parent-child relationship survey, PCRS) as the second outcomes.

Data analysis

Meta-analysis was performed using RevMan 5 and Stata 12.0. A fixed effect model is applied if the included studies are statistically homogeneous (I^2 < 50%). Otherwise, a random effect model is employed since significant heterogeneity is suspected. Effect sizes were determined using Cohen's *d* and were classified as small (0.20–0.30), medium (approximately 0.5) and large (above 0.80) (Sullivan & Feinn, 2012). Egger's test was used for funnel plot asymmetry in publication bias (Lin & Chu, 2018). Subgroup analysis was performed among different population categories and therapeutic methods. Sensitivity analysis was conducted to examine the impact of each individual study, research design and participants of included studies, and various aspects of study quality. Meta-regression was also used to examine the origin of heterogeneity among effect sizes.

RESULTS

Study characteristics

Eighteen studies examining the effects of family-based interventions on IA among adolescents were included in this meta-analysis, as shown in Table 1. Most (15, 83.33%) of the studies were conducted in China (13, 72.22%) and other Asian countries, except three studies (16.67%) were performed by European researchers (Bağatarhan & Siyez, 2022; Brandhorst et al., 2022; Torres-Rodríguez, Griffiths, Carbonell, & Oberst, 2018). Most of the participants were psychological inpatients (Lu, Yang, Mu, Wei, & Sun, 2013; Wang, C., 2014; Wang, D., 2016; Wei, Yang, Wang, & Lu, 2014; Y. Wu, Gao, & Wu, 2010; Yang et al., 2009; Zhong et al., 2011), school students (Bağatarhan & Siyez, 2022; Boor Boor, Khodabakhshi-Koolaee, & Falsafinejad, 2021; Du, Li, He, & Shang, 2014; Jiang, 2007; Liu et al., 2015; Torres-Rodríguez et al., 2018) or recruited from the community (Brandhorst et al., 2022; Pornnoppadol et al., 2018). Three studies included participants from psychological clinics or mental health centres (Cao, 2009; Torres-Rodríguez et al., 2018; Zhang, Wang, Li, & Cai, 2018). Half of them were RCTs (Boor Boor et al., 2021; Brandhorst et al., 2022; Cao, 2009; Lu et al., 2013; Wei et al., 2014; Y. Wu et al., 2010; Yang et al., 2009; Zhang et al., 2018; Zhong et al., 2011).

Most studies targeted adolescents (age 12–18 years) (Bağatarhan & Siyez, 2022; Liu et al., 2015; Pornnoppadol et al., 2018; Torres-Rodríguez et al., 2018) and adolescents and young adults (age 12–24 years) (Brandhorst et al., 2022; Cao, 2009; X. Wu, 2013; Zhang et al., 2018). Some studies also included participants aged over 24 (25–32 years old) (Lu et al., 2013; C. Wang, 2014; Wei et al., 2014; Y. Wu et al., 2010; Yang et al., 2009). However, the average age varied between 13.82 and 18.32 years, indicating that the main participants were adolescents and young adults, even though very few young adults were included. A total of 1,158 adolescents and young adults participated in those studies. Most of the adolescent or young adult participants were male (59.1–100%), except for one study that included only female adolescents and their families (Boor Boor et al., 2021). The IA

Table 1. Characteristics of studies for Internet addiction

Author (Year)	Research Design	Setting	Sample Size	Adolescent Age mean ± SD (range)	Male N (%)	IA type	Inclusive Criteria	Intervention in family-based intervention group	Intervention in control group	Outcomes
Bağatarhan, et al. (2022)	Non-RCT	Europe (Turkey) High school students	n = 26 (E:13, C1:13, C2:13)	–	–	IA	Internet Addiction Scale (addictive) screen	**Parents:** psycho-education (Internet literacy, communication, parent-adolescent relationship) 45 min * 4 session **Adolescents:** cognitive behavioral psycho-education (cognition, communication, time management et al.) 90 min * 8 sessions	C1: **Adolescents** psycho-education C2: None	IAT OCS
Boor Boor et al. (2021)	RCT	Asia (Iran) Junior secondary school female students	n = 32 (E:16, C:16)	–	–	IA	Screened by GPIUS and psychological harm caused by Internet use	**Family:** relationship enrich training 1.5 h * 5 sessions **Adolescents:** Internet literacy, emotion management skills et al. 1.5 h * 7 sessions	Waiting list	GPIUS, Media literacy questionnaire, PCRS
Brandhorst et al. (2022)	RCT	Europe (Germany) Newspaper and website recruited, or therapist reference	n = 59 (E:33, C:26)	14.68 ± 2.10 (12–20)	38/44 (86.36)	IA, or IGD, or social media addiction	Assessed subjectively and globally by parents	**Parents group**: psychoeducation, relationship, communication et al. 90 min per session, 6 sessions over 8 weeks	Waiting list	CIUS-P, EKI, PRSQ, DASS.
Cao (2009)	RCT	Asia (China) Psychological clinic outpatient	n = 42 (E:22, C:20)	16.0 ± 5.2 (13–22)	29 (69.0)	IA	YDQ≥5, Daily Internet time >4 h	**Family:** family relationship, parental, Internet literacy, psycho-education et al. 30–60 min * 8 sessions for 8 weeks Adolescents: medication	**Adolescents:** medication	IAT, HAMD, SCSQ
Du et al. (2014)	Non-RCT	Asia (China) Secondary high school student	n = 63 (E:30, C:33)	13.82 ± 1.67 (11–18)	NA	IA	YDQ Beard criteria.	**Family Satya model** 1 session every 2 weeks * 6–8 times in total (12–16 weeks)	**Adolescents:** School mental health education	YDQ

(continued)

Table 1. Continued

Author (Year)	Research Design	Setting	Sample Size	Adolescent Age mean ± SD (range)	Male N (%)	IA type	Inclusive Criteria	Intervention in family-based intervention group	Intervention in control group	Outcomes
Jiang (2007)	Non-RCT	Asia (China) Secondary school students	n = 304 (E1:33, C1:27/ E1:122, C1:122)	–	NA	IA	YDQ, Beard criteria	**Parent Group therapy & Adolescents Group therapy** (Internet literacy, communication, emotion management et al.) Both 1–1.5 h * 8 sessions	None	YDQ Beard criteria SDQ, SCARED, FAD, TMDS
Liu et al. (2015)	Non-RCT	Asia (China) Recruited on school websites.	n = 46 (E:21, C:25)	E: 15.0 ± 1.73 C: 15.7 ± 1.2 (12–18)	38 (82.6)	IA	APIUS >3.15	**Family group therapy:** Communication and relationship rebuilding 2 h every 3 days * 6 sessions follow up session at 3 months	Waiting list	APIUS, Closeness to Parent scale, PACS, Adolescent Psychological Needs Scale
Lu et al. (2013)	RCT	Asia (China) Psychological hospital inpatients	n = 120 (E:60, C:60)	E: 16.9 ± 2.9 C: 16.8 ± 2.7 (13–27)	107 (89.2)	IA	Tao's diagnosis. Symptoms last at least 3 months	**Family Satya therapy**: relationship, communication, et al. 4 h per week * 20 weeks **Adolescents:** Routine therapy (medication, behavioral, military training, cognition correction, et al.)	**Adolescents:** Routine therapy (medication, behavioral, military training, cognition correction, et al.)	Tao's diagnosis questionnaire, FACES II
Pornnoppadol et al. (2018)	Non-RCT	Asia (Thailand) Volunteer recruited online.	n = 104 (E1:26, C1:24 C2:30)	14.33 ± 1.29 (13–17)	82 (78.8)	IGD	GAST–Parent version≥30	E1: **Parent managemen**t (parental, communication, conflict management, et al.) 3-h * 9 sessions E2 **Parent management + Adolescents Siriraj** (group CBT, 10 sessions in 7 whole days)	C1: **Adolescents** Siriraj (group CBT) C2: Waiting list	GAST, GAME-Q, GAME-P, PSC-17-Thai version
Torres-Rodríguez et al. (2018)	Non-RCT	Europe (Spain) Public mental health centers referred	n = 31 (E:16, C:15)	E: 15.19 ± 1.90 C: 14.73 ± 1.58 (12–18)	31 (100)	IGD	IGD criteria (APA DSM-5), IGD-20 ≥ 71	**PIPATIC** (**Family** module: communication, limits affect, 45-min weekly * 3 sessions **Adolescents:** Psychoeducation, CBT, communication et al. 45-min weekly * 17 sessions in 6 months)	**Adolescents:** CBT	IGD-20, Combid symptoms, MACI, Family Discord, et al.

(continued)

Table 1. Continued

Author (Year)	Research Design	Setting	Sample Size	Adolescent Age mean ± SD (range)	Male N (%)	IA type	Inclusive Criteria	Intervention in family-based intervention group	Intervention in control group	Outcomes
C. Wang (2014)	Non-RCT	Asia (China) Psychological hospital inpatients	n = 120 (E:60, C:60)	E: 16.0 ± 6.4 (12–27) C: 16.0 ± 6.2 (12–22)	81 (67.5)	IA	YDQ≥5. Inpatients.	**Family:** psychoeducation, emotion management, parent-child interaction et al. **Adolescents:** Routine (psycho, medication, Chinese cultural education) 20 weeks	**Adolescents:** Routine (psycho, medication, Chinese cultural education)	IAT, HAMD, SCSQ, SDSS (1 year), Parent: SCL-90
D. Wang (2016)	Non-RCT	Asia (China) Psychological hospital inpatients	n = 100 (E:20, C1:20C2:40)	17.92 ± 2.79	77 (77.0)	IA	Inpatient diagnosed with IA	**Family**: parental, communication, et al.	C1: **Adolescents** Medication C2: **Adolescents** Psychotherapy/ Behavioral Therapy	CIAS
Wei et al. (2014)	RCT	Asia (China) Psychological hospital inpatients	n = 120 (E:60, C:60)	16.0 ± 6.4 (12–32)	101 (84.2)	IA	YDQ ≥5 for at least 3 months, Hospitalized at least 20 weeks. Severe negative impact in social levels	**Family:** environment, parental, relationships, interaction et al. 2 h * 2 sessions per week, for 20 weeks **Adolescents:** Routine (psychoeducation, medication, military, follow up)	**Adolescents:** Routine (psychoeducation, medication, military, follow up)	IAT, HAMD, SCSQ, SDSS (1 year)
X. Wu (2013)	Non-RCT	Asia (China) C: Secondary students; E: Teenagers from Psychological Center (for IA)	n = 87 (E:22, C:65)	E: 16.50 ± 2.18 (13–21) C: 16.45 ± 0.83 (14–18)	56 (64.4) E: 18 (81.81) C: 38 (58.46)	IA	IAT≥50	**Family:** parental, recognition, relationship, psycho counselling, et al. 4 whole days **Adolescents:** Group CBT, Military therapy, team work 2–3 months	**Adolescents** Psychological knowledge lecture	IAT, BIS, SAS, SDS, FAD, QLSCA
Y. Wu et al. (2010)	RCT	Asia (China) Psychological hospital inpatients	n = 60 (E:30, C:30)	Mean: 17.0 (13–28)	56 (93.3)	IA with Stigma	YDQ≥5, Daily Internet time >4 h per day. Perception of stigma	**Family psychotherapy targeting stigma:** CBT, family relationship, skill training **Adolescents**: Routine (military, medication) 1.5 h each day for 12 weeks	**Adolescents:** Routine (military, medication)	SAS, SDS, SAD, SCL-90

(continued)

Table 1. Continued

Author (Year)	Research Design	Setting	Sample Size	Adolescent Age mean ± SD (range)	Male N (%)	IA type	Inclusive Criteria	Intervention in family-based intervention group	Intervention in control group	Outcomes
Yang et al. (2009)	RCT	Asia (China) Psychological hospital inpatient	n = 150 (E:30, C1:30 C2:60)	17.62 ± 3.13 (13–26)	135 (90.0)	IA	YDQ≥5, Daily Internet time >4 h, Last for at least 3 months	Family: family relationship, parental, interaction et al. 16 weeks	C1: **Adolescents** Medication (antidepressants, anti-anxiety, Chinese medicine) C2: **Adolescents** Psycho therapy (cognition, emotion, Internet literacy et al.)/ Behavioral therapy (military therapy, version therapy et al.)	CIAS, Overall treatment effect questionnaire (self-developed)
Zhang et al. (2018)	RCT	Asia (China) Psychological clinic outpatient	n = 66 (E:33, C:33)	E: 17.15 ± 2.00 C: 17.18 ± 1.78 (14–22)	39 (59.1)	IA	IAT≥50	**Family Sand tray**: family environment, communication, emotion, et al.) 1–1.5 h per week * 12 weeks	**Family** Internet related education	IAT, FAD, EMBU
Zhong et al. (2011)	RCT	Asia (China) Psychological inpatient	n = 57 (E:28, C:29)	E: 17.88 ± 3 C: 18.32 ± 2 (14–25)	50 (87.7)	IA	Tao's diagnosis (symptoms + clinically significant impairment) for 3 months, Daily Internet time 6 hrs	**Family Group:** family function, Internet literacy, cognition et al. (some adolescents received medication and individual counselling) 90–120 min session per week * 14 weeks (7 for adolescents, 4 for parents, 3 for both, 8–10 people per group)	**Adolescents** Military therapy, group behavioral therapy (some received medication and individual counselling)	OCS, FAD, PSSS, Mach Scale IV

Note: IA: Internet Addiction, IGD: Internet Gaming disorder. C: Control group, E: Experimental group. APIUS: Adolescent Pathological Internet Use Scale, BIS: Barratt Impulsivity Scale, CIAS: Chen Internet Addiction Scale, CIUS-P: Compulsive Internet Use Scale-Parent Version, DASS: Depression Anxiety Stress Scale, EKI: Parent-Child Inventory, EMBU: Egna Minnen Beträffande Uppfostran, FACES II: Family Adaptability and Cohesion Evaluation Scales, FAD: Family Assessment Device, GAME-P: Game Addiction Protection Scale, GAME-Q: Game Addiction Quality of life Scale, GAST: Game Addiction Screening Test, GPIUS: Generalized and Problematic Internet Use Scale, HAMD: Hamilton Depression Rating Scale, IAT: Yong's Internet Addiction Test, MACI: Millon Adolescent Clinical Inventory, OCS: Online Cognition Scale, PACS: Parent-Adolescent Communication Scale, PCRS: Parent-child relationship survey, PRSQ: Parental Representation Screening Questionnaire, PSC-17: Pediatric Symptom Checklist-17, PSSS: Perceived Social Support Scale, QLSCA: Quality of life scale for children and adolescents, SAD: Social Avoidance and Distress Scale, SAS: Zung Self-Rating Anxiety Scale, SCL-90: Symptom Checklist 90, SCARED: Screen for Child Anxiety Related Disorders, SCSQ: Simplified Coping Styles Questionnaire, SDQ: Strengths and Difficulties Questionnaire, SDS: Zung Self-Rating Depression Scale, SDSS: Social Disability Screening Schedule, TMDS: Time Management Disposition Scale.

type of the included participants was general IA or problematic Internet usage, except for gaming addiction in two studies (Pornnoppadol et al., 2018; Torres-Rodríguez et al., 2018). The most commonly used instrument for screening for IA was the Young's Diagnostic Questionnaire (YDQ) (Cao, 2009; Du et al., 2014; C. Wang, 2014; Wei et al., 2014; Yang et al., 2009). Two studies that used Tao's criteria were similar to YDQ symptoms but lasted at least three months (Lu et al., 2013; Zhong et al., 2011). Most studies conducted on psychological patients recruited participants using more advanced criteria: daily Internet use (at least four hours per day) (Cao, 2009; Yang et al., 2009; Zhong et al., 2011), duration of addiction symptoms (at least three months) (Lu et al., 2013; Wei et al., 2014; Yang et al., 2009; Zhong et al., 2011), or substantial negative impacts (Wei et al., 2014; Zhong et al., 2011). Sixteen (88.89%) included studies that measured the severity of IA or gaming addiction, except two (Jiang, 2007; Y. Wu et al., 2010). The IAT was the most applied instrument for measuring IA (in seven studies). Other outcomes mostly reported were anxiety, depression, family functioning, and parent-child relationships. However, the instruments used in those studies varied greatly, making it difficult to perform a pooling meta-analysis. Only data that can be combined were reported in the present study.

Risk of bias

According to RoB 2.0, most studies are classified as having some risk of bias, mainly related to the randomization process (as shown in Fig. 2). Only one was identified as having a high risk of bias in the outcome reporting (Zhong et al., 2011). As demonstrated in Fig. 3, half of the

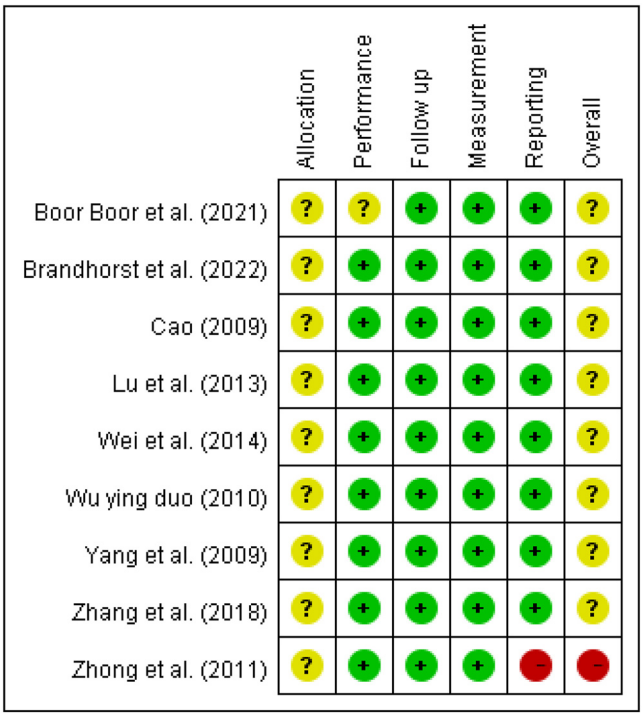

Fig. 2. Risk of bias of RCT studies included

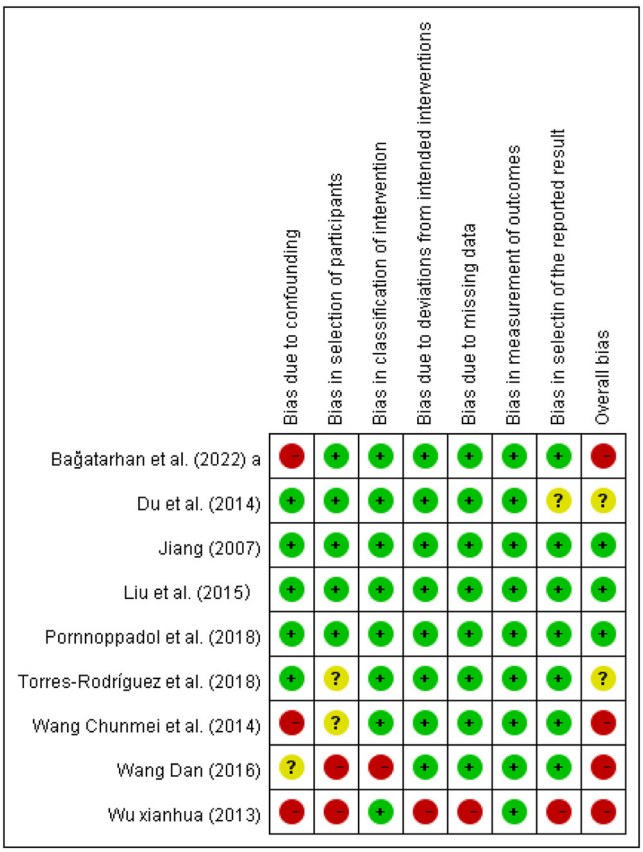

Fig. 3. Risk of bias of nonrandomized trials included

nonrandomized controlled studies had a low risk of bias, while three were recorded as having serious bias (Bağatarhan & Siyez, 2022; C. Wang, 2014; D. Wang, 2016; X. Wu, 2013). In two studies, the groups were assigned according to the willingness of parents (Bağatarhan & Siyez, 2022; Wang, 2014) or recruited from quite different organizations (X. Wu, 2013), leading to bias due to confounding in two groups, such as parents' education level and severity of IA in adolescents. The kappa statistic of interrater reliability was 0.909.

The overall funnel plot is nearly symmetrical, and Egger's test gave a p-value of 0.255, indicating insignificant publication bias in those studies in the present meta-analysis.

Intervention characteristics

The intervention characteristics of the included studies are illustrated in Table 1. The most reported compositions of family therapy were family environment rebuilding, parent-child relationship reshaping, parental style, communication skills, psychological intervention, improving Internet literacy, and cognition correction. Some studies provided combined and separate classes for adolescents and parents (Bağatarhan & Siyez, 2022; Jiang, 2007; Pornnoppadol et al., 2018). Parental accompaniment and interaction with adolescents were required in some inpatient treatments (Wei et al., 2014; Yang et al., 2009). In addition, many studies

provided co-therapy, including medicine treatment (Cao, 2009; Lu et al., 2013; Wang, 2014; Wei et al., 2014), psychological treatment (Lu et al., 2013; Wang, 2014; Wei et al., 2014) and military training (Lu et al., 2013; Wei et al., 2014; Y. Wu et al., 2010), in both groups. Some studies compared family-based interventions with other treatments, such as psychological interventions (Pornnoppadol et al., 2018; Wang, 2016; Yang et al., 2009; Zhang et al., 2018), education programs (Yang et al., 2009), and medicine (Wang, 2016; Yang et al., 2009). Some of them used non-intervention comparisons, including no treatment (Bağatarhan, et al., 2022) or waiting lists (Boor Boor et al., 2021; Brandhorst et al., 2022; Du et al., 2014; Jiang, 2007; Liu et al., 2015; Pornnoppadol et al., 2018). A specific strategy was applied in some studies, such as a family sand tray (Zhang et al., 2018) or Satya family therapy (Du et al., 2014; Lu et al., 2013). The most reported medicines include antidepressants, antipsychotics, and antipsychotics (Cao, 2009; Lu et al., 2013; C. Wang, 2014; D. Wang, 2016; Wei et al., 2014). Some also used neurotrophic medications (Wang, 2014; Wei et al., 2014) or Chinese medicine targeted at IA (Wang, 2016; Yang et al., 2009).

Intervention duration varied among studies (Table 1), with more sessions observed in studies on psychological inpatients (with the mode of 20 sessions). Fewer sessions were scheduled in studies with participants recruited from the community (an average of eight sessions). The most common duration of family treatment for inpatients and the community was 1.5 h per session.

Effects of family-based intervention on addiction severity

Overall effect. Sixteen studies reported the severity of IA or gaming addiction (Fig. 4). The overall effect of the meta-analysis showed that participants in the family-based therapy group had significantly lower severity of IA than those in the control group [standardized mean difference (SMD) = −1.43, 95% CI (−2.19, −0.67), p = 0.0002]. However, significant heterogeneity was detected (I^2 = 96%, p < 0.001), so a random-effects model was applied.

Subgroup analysis. Subgroup analysis was performed according to intervention methods as well as adolescent participants' characteristics. Subgroup analysis in five studies with community adolescent participants showed that family-based therapy had significant beneficial effects on IA compared with non-intervention group [SMD = −1.93, 95% CI (−3.13, −0.73), p = 0.002] but demonstrated an inferior effect when compared with medicine [SMD = 1.55, 95% CI (0.83, 2.27), p < 0.001] (Fig. 5). When family therapy was compared with another psychological or behavioural therapy, the effect was marginally significant in two studies with community participants, with [SMD = −2.45, 95% CI (−4.98, 0.09), p = 0.06]. However, in terms of inpatients without medication, shown in the subgroup analysis of another two studies, the difference between family therapy and another alternative method was insignificant [SMD = 0.05, 95% CI (−0.39, 0.49), p = 0.82]. When family-based therapy was added to another psychological/behavioural therapy, better effects were observed in four studies of patients with co-medication therapy in both groups, with less severity of IA [SMD = −3.75, 95% CI (−5.14, −2.37), p < 0.001], not in community participants [SMD = −0.38, 95% CI (−0.94, 0.18), p = 0.19].

Sensitivity analysis and meta-regression. Sensitivity analysis was applied to examine the impact of each individual study by repeating the meta-analysis after omitting each study in turn. The results of pooled SMDs remained statistically significant (p < 0.05), consistent with the conclusion before exclusion. The conclusion remained consistent after

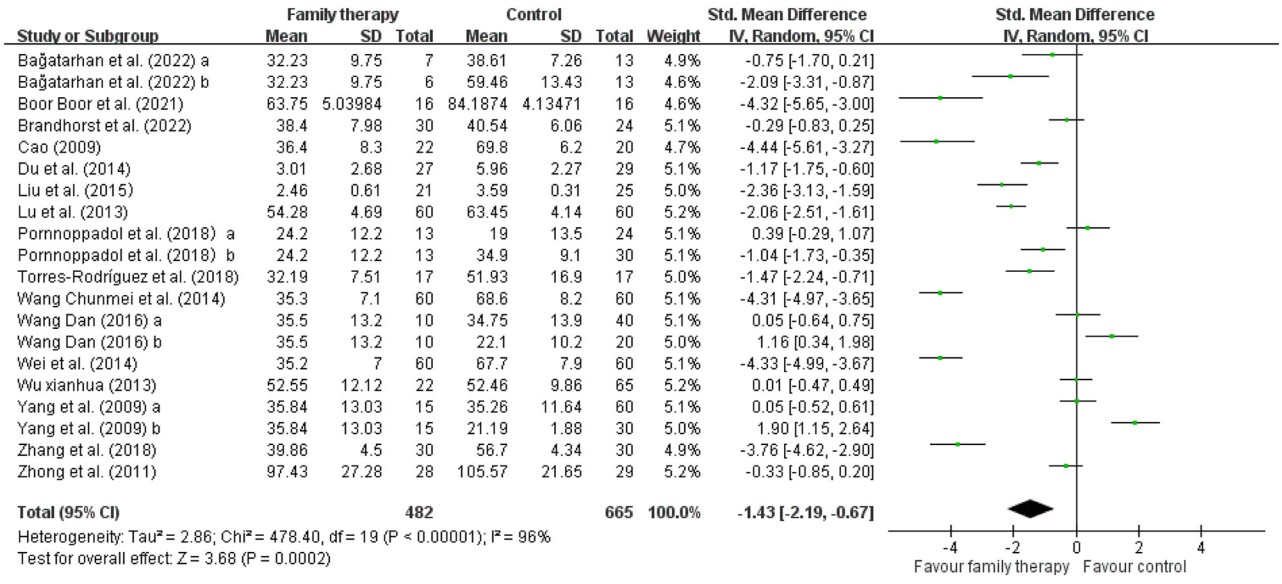

Fig. 4. Forest plot of the overall effect on reducing the severity of Internet addiction

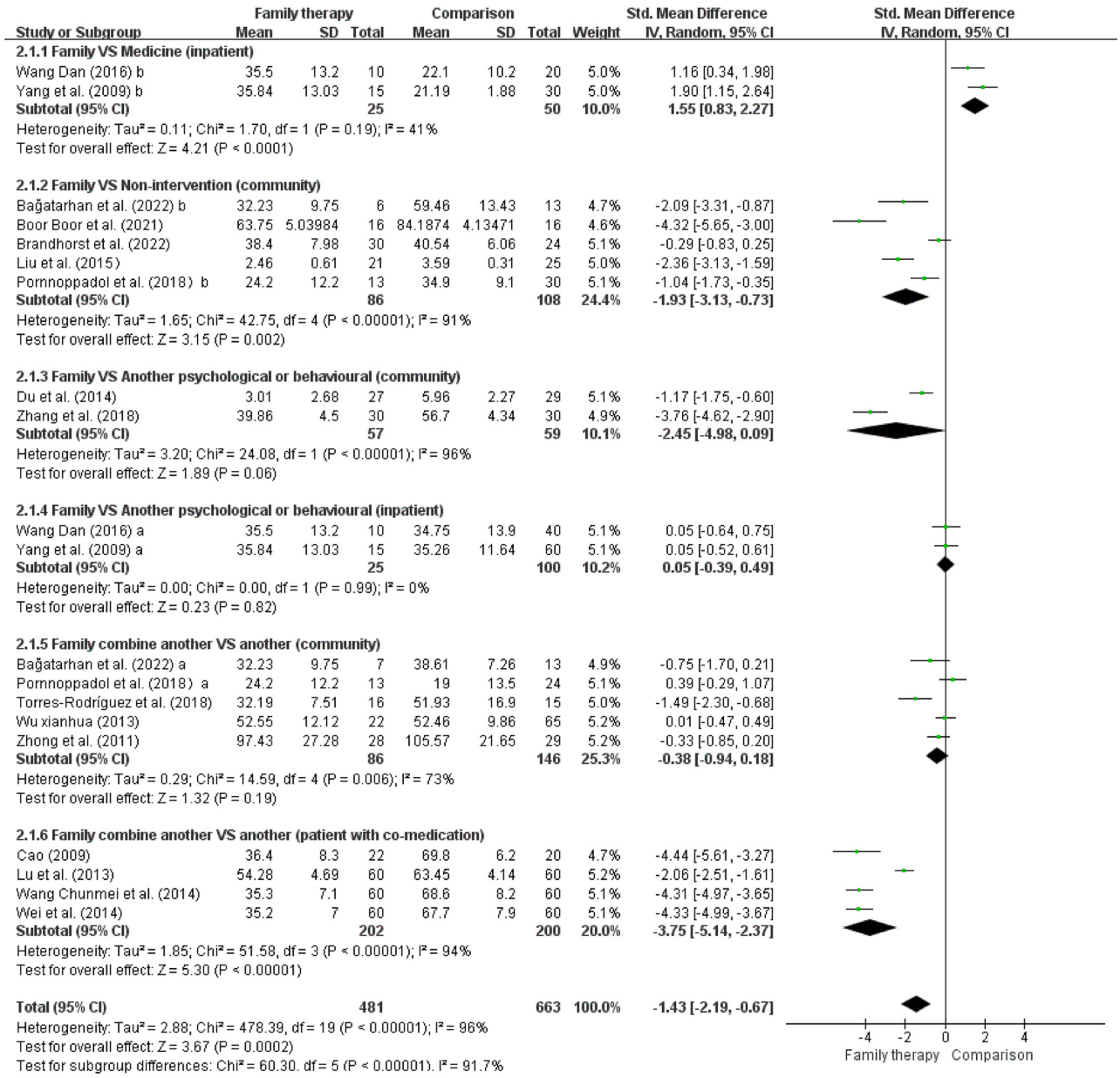

Fig. 5. Forest plot of subgroup analysis

excluding non-RCT research, studies performed in non-Asian cultures, or participants with gaming disorder, as well as high-risk bias studies, excluding the impact of different research designs, participant characteristics and quality of studies on the overall effect of family-based therapy on severity of IA.

Meta-regression showed large effect sizes were related to medication treatment and patients with medication, which accounted for about 55.36% of the between-study variances. Other moderators failed to show a significant impact on heterogeneity, including publication year, setting of intervention, and design of comparing modes.

Post-intervention effect. Four studies followed up with the participants to measure the post-intervention effect on the severity of IA. At three and six months, the therapeutic effect showed a marginally significant preferable effect in the family treatment groups ($p = 0.06$) (Fig. 6). In the subgroup analysis of two studies comparing family therapy and non-interventions, family-based therapy showed beneficial effects at the 6-month follow-up [SMD = −1.03, 95% CI (−1.56, −0.49), $p < 0.001$], ($I^2 = 18\%$, $p = 0.27$).

Effects of family-based intervention on depression

Five studies were included to examine the effect of family-based therapy on depression in adolescents as a secondary outcome, measured by the Hamilton Depression Rating Scale (HAMD) (Cao, 2009; Wang, 2014; Wei et al., 2014) or Zung's Self-rating Depression Scale (SDS) (X. Wu, 2013; Y. Wu et al., 2010). Another measured mental burden in parents of the adolescent participants using the Depression Anxiety Stress

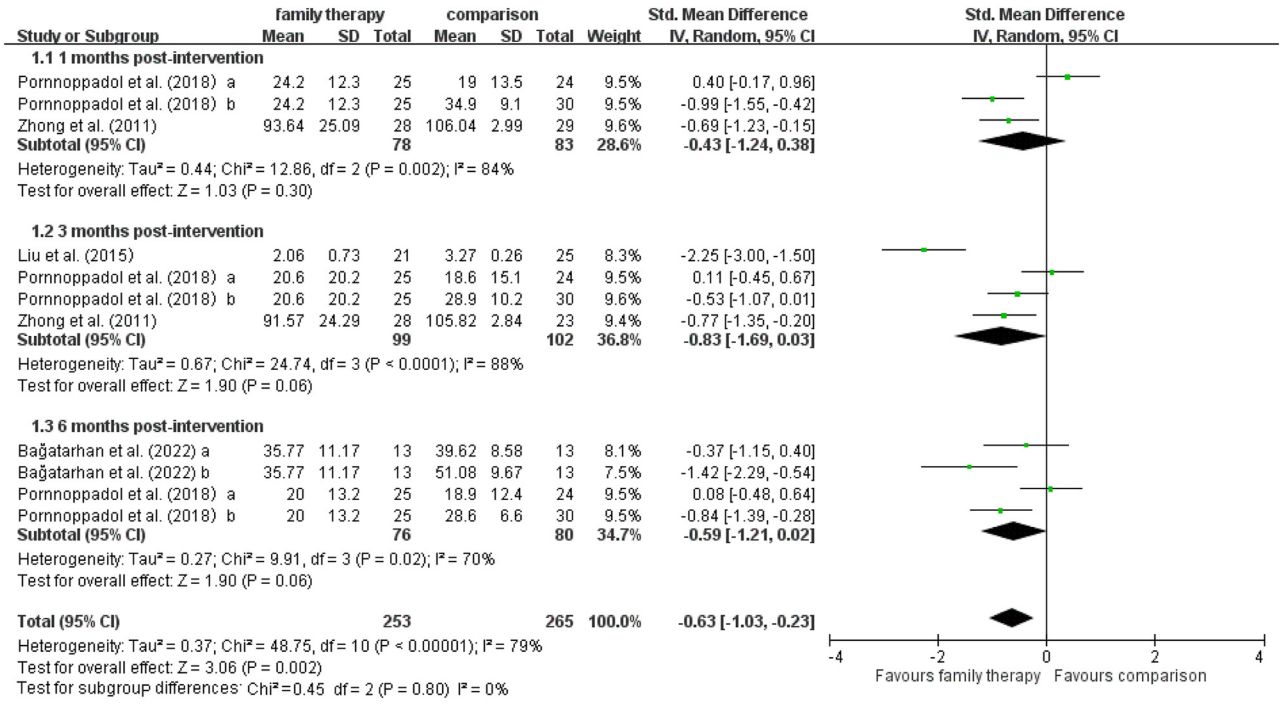

Fig. 6. Forest plot of postintervention effects on reducing the severity of Internet addiction

Scale (DASS)-Depression subscale was not included in the analysis (Brandhorst et al., 2022). Family therapy showed a significant favourable effect in treating depression when compared with other treatments (e.g. CBT, behavioural therapy) [SMD = −0.89, 95% CI (−1.68, −0.09), $p = 0.03$], ($I^2 = 93\%$, $p < 0.001$). However, participants in both groups had medication as co-treatment in four of the five included studies. Subgroup analysis of these four studies was performed, and family therapy also showed additional therapeutic effects compared with the comparison group (e.g. CBT, behavioural therapy) when co-medication was applied in both groups [SMD = −0.54, 95% CI (−0.76, −0.31), $p < 0.001$], ($I^2 = 94\%$, $p < 0.001$).

Effects of family-based intervention on anxiety

Only two studies included anxiety as a secondary outcome, measured by Zung's Self-rating Anxiety Scale (SAS) (X. Wu, 2013; Y. Wu et al., 2010) and were reported individually without pooling the data. Participants in the family therapy group reported lower levels of SAS after treatment when compared with baseline, while no significant changes were seen in the control group with behavioural and military treatment (Y. Wu et al., 2010) and education programs (X. Wu, 2013). Unfortunately, both studies failed to compare SAS levels in two groups after treatment.

Effects of family-based intervention on coping style

Three studies included coping style as a secondary outcome, including positive coping style and negative coping style, measured by the Simplified Coping Style Questionnaire (SCSQ) (Cao, 2009; C. Wang, 2014; Wei et al., 2014). According to the meta-analysis, family therapy demonstrated a dramatic beneficial effect in improving coping style when compared with other therapies (e.g., CBT, behavioural therapy), both in enhancing positive coping style [SMD = 1.57, 95% CI (1.24, 1.89), $p < 0.001$] and eliminating negative coping style [SMD = −8.29, 95% CI (−9.92, −6.65), $p < 0.001$]. It is worth noting that all these participants are inpatients with co-medication therapy.

Effects of family-based intervention on family functioning

Four studies examined the effects of family-based interventions on family functioning as a secondary outcome, measured by the Family Assessment Device (FAD) (Jiang, 2007; X. Wu, 2013; Zhang et al., 2018; Zhong et al., 2011) and Family Adaptability and Cohesion Evaluation Scale (FACES II) (Lu et al., 2013). Since the subscales of the FACES II are quite different from those of FAD, making it impossible to combine those data together, only the results of the FAD were included in the meta-analysis. X. Wu (2013) failed to report the data in the control group and thus was also excluded from the analysis.

Figure 7 shows that the overall effect in improving family functioning is significantly positive in groups with family therapy [SMD = −0.84, 95% CI (−1.14, −0.54), $p < 0.001$] but insignificant when measuring effects in each subscale of the FAD.

Effects of family-based intervention on parent-child relationships

Parent-child relationships were included in four studies using various instruments, including Closeness to Parent,

parent-child relationship survey, parent-child inventory and parental representation screening questionnaire (Boor Boor et al., 2021; Brandhorst et al., 2022; Liu et al., 2015). Adolescents' perspectives of family relationships were tested in a study by Torres-Rodríguez et al. (2018) using the Family Discord Scale, and only the scores of three subscales were available. The Parent-Child Communication Scale was also used in one of the studies (Liu et al., 2015). Therefore, these outcomes were not included in the meta-analysis.

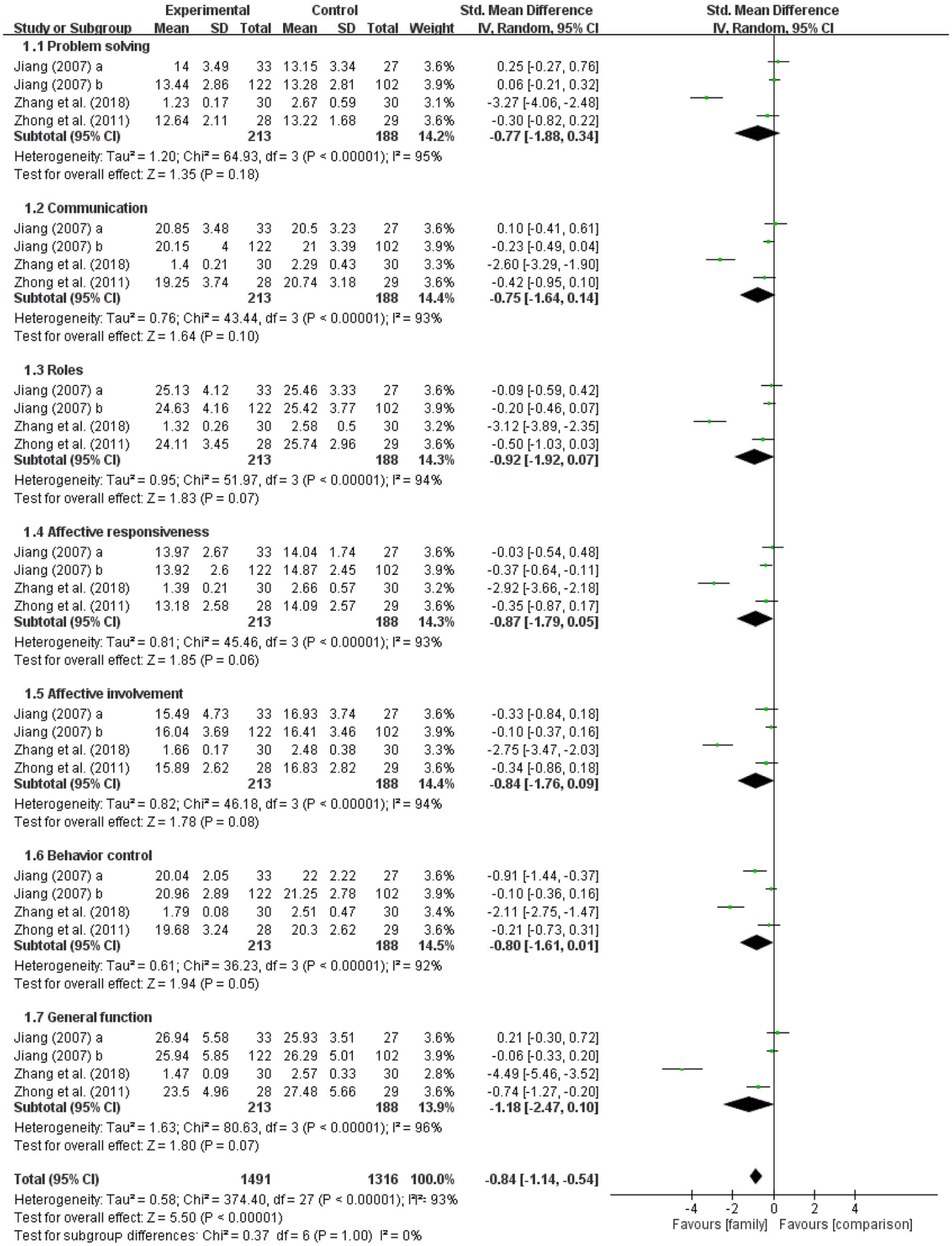

Fig. 7. Forest plot of family-based therapy for improving family functioning

DISCUSSION

The present meta-analysis summarized evidence about the effects of family-based interventions targeting Internet-addicted adolescents and young adults. The analysis showed beneficial effects of family-based interventions on reducing the severity of IA and improving the coping style of participants, as well as overall family functioning. Subgroup analysis of different intervention modes and participants provided more useful information to better design family-based therapy.

Family-based interventions can effectively reduce the overall severity of IA immediately post-test, although significant heterogeneity was found among the studies. The effect size is large (SMD = −1.43) (Sullivan & Feinn, 2012), and even larger than the effect size (SMD = −0.67) of psychological interventions on smartphone addiction in previous meta-analyses, including CBT and educational programs (Malinauskas & Malinauskiene, 2019). Another meta-analysis failed to find beneficial effect of CBT on relieving severity of gaming disorder in both adolescents and adults (Stevens et al., 2018). Most family-based interventions focused on reshaping family relationships and improving parent-child communication and parental style, consistent with previous studies showing that these are most important risk factors in the family leading to IA in adolescents (Schneider, King, & Delfabbro, 2017). For this reason, it is highly recommended that families be involved in therapeutic procedures in adolescents (Lo et al., 2021). According to a study by Liu et al. (2015), which studied the underlying mechanism of family therapy, satisfaction of the psychological needs in adolescents, as well as improvement in parent-adolescent communication and attachment, were the most important contributors to variances in reducing IA severity in adolescents. Moreover, family-based interventions are more likely to provide long-lasting therapeutic effects on family function and social support (Zhong et al., 2011). However, very few studies have followed up with participants to examine short-term post-intervention effects, making it difficult to draw a conclusion in the present meta-analysis, with a large effect size (SMD = −0.83) but marginally significant (p = 0.06).

Since major heterogeneity was found among those studies, subgroup analysis was conducted to better understand the effects of different family intervention modes among different participants. Although only two studies have compared the effects of family therapy with medicine, medicine therapy showed a significantly preferable effect in reducing IA severity in inpatients with a large effect size. According to a previous systematic review, IA is associated with multiple psychiatric comorbidities, such as depression, anxiety, and aggression, and medications can not only relieve those psychiatric symptoms but also reduce gaming addiction symptoms (Zajac et al., 2017). Unfortunately, there were very limited studies included without the pooling effect explored. In the present meta-analysis, family-based intervention showed extra benefits (with large effect sizes, SMD = −3.75) when added to another psychological or behavioural therapy in psychological patients with co-medication in both groups. Without medication treatments, when necessary for inpatients, family therapy can barely provide further beneficial effects when compared with other psychological therapies, such as CBT and behaviour therapy (p = 0.82). This might highlight the importance of medication therapy in severe cases. This is consistent with the findings in a recent meta-analysis. Chang, Chang, Yang, and Tzang (2022) also found combination treatment with pharmacotherapy and CBT or multi-level counselling to be the most effective therapy modality. However, only two studies were included in the present subgroup analysis, which needs further evidence to make the final conclusion.

In community participants, when medication is not essential, family-based interventions can provide preferable efficacy with a large effect size when compared with the non-intervention control group (SMD = −1.93). However, when compared with other psychological therapies, cognitive therapy or behaviour therapy, the solo family-based intervention was proven to be equally effective for reducing the severity of IA (Fig. 5, p = 0.06). Even if family therapy is combined with another psychological therapy as a complementary treatment, no dramatic additional benefits can be achieved (p = 0.19). This is inconsistent with results in previous study by Nielsen et al. (2021), in which multidimensional family therapy was superior to traditional family therapy. Since family therapy focuses more on the environment that has influenced adolescents' IA, while other modes, such as CBT, focus on the addiction itself, it was supposed to have a better effect in maintaining intervention effects and preventing reoccurrence in the longer term (Zhong et al., 2011). However, only very few studies with small sample sizes were included in this meta-analysis to make a conclusive summary. Further studies are required to achieve a persuasive conclusion. Also, standardized treatment is highly recommended, not only in the control group but also in family-based therapy.

Moreover, more evidence is needed about the longer-term effect of family-based interventions, and the results might be controversial among studies (Pornnoppadol et al., 2018; Zhong et al., 2011). According to the results of the present meta-analysis, the beneficial effects in the family-based therapy group at three months and six months after intervention showed marginally significant differences. This may be caused by a minimal sample size. Therefore, the follow-up of family therapy deserves further research.

The most included secondary outcome was depression, measured in five studies (27.78%). Data on other secondary indicators analysed in this meta-analysis were also very limited, with only three or four studies for each. This is consistent with previous meta-analyses, usually without secondary outcomes reported (Malinauskas & Malinauskiene, 2019).

The overall effects of family intervention on depression showed significant differences. It is worth noting that most study participants were inpatients using medication as a co-therapy in both groups (Cao, 2009; C. Wang, 2014;

Wei et al., 2014; Y. Wu et al., 2010). Again, this finding also supports the above opinion that family therapy can take effect the most when added to medication therapy. Only two studies examined the impact of family therapy on anxiety, but with a high risk of bias. In a previous meta-analysis, Stevens et al. (2018) failed to find the effects of CBT on anxiety and depression in adolescents with gaming disorder. In another study in Hong Kong, in which a family perspective was applied, the participants showed a significant decline in IA symptoms, but the indicators of psychological well-being and Beck's depression inventory did not change significantly (Shek, Tang, & Lo, 2009). However, this might be caused by the low level at baseline. Thus, the effect of family therapy on relieving depression and anxiety in community participants with IA needs further evidence to reach final conclusions.

Family-based therapy was verified to be beneficial for adolescents in coping style management. According to a previous meta-analysis, a medium correlation was found between coping style and IA: teenagers with IA tend to apply negative coping to handle stress, which is associated with social dysfunction (Lei, Cheong, Li, & Lu, 2018). Similarly, a full mediating effect of coping was found on the relationship between gaming addiction and symptoms of depression, anxiety and pressure, with avoidant withdrawal and resignation coping demonstrating the largest effect (Moge & Romano, 2020). Another study by Ding, Li, Zhou, Dong, and Luo (2017) showed that deviant peer affiliation was partially a mediator between perceived parental monitoring and IA, and this association was stronger in adolescents with poor effortful control than in those with high effortful control.

Since family conflicts might contribute to IA, tailored family-based interventions modifying the family environment and repairing family relationships are essential to better support adolescents and young adults (Lo et al., 2021). This is consistent with the main components of family therapy in the present meta-analysis, such as family function and relationship reshaping and communication skills programs. Although the sample size was small, which might lead to statistical insignificance between groups, the overall effect on family function was beneficial in the family-based treatment group. Additionally, marginal significance was reported in some subscales of the FAD, including roles, affective responsiveness, affective involvement, behaviour control and general function ($p < 0.1$). Family-based therapy can also help to enhance parent-child relationships and reduce family conflicts (Brandhorst et al., 2022), and the most important underlying mechanism was the fulfilment of adolescents' psychological needs as well as enhancement in parent-child communication and closeness (Liu et al., 2015). Although more research has tried to test the effects of family-based interventions on family functioning or parent-child communication, few studies have applied instruments allowing conclusive synthesis of the scores.

We planned to perform a subgroup analysis if more studies examined family therapy in gaming disorder or other subtypes of Internet addiction. Due to the limited study available (only two studies), the synthesis seems unnecessary. Sensitivity analysis showed stable results after omitting studies examining participants with gaming disorders. More studies may be needed to determine whether family-based therapy is also beneficial to participants with gaming disorders.

In terms of culture, the majority of studies were performed in Asian culture, and sensitivity analysis failed to find the impact of non-Asian culture, as reported in previous meta-analyses of CBT (Stevens et al., 2018). However, cultural differences may exist but are usually overlooked. Countries with a displeasure of life, higher commute time, greater overall pollution, and lower national income are inclined to score higher on Internet addiction (Błachnio et al., 2019; Cheng & Li, 2014). This might help explain why the majority of studies included were reported in Asian culture, similar to previous research reported (Cheng, Lau, Chan, & Luk, 2021; Zajac et al., 2017). Regarding treatment, CBT is the most common therapy in Western cultures (Zajac et al., 2017). On the contrary, the Chinese government established clinics and military-style detox camps to treat addiction to the Internet (Ko & Yao, 2015), which is common in most Chinese studies in the present meta-analysis. In addition, most of those studies that included young adult participants (older than 19 years) were conducted among Chinese psychiatric patients (Cao, 2009; Lu et al., 2013; C. Wang, 2014; Wei et al., 2014; X. Wu, 2013; Y. Wu et al., 2010; Yang et al., 2009; Zhang et al., 2018; Zhong et al., 2011). They were usually sent seeking treatment due to the breakdown of parental control, which causes distress for parents and children (Rao, 2019). The impact of culture on the effect of treatment might need further evidence.

Limitations

After a systematic literature review, including some grey literature databases, as well as registered trials, most of the evidence about family-based intervention was collected in Asia, which might influence the generalization of the results of the present meta-analysis. Although only English and Chinese databases were included, no study was excluded due to language issues if there was an English abstract for reference. Some studies in other languages were excluded because of the research design. For instance, a study registered in Australia (Cochrane Central Register of Controlled Trials, 2022) and another in Switzerland (Nielsen et al., 2021) was not included because they were comparing two different types of family intervention modes.

Another limitation is that about half of the research included in the present meta-analysis is non-RCT, which might compromise the generalization of the results in this study. Also, the overall effect of family therapy may not be due to the therapy itself because many studies had used medication as a co-therapy in both groups, leaving it impossible to identify the solo effect of family therapy. What's more, the sample size was too small, so the results from the subgroup analysis need to be verified with more evidence.

CONCLUSIONS

Family-based therapy showed a significant overall effect on reducing the severity of IA. It might generate additional effects when combined with other treatments, such as psychological or behavioural therapies and medication treatments. Medication showed a better effect on reducing the severity of IA in inpatients than family-based therapy and might be a great source of heterogeneity among studies. Limited studies were included in the present meta-analysis, especially those with large sample sizes or conducted in Western cultural countries. The risk of bias in some studies, including the present study, was serious, especially in nonrandomized studies. Important confounding factors, such as parental education level and willingness to participate in family therapy, should be controlled and balanced. The long-term post-intervention effect of family-based interventions also needs to be further examined.

Funding sources: This study was funded by the Science and Technology Development Fund (FDCT) of Macau (Grant NO. 0024/2021/ITP) and Kiang Wu Nursing College of Macau (#2021OCT01).

Authors' contribution: HW was responsible for study concept and design, analysis and interpretation of data, statistical analysis, obtained funding, study supervision, manuscript writing. XL was responsible for study concept and design, analysis and interpretation of data, quality evaluation of the study. GKIL took part in study concept and design, analysis and interpretation of data, quality evaluation of the study. CM was responsible for literature search and analysis of data, statistical analysis. YT was responsible for literature search and analysis of data, statistical analysis. UML was responsible for literature search and analysis of data, statistical analysis. LSML participated in literature search and manuscript writing. NC participated in literature search and manuscript writing.

Conflict of interest: The authors declare no conflict of interest.

Pre-registration: This metaanalysis was registered on INPLASY (Registration NO. INPLASY202420031).

Acknowledgements: We would like to acknowledge the Science and Technology Development Fund (FDCT) of Macau and Kiang Wu Nursing College of Macau for supporting and funding for present study.

SUPPLEMENTARY DATA

Supplementary data to this article can be found online at https://doi.org/10.1556/2006.2024.00015.

REFERENCES

André, F., Broman, N., Håkansson, A., & Claesdotter-Knutsson, E. (2020). Gaming addiction, problematic gaming and engaged gaming – Prevalence and associated characteristics. *Addictive Behaviors Reports*, *12*, 100324. https://doi.org/10.1016/j.abrep.2020.100324.

Błachnio, A., Przepiórka, A., Gorbaniuk, O., Benvenuti, M., Ciobanu, A. M., Senol-Durak, E., … Ben-Ezra, M. (2019). Cultural correlates of Internet addiction. *Cyberpsychology, Behavior and Social Networking*, *22*(4), 258–263. https://doi.org/10.1089/cyber.2018.0667.

Bağatarhan, T., & Siyez, D. M. (2022). The effectiveness of a cognitive-behavioral prevention program for Internet addiction. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, *40*, 767–792. https://doi.org/10.1007/s10942-021-00439-7.

Boor Boor, B., Khodabakhshi-Koolaee, A., & Falsafinejad, M. R. (2021). The effect of the parent-child relationship enrichment training package with an emphasis on the Internet use: A mixed methods approach. *Practice in clinical psychology*, *9*(3), 199–209. https://doi.org/10.32598/jpcp.9.3.746.2.

Brandhorst, I., Lahres, P., Hanke, S., Batra, A., Renner, T., Barth, G., … Petersen, K. (2022). Randomized controlled evaluation of a group training for parents of adolescents with gaming disorder or social network use disorder. *International Journal of Environmental Research and Public Health*, *20*(1), 272. https://doi.org/10.3390/ijerph20010272.

Cao, Y. (2009). An intervention program for both adolescents with Internet addiction disorder and their parents. *Shangdong Archives of Psychiatry*, *22*(1), 48–49. https://doi.org/10.3969/j.issn.1009-7201.2009.01.020.

Chang, C. H., Chang, Y. C., Yang, L., & Tzang, R. F. (2022). The comparative efficacy of treatments for children and young adults with internet addiction/internet gaming disorder: An updated meta-analysis. *International Journal of Environmental Research and Public Health*, *19*(5), 2612. https://doi.org/10.3390/ijerph19052612.

Cheng, C., Lau, Y., Chan, L., & Luk, J. W. (2021). Prevalence of social media addiction across 32 nations: Meta-analysis with subgroup analysis of classification schemes and cultural values. *Addictive Behaviors*, *117*, 106845. https://doi.org/10.1016/j.addbeh.2021.106845.

Cheng, C., & Li, A. Y. (2014). Internet addiction prevalence and quality of (real) life: A meta-analysis of 31 nations across seven world regions. *Cyberpsychology, Behavior and Social Networking*, *17*(12), 755–760. https://doi.org/10.1089/cyber.2014.0317.

Cochrane Central Register of Controlled Trials (2022). Parent education and behavioural management interventions for screens and gaming disorder in children, from https://www.cochranelibrary.com/central/doi/10.1002/central/CN-02408249/full.

Dallos, R., & Draper, R. (2015). *Ebook: An introduction to family therapy: Systemic theory and practice* (pp. 173–174). McGraw-Hill Education (UK).

Ding, Q., Li, D., Zhou, Y., Dong, H., & Luo, J. (2017). Perceived parental monitoring and adolescent internet addiction: A moderated mediation model. *Addictive Behaviors*, *74*, 48–54. https://doi.org/10.1016/j.addbeh.2017.05.033.

Dong, H., Yang, F., Lu, X., & Hao, W. (2020). Internet addiction and related psychological factors among children and adolescents in China during the Coronavirus Disease 2019 (COVID-19) epidemic. *Frontiers in Psychiatry*, *11*. https://doi.org/10.3389/fpsyt.2020.00751.

Du, Y., Li, X., He, X., & Shang, W. (2014). Intervention effect of Satir family therapy model on adolescent Internet addiction. *Journal of Chengde Medical College*, *31*(5), 459–460. https://doi.org/10.15921/j.cnki.cyxb.2014.05.102.

Ferraro, L., Avanzato, C., Maniaci, G., Sartorio, C., Daino, M., Seminerio, F., … La Cascia, C. (2020). Prevalence and risk factors for Internet gaming disorder (IGD) in a sample of 5,979 Italian online gamers. *Mediterranean Journal of Clinical Psychology*, *8*(3). https://doi.org/10.6092/2282-1619/mjcp-2674.

Firth, J., Torous, J., Stubbs, B., Firth, J. A., Steiner, G. Z., Smith, L., … Sarris, J. (2019). The "online brain": How the internet may be changing our cognition. *World Psychiatry*, *18*(2), 119–129. https://doi.org/10.1002/wps.20617.

Griffiths, M. D. (2017). Conceptual issues concerning internet addiction and internet gaming disorder: Further critique on Ryding and Kaye (2017). *International Journal of Mental Health and Addiction*, *16*(1), 233–239. https://doi.org/10.1007/s11469-017-9818-z.

Higgins, J., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M., … Welch, V. (2022). Cochrane Handbook for systematic reviews of interventions 03.08, 2022, from https://training.cochrane.org/handbook/current.

Jiang, W. (2007). *Study on psychological characteristics and effects of integrated intervention for internet addiction middle school students in Shanghai*. Shanghai: Master, Shanghai Jiaotong University. (Retrieved from CNKI).

Jorgenson, A. G., Hsiao, R. C., & Yen, C. (2016). Internet addiction and other behavioral addictions. *Child and Adolescent Psychiatric Clinics of North America*, *25*(3), 509–520. https://doi.org/10.1016/j.chc.2016.03.004.

King, D. L., & Delfabbro, P. H. (2018). The concept of "harm" in Internet gaming disorder. *Journal of Behavioral Addictions*, *7*(3), 562–564. https://doi.org/10.1556/2006.7.2018.24.

Ko, D., & Yao, M. (2015). 11. Internet addiction: An cross-cultural perspective. In *The Psychology of social networking Vol.2: Identity and relationship in online communities* (pp. 141–158). Warsaw, Poland: De Gruyter Open Poland. https://doi.org/10.1515/9783110473858-013.

Lei, H., Cheong, C. M., Li, S., & Lu, M. (2018). The relationship between coping style and internet addiction among mainland Chinese students: A meta-analysis. *Psychiatry Research*, *270*, 831–841. https://doi.org/10.1016/j.psychres.2018.10.079.

Lin, L., & Chu, H. (2018). Quantifying publication bias in meta-analysis. *Biometrics*, *74*(3), 785–794. https://doi.org/10.1111/biom.12817.

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.

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.

Lu, Y., Yang, Y., Mu, J., Wei, Q., & Sun, Z. (2013). The influence of Satir family therapy on family cohesion and family adaptability in internet addictive disorder. *Chinese Journal of Behavioral Medicine and Brain Science*, *22*(5), 425–427. https://doi.org/10.3760/cma.j.issn.1674-6554.2013.05.014.

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.

Meng, S. Q., Cheng, J. L., Li, Y. Y., Yang, X. Q., Zheng, J. W., Chang, X. W., … Shi, J. (2022). Global prevalence of digital addiction in general population: A systematic review and meta-analysis. *Clinical Psychology Review*, *92*, 102128. https://doi.org/10.1016/j.cpr.2022.102128.

Moge, C. E., & Romano, D. M. (2020). Contextualising video game engagement and addiction in mental health: The mediating roles of coping and social support. *Heliyon*, *6*(11), e5340. https://doi.org/10.1016/j.heliyon.2020.e05340.

Nakshine, V. S., Thute, P., Khatib, M. N., & Sarkar, B. (2022). Increased screen time as a cause of declining physical, psychological health, and sleep patterns: A literary review. *Cureus*, *14*(10), e30051. https://doi.org/10.7759/cureus.30051.

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.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *British Medical Journal*, *372*(71). https://doi.org/10.1136/bmj.n71.

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

Pornnoppadol, C., Ratta-apha, W., Chanpen, S., Wattananond, S., Dumrongrungruang, N., Thongchoi, K., … 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*(4), 932–948. https://doi.org/10.1007/s11469-018-9995-4.

Rao, Y. (2019). From confucianism to psychology: Rebooting internet addicts in China. *History of Psychology*, *22*(4), 328–350. https://doi.org/10.1037/hop0000111.

Rho, M. J., Lee, H., Lee, T. H., Cho, H., Jung, D. J., Kim, D. J., … Choi, I. Y. (2018). Risk factors for Internet gaming disorder: Psychological factors and Internet gaming characteristics. *International Journal of Environmental Research and Public Health*, *15*(1), 40. https://doi.org/10.3390/ijerph15010040.

Schneider, L. A., King, D. L., & Delfabbro, P. H. (2017). Family factors in adolescent problematic internet gaming: A systematic review. *Journal of Behavioral Addictions*, *6*(3), 321–333. https://doi.org/10.1556/2006.6.2017.035.

Shek, D. T., Tang, V. M., & Lo, C. Y. (2009). Evaluation of an Internet addiction treatment program for Chinese adolescents in Hong Kong. *Adolescence*, *44*(174), 359–373.

Sterne, J. A., Hernán, M. A., Reeves, B. C., Savović, J., Berkman, N. D., Viswanathan, M., … Higgins, J. P. (2016). ROBINS-I: A tool for assessing risk of bias in non-randomised studies of interventions. *British Medical Journal*, *355*, i4919. https://doi.org/10.1136/bmj.i4919.

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.

Sullivan, G. M., & Feinn, R. (2012). Using Effect Size — or why the *P* value is not enough. *Journal of Graduate Medical Education*, *4*(3), 279–282. https://doi.org/10.4300/JGME-D-12-00156.1.

Sun, J. T., Hu, B., Chen, T. Q., Chen, Z. H., Shang, Y. X., Li, Y. T., … Wang, W. (2023). Internet addiction-induced brain structure and function alterations: A systematic review and meta-analysis of voxel-based morphometry and resting-state functional connectivity studies. *Brain Imaging and Behavior*, *17*(3), 329–342. https://doi.org/10.1007/s11682-023-00762-w.

Taş, İ. (2017). Relationship between Internet addiction, gaming addiction and school engagement among adolescents. *Universal Journal of Educational Research*, *5*(12), 2304–2311. https://doi.org/10.13189/ujer.2017.051221.

Thomas, R. E., Baker, P. R., Thomas, B. C., & Lorenzetti, D. L. (2015). Family-based programmes for preventing smoking by children and adolescents. *Cochrane Database of Systematic Reviews*, *2015*(2), CD004493. https://doi.org/10.1002/14651858.CD004493.pub3.

Torres-Rodríguez, 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.

Wang, C. (2014). Effect of the comprehensive management mode of the parent intervention on the treatment for patients with Internet addiction and their parents' psychological health. *International Journal of Nursing (Chinese)*, *33*(2), 405–407. https://doi.org/10.3760/cma.j.issn.1673-4351.2014.02.084.

Wang, D. (2016). A control study on the clinical efficacy of different interventions and treatment of Internet addiction. *Guide of China Medicine*, *14*(11), 88–89.

Wei, Q., Yang, Y., Wang, C., & Lu, Y. (2014). An intervention program for both adolescents with Internet addiction disorder and their parents. *Journal of Nursing Science (Chinese)*, *29*(19), 68–71.

Weinstein, A., Livny, A., & Weizman, A. (2017). New developments in brain research of internet and gaming disorder. *Neuroscience and Biobehavioral Reviews*, *75*, 314–330. https://doi.org/10.1016/j.neubiorev.2017.01.040.

World Health Organization (2022). *Older adolescent (15 to 19 years) and young adult (20 to 24 years) mortality*. Who.int: World Health Organization: WHO. https://www.who.int/news-room/fact-sheets/detail/levels-and-trends-in-older-adolescent-(15-to-19-years)-and-young-adult-(20-to-24-years)-mortality.

World Health Organization (2024). *ICD-11 for mortality and morbidity statistics*. Who.int: World Health Organization: WHO. https://icd.who.int/dev11/l-m/en#!/http%3A%2F%2Fid.who.int%2Ficd%2Fentity%2F1448597234.

Wu, X. (2013). *Study on interpersonal characteristics of Internet addiction among adolescents and its comprehensive intervention*. Ph.D. Huazhong University of Science and Technology, Wuhan.

Wu, Y., Gao, C., & Wu, C. (2010). Psychological nursing interventions targeted stigma improves rehabilitation of patients with internet addiction disorder. *Journal of Nursing Science (Chinese)*, *25*(23), 54–56. https://doi.org/10.3870/hlxzz.2010.23.054.

Xu, L., Wu, L., Geng, X., Wang, Z., Guo, X., Song, K., … Potenza, M. N. (2021). A review of psychological interventions for internet addiction. *Psychiatry Research*, *302*, 114016. https://doi.org/10.1016/j.psychres.2021.114016.

Yang, Y., Wu, S., Ren, G., Wei, Q., Zhao, S., Lu, Y., … You, Y. (2009). A comparative study on the clinical effect to internet addiction with different intervention methods and therapy. *Chinese Journal of Behavioral Medicine and Brain Science*, *18*(03), 242–245. https://doi.org/10.3760/cma.j.issn.1674-6554.2009.03.022.

Young, K., Pistner, M., O'Mara, J., & Buchanan, J. (1999). Cyber disorders: The mental health concern for the new millennium. *CyberPsychology & Behavior*, *2*(5), 475–479. https://doi.org/10.1089/cpb.1999.2.475.

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.

Zhang, L., Wang, Y., Li, G., & Cai, S. (2018). Intervention effect of family sandplay therapy on adolescent internet addiction. *Journal of Guangdong Medical College (Chinese)*, *36*(3), 263–266. https://doi.org/10.3969/j.issn.1005-4057.2018.03.009.

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