Clinical Psychology Review 33 (2013) 317–329

Contents lists available at SciVerse ScienceDirect

Clinical Psychology Review

Treatment of internet addiction: A meta-analysis

Alexander Winkler *[,1], Beate Dörsing [1,2], Winfried Rief [3], Yuhui Shen [4], Julia A. Glombiewski [5]

University of Marburg, Department for Clinical Psychology and Psychotherapy, Gutenbergstraße 18, 35032 Marburg, Germany

HIGHLIGHTS

- Psychological and pharmacological treatments for internet addiction were examined.
- Meta-analytic methods were applied to quantify the treatment efficacy.
- Special emphasis was given to the inclusion of studies from non-western countries.
- Most effect sizes were high, robust, and maintained over follow-up.
- Several variables moderating the effect sizes were identified.

ARTICLE INFO

Article history:
Received 14 June 2012
Received in revised form 17 November 2012
Accepted 27 December 2012
Available online 5 January 2013

Keywords:
Addiction
Internet
Meta-analysis
Psychological
Treatment
Review

ABSTRACT

Internet addiction (IA) has become a widespread and problematic phenomenon. Little is known about the efficacy of treatment approaches for IA. Therefore, our objective was to perform an effect size analysis of psychological and pharmacological interventions for IA. We conducted a literature search using PsycINFO, PSYNDEX, MEDLINE, EMBASE, PQDT OPEN, WorldCat, Cochrane Clinical Trials Library, and manual searches. Our meta-analysis was based on 16 studies, covered a total of 670 participants, and used a random effects model. Special emphasis was given to the inclusion of studies from "non-western" countries. Effect size estimates suggest that psychological and pharmacological interventions were highly effective for improving IA ($g = 1.61$), time spent online ($g = 0.94$), depression ($g = 0.90$) and anxiety ($g = 1.25$) from pre- to post-treatment in the overall sample. Moderator analyses revealed that studies including individual treatments, a higher number of female participants, older patients, or a North-American sample had larger effect sizes for some outcome variables. Most effect sizes were high, robust, unrelated to study quality or design, and maintained over follow-up. Due to a small number of included studies and methodological limitations the results of this meta-analysis should be regarded as preliminary.

Contents

* Corresponding author. Tel.: +49 176 20684431; fax: +49 6421 28 28904.
E-mail addresses: Winkler-Alex@t-online.de (A. Winkler), beate.doersing@gmx.de (B. Dörsing), rief@staff.uni-marburg.de (W. Rief), aluoduo@hotmail.com (Y. Shen), julia.glombiewski@staff.uni-marburg.de (J.A. Glombiewski).
[1] The two first authors contributed equally to the paper.
[2] Tel.: +49 174 3218405.
[3] Tel.: +49 6421 2823657.
[4] Tel.: +49 6421 590894.
[5] Tel.: +49 6421 2823617.

0272-7358/$ – see front matter
http://dx.doi.org/10.1016/j.cpr.2012.12.005

1. Introduction

Worldwide more than one billion computers are connected to the internet (Braun, 2010). After a series of 10 cardiopulmonary-related deaths in internet cafés and a game-related murder, South Korea considers internet addiction to be one of its most serious public health issues. China began restricting computer game use after a hospital director reported 13.7% of Chinese adolescent internet users (about 10 million teenagers) meet internet addiction diagnostic criteria (Block, 2008).

Surveys in the United States and Europe have indicated that IA affects 1.5–8.2% of the general population (Weinstein & Lejoyeux, 2010). Chakraborty, Basu, and Kumar (2010) place the rates between 0.3% and 38%, illustrating the considerable variance of the reported prevalence rates in the body of literature. This may be attributable to the fact that diagnostic criteria and assessment questionnaires used for diagnosis vary between countries and studies often use highly selective samples of online surveys (Peukert, Sieslack, Barth, & Batra, 2010).

While internet addiction appears to be an expanding problem worldwide, researchers and practitioners still argue about its existence, classification and how to assess this condition reliably and accurately (Czincz & Hechanova, 2009; Frances & Widiger, 2012; Pies, 2009).

There is an ongoing debate as to whether IA is a discrete mental disorder, or represents a symptom manifestation of another underlying disorder (Beard, 2005; Ha et al., 2006; Pies, 2009).

Furthermore, there is some controversy as to whether one may integrate different Internet-related problems (e.g., excessive pornography use/gaming/surfing/social networking) into one category "Internet addiction", because it remains unclear whether the underlying mechanisms responsible for the addictive behavior are the same for these different problems (Holden, 2001). This raises the additional question whether people are addicted *to* the internet or *on* the Internet (to the different Internet-related problems mentioned above) (Griffiths, 2000).

While the debate continues as to whether these Internet-related phenomena should be classified as an addiction, an impulse-control disorder, or even an obsessive–compulsive disorder (Pies, 2009), there is substantial overlap of the symptoms commonly associated with (behavioral) addictions (Griffiths, 2000), and neurological similarities with other addictions (Thalemann, Wolfling, & Grusser, 2007).

Additionally, there is a recently released new definition of addiction by the American Society of Addiction Medicine (ASAM), officially proposing for the first time that addiction is not limited to substance use (American Society of Addiction Medicine, 2011).

Blum, Chen, Braverman et al. (2008) and Blum, Chen, Chen et al. (2008) have discussed IA as part of "Reward Deficiency Syndrome", which they link to abnormal neurotransmitter interactions in the mesolimbic system (those who achieve less satisfaction seek enhanced stimulation of the "reward center" of the brain), hypothesizing that IA is not that much different from other substances or activities that stimulate excessive dopamine release (Blum, Chen, Braverman et al., 2008; Blum, Chen, Chen et al., 2008; Blum et al., 1996).

According to Grant, Potenza, Weinstein, and Gorelick (2010) natural history, phenomenology, tolerance, comorbidity, overlapping genetic contribution, neurobiological mechanisms, and response to treatment suggest that behavioral addictions resemble substance addictions. The bottom line is: there seems to be growing consensus that excessive internet use is an addiction (Cash, Rae, Steel, & Winkler, 2012).

While there is currently no standard definition of internet addiction in diagnostic manuals, a review of the relevant literature offers a variety of recommendations on how to define IA. For an overview see Byun et al. (2009). According to the American Psychiatric Association (2012) "Internet Use Disorder" is being recommended for further study in Section III of the DSM-5. The following diagnostic criteria for "Internet Use Disorder" are proposed: (A) preoccupation with the Internet; (B) withdrawal symptoms when internet is taken away; (C) tolerance (the need to spend increasing amounts of time on the internet to achieve the same "high"); (D) unsuccessful attempts to control internet use; (E) continued excessive internet use despite knowledge of negative psychosocial problems; (F) loss of other interests; (G) use of the internet to escape or improve a dysphoric mood; (H) deceived others regarding the amount time spent online; and (I) jeopardized or lost a significant relationship, job, educational or career opportunity because of internet use (American Psychiatric Association, 2012).

Even without the official recognition of IA and disagreement over diagnostic criteria, there are various assessment tools that measure IA like the Internet Addiction Test (Young, 1998b), the Problematic Internet Use Questionnaire (Demetrovics, Szeredi, & Rozsa, 2008), the Compulsive Internet Use Scale (Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009), and the Chen Internet Addiction Scale (Cao, Su, & Gao, 2007). There are many more assessment tools circulating, in particular self-developed questionnaires from the authors of the studies that we integrated in this meta-analysis.

Internet addiction (IA) may cause neurological complications, psychological distress, social problems, and health problems, especially in teenagers and young adults (Greenfield, 1999; Young, 1998a; Zhou et al., 2011). In addition, high comorbidity with psychiatric disorders, especially affective disorders, anxiety disorders, impulse control disorders, substance abuse disorders, and attention deficit hyperactivity disorder have been reported (Petersen, Weymann, Schelb, Thiel, & Thomasius, 2009; Peukert et al., 2010; Shaw & Black, 2008; Weinstein & Lejoyeux, 2010). According to Block (2008) about 86% of IA cases

have some other comorbid DSM-IV diagnosis, which raises complex questions of causality since we cannot be absolutely sure if IA is a cause or consequence of these disorders (Ha et al., 2006; Pies, 2009).

Several authors offer different models for the development and maintenance of IA. For a brief overview see Cash et al. (2012).

There are several reviews addressing the topics of diagnosis, phenomenology, epidemiology, comorbid disorders and neuroimaging findings of IA (e.g., Chakraborty et al., 2010; Ko, Yen, Yen, Chen, & Chen, 2012; Kryspin-Exner, Felnhofer, & Kothgassner, 2011; Weinstein & Lejoyeux, 2010; Yuan, Qin, Liu, & Tian, 2011), but still, little is known about the treatment of IA. In their systematic review of the IA treatment literature King, Delfabbro, Griffiths, and Gradisar (2011) have evaluated the reporting quality of treatment studies and there are some qualitative reviews which have also reported on treatments for IA (e.g., Cash et al., 2012; Petersen et al., 2009; Peukert et al., 2010; Widyanto & Griffiths, 2006), but none of them have applied meta-analytic methods to quantify the size of the treatment effect.

Petersen et al. (2009) conducted a survey at the request of the German health department and argue that clinical recommendations are not possible due to the lack of studies and that further research is urgently needed. Peukert et al. (2010) indicate cognitive–behavioral and pharmacological approaches as potentially effective treatments in their review. They further suggest that interventions with family members or other relatives could be useful. In their review, Widyanto and Griffiths (2006) report that most of the treatments employed so far had utilized a cognitive–behavioral approach. They did not comment on their efficacy.

It remains unclear both whether psychological or pharmacological treatments are effective in reducing symptoms of IA at all, and whether psychological or pharmacological treatments are more effective. Therefore, we conducted a meta-analysis to examine and compare the short and long-term efficiencies of different psychological and pharmacological treatments for IA and to identify treatment moderators. For this purpose, we reviewed treatment studies examining the effects of psychological or pharmacological interventions on internet addiction symptoms, time spent online, depression and anxiety. We tested the hypothesis that psychological as well as pharmacological interventions are effective treatments for reducing time spent online and symptoms of IA, anxiety and depression.

2. Method

2.1. Search procedure

Studies were identified by searching PsycINFO, PSYNDEX, MEDLINE, EMBASE, PQDT OPEN, WorldCat, and the Cochrane Clinical Trials Library. We conducted extensive searches for studies published between the first available year and April 29, 2011 using the terms *internet addiction*, *internet usage*, *problematic internet*, *cybersex*, *computer game addiction*, *online addiction*, *internet overuse* and *internet disorder* combined with the terms *treat**, *intervent**, *therap**, *psychotherap**, *training**, *program**, *curricul** and *workshop**.

In addition, we conducted a search of the Google Scholar database, a manual review of relevant journals, and a manual review of reference lists of relevant articles and review papers extracted from the database searches. Considering the substantial relevance of IA and the corresponding research activities in East Asia, a special goal was to include as many available studies as possible from these countries. We adopted comprehensive search strategies in order to find both published and unpublished articles. With respect to unpublished articles, we made an a priori decision to include them in our analysis if all inclusion criteria were met. In addition, we decided to code each study as published or unpublished and to conduct a moderator analysis in order to find out if publication status moderated the effect sizes. We decided a priori to ask the authors of the articles we included in our meta-analysis for further leads on studies covering the treatment of IA.

2.2. Determination of outcome variables

As a consequence of the current lack of research on IA and potential treatments, we could not access an established set of recommendations for the inclusion of outcome variables measuring IA. After a manual review of relevant articles we chose “internet addiction status” and “time spent online” as core outcome variables. These variables are commonly assessed in treatment studies (e.g., Dell'Osso et al., 2008; Han, Hwang, & Renshaw, 2010; Orzack, Voluse, Wolf, & Hennen, 2006; Twohig & Crosby, 2010; Young, 2007). For the purposes of the meta-analysis, the variable internet addiction status comprises outcome variables assessed by several questionnaires on internet addiction or compulsive internet use. We also included depression (assessed with a depression questionnaire) and anxiety (assessed with an anxiety scale) as additional outcome variables. A full list of assessment tools used in the studies included in the meta-analysis is provided in Table 1.

2.3. Study selection

Studies were included if they met the following inclusion criteria: (1) the study addressed the topic “internet addiction”; (2) the study included a psychological or pharmacological treatment intended to decrease IA related problems. Studies meeting the following criteria were excluded: (1) the study was a case study; (2) the full text of the study was unavailable; (3) the study provided insufficient data to perform an analysis of the effect sizes and additional data could not be obtained from the author; (4) the study failed to report results for at least one of the four outcome variables; (5) the sample overlapped either partially or completely with the sample of another study included in the meta-analysis.

If available, follow-up data was used to determine the effect sizes for pre-treatment to follow-up comparisons. In order to determine controlled effect sizes for intergroup comparisons at post-treatment, data from control conditions was used. For studies in which two or more groups received different interventions, all groups were independently included. For studies reporting data for the total sample and sub-samples within the same population, total sample data was included. We made an a priori decision to include all available participant samples because of the anticipated small selection of studies addressing the treatment of IA. We made no restrictions on the publication date because of the anticipated small sample of studies available and because research on this topic is relatively new. We also made no geographical or cultural restrictions because we were interested in a global perspective on IA and its treatments.

We anticipated difficulties in locating treatment studies and initially considered publications in English, German, and Chinese language. Each identified article was further examined by two independent reviewers (BD and AW) for potential inclusion in the meta-analysis. Disagreements were resolved by discussion. We screened the title and abstract of each article after duplicates were removed to determine whether articles addressed the topic IA, reported at least one treatment approach for IA, and were not case studies. To examine whether the studies provided insufficient data or whether the sample overlapped with that of another study, we screened the full text of each article.

2.4. Validity assessment

No additional exclusion criteria were applied based on methodological quality. Studies using an intergroup comparison design and randomized controlled trials as well as studies using an intragroup change design and observational studies were included. To control for possible confounds (Glass, 1976), we rated the quality of each study and analyzed study quality as a moderator.

We used a quality scale (GGK quality scale) developed by Glombiewski et al. (2010) based on Jadad criteria (Jadad et al., 1996) and PRISMA recommendations (Liberati et al., 2009). This scale consists

Table 1
Characteristics of included studies.

Author and year	*N* total (tN_{t0}/tN_{t1})[a] (cN_{t0}/cN_{t1})[b]	Type of treatment (*group/individual*)	Hours of intervention applied[c]	Average age (% female participants)	Follow-up period in months[d]	Cultural background	Outcome variables and assessment tools	GGK quality score
Bai and Fan (2007)	48 (24/24) (24/24)	MLC: CBT & SoCo & self-control strategies & communication skills (*group*)	16	19.00 (16.70%)	1.5	Chinese	IA (CIAS-R)	10
Cao et al. (2007)	57 (29/26) (35/31)	CBT (*group*)	10	14.80 (24.14%)	None	Chinese	IA (YDQ, CIAS) Anxiety (SCARED)	12
Dell'Osso et al. (2008)	17 (19/17) (0/0)	Medication: 10 mg Escitalopram/day at start, then 20 mg/day for 10 weeks (*individual*)	Not reported	37.50 (35.29%)	None	US	IA (IC-IUD-YBOCS) Time (hours/week)	8
Du, Jiang, and Vance (2010)	56 (32/32) (24/24)	MLC: school-based intervention (parent training & teacher education & CBT) (*group*)	14	15.92 (19.64%)	6	Chinese	IA (IOSRS) Anxiety (SCARED)	15
Fang-ru and Wei (2005)	52 (52/52) (0/0)	MLC: SFBT & family therapy & CT (*individual*)	Not reported	15.20 (26.92%)	None	Chinese	IA (YDQ)	6
Han et al. (2010)	11 (12/11) (0/0)	Medication: Bupropion sustained release treatment (*individual*)	Not reported	21.50 (00.00%)	None	Korean	IA (YIAS, CFPS) Time (hours/day) Depression (BDI)	8
Han et al. (2009)	21 (62/21) (0/0)	Medication: Methylphenidate treatment (*individual*)	Not reported	09.30 (16.13%)	None	Korean	IA (YIAS-K) Time (hours/day)	7
Kim (2008)	25 (13/13) (12/12)	Reality therapy group counseling program (*group*)	12.5	24.20 (20.00%)	None	Korean	IA (K-IAS)	8
Lanjun (2009)	70 (35/35) (35/35)	MLC: CBT & sports (*group*)	24	21.04 (45.71%)	None	Chinese	IA (IAS) Anxiety (STAI)	8
Li and Dai (2009)	76 (38/38) (38/38)	CBT (*individual*)	14	16.50 (10.53%)	None	Chinese	IA (CIAS)	8
Orzack et al. (2006)	32 (35/32) (0/0)	MLC: psycho-educational program (psychodynamic & CBT), readiness to change, MI (*group*)	Not reported	44.50 (00.00%)	None	US	Time (OTIS) Depression (BDI)	8
Rong et al. (2005)	18 (23/18) (0/0)	MLC: CBT & parent training & medication (*individual*)	10.5	16.00 (13.04%)	None	Chinese	IA (CIUS) Depression (SDS)	5
Shek, Tang, and Lo (2009)	22 (59/22) (0/0)	MLC: counseling & MI & family perspective & case-, group work (*individual*)	Not reported	15.24 (01.72%)	None	Chinese	IA (CIAS, SOIAS) Depression (C-BDI)	6
Twohig and Crosby (2010)	6 (6/6) (0/0)	Acceptance and commitment therapy (*individual*)	12	26.50 (00.00%)	3	US	Time (hours/day)	11
Young (2007)	114 (114/114) (0/0)	CBT (*individual*)	Not reported	41.04 (42.11%)	6	US	IA (MTS, ATC, SF, ATA) Time (TSOA)	10
Zhu, Jin, and Zhong (2009) (1)	22 (23/22) (0/0)	CBT (*individual*)	5	23.04 (31.82%)	None	Chinese	IA (ISS) Depression (SDS, HAMD) Anxiety (SAS, HAMA)	11
Zhu et al. (2009) (2)	23 (24/23) (0/0)	CBT & acupuncture (*individual*)	15	39.13 (31.82%)	None	Chinese	IA (ISS) Depression (SDS, HAMD) Anxiety (SAS, HAMA)	11

Note. GGK quality score = Glombiewski–Gutterman–Koenig quality score (range: 0–20 points with a low value indicating poor study quality); MLC = Multi-level Counseling Program; CBT = Cognitive Behavioral Therapy; MI = motivational interviewing; SoCo = social competence training; SFBT = Solution-focused Brief Therapy; CT = Cognitive Therapy; CIAS = Chinese Internet Addiction Scale-Revision; Chen Internet Addiction Scale or Chinese Internet Addiction Scale; YDQ = Young Diagnostic Questionnaire for Internet Addiction; SCARED = screening for child anxiety related emotional disorders; IC-IUD-YBOCS = Yale-Brown Obsessive Compulsive Scale (Y-BOCS) modified for IA; IOSRS = Internet Overuse Self-Rating Scale; YIAS = Young Internet Addiction Scale. YIAS-K: Young Internet Addiction Scale — Korean version; CFPS = craving to play Starcraft (self-report on a 7-point analogue scale); BDI = Beck Depression Inventory; C-BDI: Chinese Beck Depressions Inventory; IAS = Internet Addiction Scale; K-IAS = Korean Internet Addiction Scale; STAI = State-Trait Anxiety Inventory for Adults; OTIS = Orzack time intensity survey; CIUS = Callan Internet Use Scale; SDS = Self-Rating Depression Scale; SOIAS = sum of internet addiction symptoms; MTS = motivation to stop abusing the internet; ATC = ability to control computer use; SF = sexual function (the ability to abstain from sexually explicit online material); ATA = ability to abstain from problematic online applications; TSOA = time spent on offline activities; ISS = Internet Addiction Disorder Self-Rating Scale; HAMD = Hamilton Depression Scale; SAS = Self-Rating Anxiety Scale; HAMA = Hamilton Anxiety Scale.

[a] Number of subjects at pre- and post-test in the treatment condition.

[b] Number of subjects at pre- and post-test in the control condition.

[c] Total number of hours spent in treatment.

[d] Longest available follow-up period in months.

of 20 dichotomous items with a maximum score of 20 and assesses aspects of internal, external, and construct validity. The quality of each study with English full text was assessed independently by two reviewers (BD and AW) and interrater reliability was calculated. Disagreements were resolved through discussion. Each study with Chinese full text was assessed by one reviewer (YS).

2.5. Data extraction

For each study, the quantitative variables of internet addiction status, time spent online, depression, and anxiety were selected by two of the authors (BD and AW). Numerical data was extracted from the studies by the same authors for studies with English full text (for studies with Chinese full text, numerical data was extracted by YS). In addition, the following information was extracted from each study collectively by the same three reviewers: total *N*, type of treatment, average age, percentage of female participants, culture in which the study was conducted, GGK quality score, and hours of intervention applied. Disagreements were resolved through discussion. In cases of missing data for individual moderator variables, the relevant study was excluded only from the analysis of that moderator variable.

2.6. Quantitative data synthesis

All analyses were completed manually or by using the software program "Comprehensive Meta-analysis," version 2 (Borenstein, Hedges, Higgins, & Rothstein, 2005). As no case of intention-to-treat (ITT) data was found in the included studies, we analyzed completer data in all cases. Separate effect sizes for the continuous variables internet addiction status, time spent online, depression, and anxiety were calculated by using pre-post-treatment changes for all studies using an intragroup design[6] and intervention group (IG)–comparison group (CG) differences for all studies using an intergroup design.[6] We calculated effect sizes by using Hedges's *g* and its 95% confidence interval. Hedges's *g* is a variation of Cohen's *d* that corrects for bias due to small sample sizes[6] (Hedges & Olkin, 1984). The magnitude of Hedges's *g* can be interpreted using *Cohen's* recommendation for small (.20), medium (.50), and large (.80) (Cohen, 1988). The correlation between pre- and post-treatment measures is needed in order to calculate the pre-post effect sizes, but could not be determined from the study reports. Therefore, we followed the recommendation by Rosenthal (1993) and used a conservative estimate of $r = .70$.

We used a test of significance based on the *Q* statistic, a measure of weighted squared deviations, to identify heterogeneity in effect sizes.[6] Furthermore, we estimated the variance of the true effect between the studies (T^2) to quantify the heterogeneity in effect sizes.[6]

In addition, we used the ratio of true heterogeneity to total observed variation I^2 (Higgins, Thompson, Deeks, & Altman, 2003).[6] These methods are described in more detail in Borenstein, Hedges, Higgins, and Rothstein (2009).

Effect size estimates for internet addiction status, time spent online, depression, and anxiety were pooled across studies to obtain a summary statistic. For studies reporting more than one effect size for the same outcome variable, we pooled all effect sizes reported for that outcome. The effect size estimates were calculated by using a random effects model rather than a fixed effects model because the studies included were not functionally identical (Hedges & Vevea, 1998). Effect size estimates for follow-up data were also calculated in the manner described above. Effect sizes for intragroup study designs, intergroup study designs, and a combination of both study designs at post-treatment as well as at follow-up were reported separately.[6] Instead of conducting a power analysis, we report the observed effect size with its confidence interval, which is more informative than the statement that power was low (Borenstein et al., 2009). We also did not report *M*s and *SD*s for measurement artifacts because construct-level relationships were not the focus of this analysis.

For the purposes of conducting subgroup analyses, we chose a random effects model with separate estimates of T^2 for each subgroup and used a *Q*-test for heterogeneity (see Appendix A) across studies to compare the effects of different subgroups.

[6] For detailed information see Appendix A.

2.7. Sensitivity analysis

Studies with non-significant results are less likely to be published than are those reporting significant results (Johnson & Eagly, 2000). The mean effect reported by the meta-analysis based on this biased sample of all possible studies is likely to reflect this bias. To minimize publication bias, we conducted a careful search of the literature, which included strategies to find published and unpublished studies. We then computed the *fail-safe N* [6] (Rosenthal, 1993) to address potential publication bias. In addition, we constructed funnel plots for the effect sizes regarding all outcome variables, and we used the Trim and Fill method[6] (Duval & Tweedie, 2000) to measure the robustness of the results. The results of a meta-analysis are considered to be unbiased and robust if the funnel plot is symmetrical, the Trim and Fill method results in comparable original and re-calculated effect sizes, and the *fail safe N* exceeds 5 $K + 10$. We constructed a box plot for the mean effect sizes of all studies, including all outcome variables, to identify outliers. We treated effect sizes as outliers if the distance to the average value of all effect sizes was 1.5 times the inter-quartile range or more. Outliers were not considered in the integration of effect sizes.

2.8. Moderator analyses

Potential moderating variables were determined based on previous research and methodological considerations. Study quality (assessed with GGK quality scores), culture (the cultural area where the study was conducted), design (intragroup changes or intergroup comparisons), average age, percentage of female participants, individual vs. group therapy, and type of treatment were chosen as potential moderators. The moderating effect of study quality was tested to address the problem of possible confounds of effect sizes (Glass, 1976; Johnson & Eagly, 2000) due to differences in methodological quality across studies, which is known in the literature as the *garbage in/garbage out problem* (Borenstein et al., 2009). Culture was chosen as a potential moderator because a sizeable number of the treatment studies were conducted in China or Korea. Design was chosen as a potential moderator because different designs were included in the meta-analysis and we considered it important to compare them. Individual vs. group therapy, average age, and percentage of female participants were chosen as potential moderators to examine (i) whether individual or group therapy is more effective in treating IA and whether (ii) men and women or (iii) younger and older participants gained the same benefit from the treatment. The moderating effect of type of treatment was tested by sorting the studies into the following five classes of treatments: (1) Cognitive Behavioral Therapy (CBT) including emotion regulation, communication, social competence, restructuring, alternative behaviors, psychoeducation, (2) Reality Therapy (RT) which avoids discussion about symptoms but targets at reconnection with people, time management, introduction of alternative activities, (3) Multi-level Counseling Programs which implement several different types of treatment (4) Acceptance and Commitment Therapy (ACT) consisting of acceptance and mindfulness strategies as well as commitment and behavior change strategies, and (5) medication (SSRI's (escitalopram), non-tricyclic antidepressants (bupropion) and psycho stimulant drugs (methylphenidate)). Moderator effects were examined by using meta-regression analyses (95% confidence intervals).

3. Results

3.1. Study selection

Our study selection process is illustrated in Fig. 1. In our initial search for relevant articles, our search algorithm identified 16 unique articles. Two of the 16 studies that met our selection criteria reported unusually high effect sizes (Hedges's $g > 4$) for one of the outcome

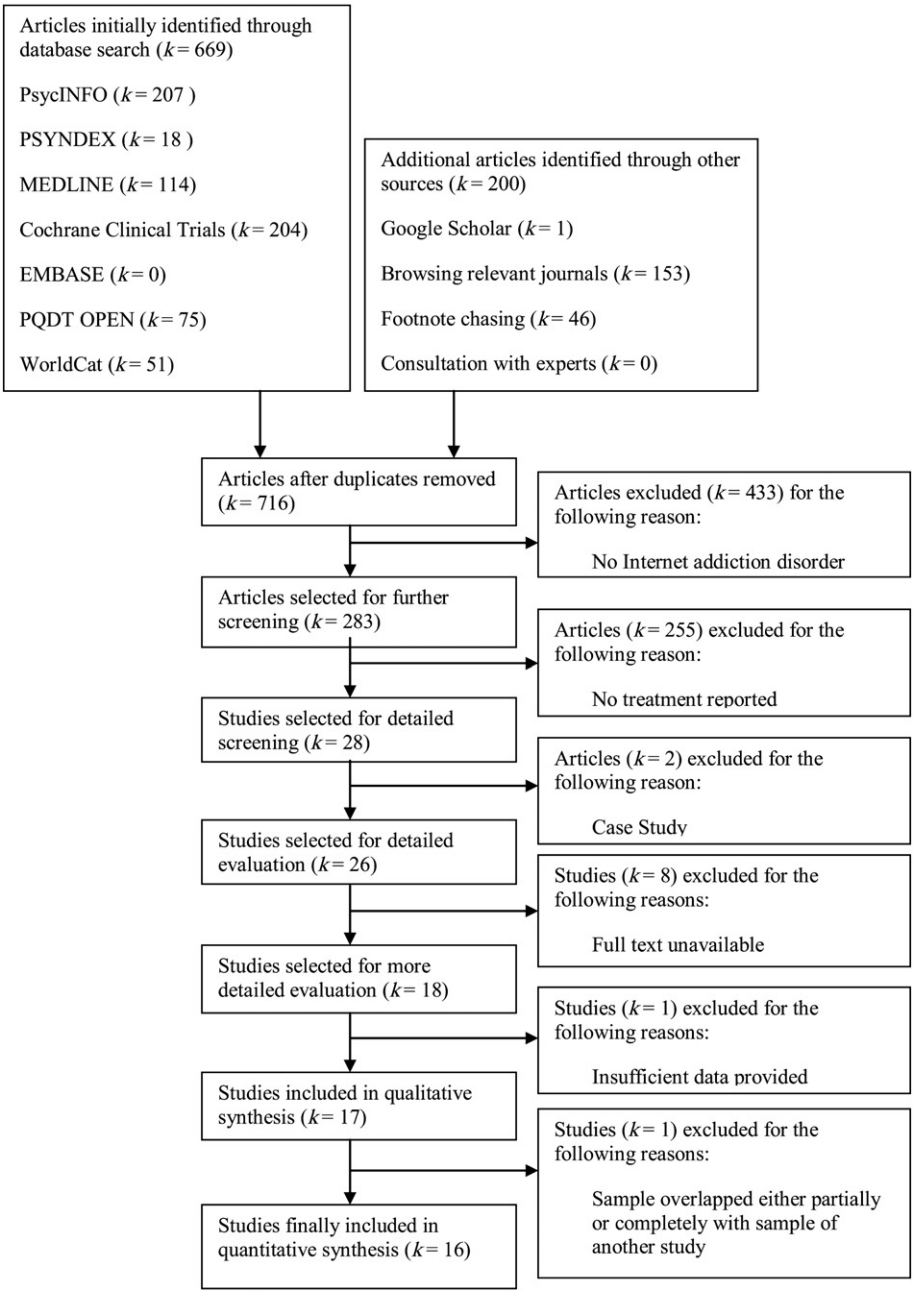

Fig. 1. Flow diagram of the study selection process.

variables. We treated those effect sizes as outliers and excluded them from further analyses. The studies included in the meta-analysis (see Tables 1 and 2) included 17 treatment conditions and covered a total of 670 participants. We did not find any unpublished studies. Two of the authors we asked for further leads on studies covering the treatment of IA responded and indicated they were not aware of any studies not yet included in our meta-analysis.

3.2. Study characteristics

The characteristics of the included studies and treatment conditions are summarized in Table 1. The 17 psychological or pharmacological treatment conditions are four CBT conditions ($n = 269$ participants), seven Multi-level Counseling Programs ($n = 298$ participants), one RT condition ($n = 25$ participants), one ACT condition ($n = 6$ participants), and three medication treatments ($n = 49$ participants).

Eleven of these treatments were individual therapies, and six were group therapies. The number of hours of intervention ranges from 5 to 16 ($k = 10$ studies, $M = 12.44$, $SD = 4.89$); seven studies did not report the duration of the therapy. The studies did not report any concurrent treatment and were regarded as purely psychological or purely pharmacological, with one exception (Rong, Zhi, & Yong, 2005) being a predominantly psychological intervention with additional medication. Six treatment conditions had a control group (five of them were randomized controlled trials). Eleven treatment conditions were conducted without a control group. No treatment was provided for the comparison group for the six controlled treatment conditions. Follow-up data was reported for four of the treatment conditions. Follow-up periods ranged from 1.5 to 6 months ($M = 4.13$, $SD = 2.25$).

The total number of patients across all studies was 670, with 506 patients in treatment and the remaining 164 in control groups. The samples were predominantly male (80.26% of all patients). Each of

Table 2
Efficacy of psychological and pharmacological interventions for internet addiction status (IA status), time spent online (Time), depression, and anxiety.

Author, publication year	Type of treatment	Outcome variables	Pre-post			Pre-follow-up		
			g	95% CI	*p*-Value	*g*	95% CI	*p*-Value
Bai and Fan (2007)	MLC	IA status	1.45[b]	[0.82, 2.08]	<.001**	1.73	[1.08, 2.39]	<.001**
Cao et al. (2007)	CBT	IA status	1.09[b]	[0.54, 1.64]	<.001**	NA[a]	–	–
		Anxiety	.78[b]	[0.45, 1.12]	<.001**	NA	–	–
Dell'Osso et al. (2008)	Drug[c]	IA status	2.54	[1.79, 3.29]	<.001**	NA	–	–
		Time	.69	[0.30, 1.09]	<.001**	NA	–	–
Du et al. (2010)	MLC	IA status	.67[b]	[0.13, 1.20]	.015*	.90	[0.35, 1.45]	.001**
		Anxiety	.78[b]	[0.24, 1.32]	.005**	1.02	[0.47, 1.58]	<.001**
Fang-ru and Wei (2005)	MLC	IA status	2.07	[1.70, 2.44]	<.001**	NA	–	–
Han et al. (2010)	Drug[d]	IA status	.82	[0.32, 1.32]	.001**	NA	–	–
		Time	1.06	[0.51, 1.60]	<.001**	NA	–	–
		Depression	.12	[−0.31, 0.54]	.582	NA	–	–
Han et al. (2009)	Drug[e]	IA status	.57	[0.23, 0.92]	.001**	NA	–	–
		Time	.61	[0.26, 0.96]	.001**	NA	–	–
Kim (2008)	RT	IA status	Outlier			NA	–	–
Lanjun (2009)	MLC	IA status	2.98[b]	[2.30, 3.66]	<.001**	NA	–	–
		Anxiety	.43[b]	[−0.04, 0.90]	.075	NA	–	–
Li and Dai (2009)	CBT	IA status	1.46[b]	[0.96, 1.96]	<.001**	NA	–	–
Orzack et al. (2006)	MLC	Time	.27	[−0.08, 0.61]	.132	NA	–	–
		Depression	.35	[0.00, 0.70]	.048*	NA	–	–
Rong et al. (2005)	MLC	IA status	Outlier			NA	–	–
		Depression	.52	[0.15, 0.88]	.006**	NA	–	–
Shek et al. (2009)	MLC	IA status	.96	[0.46, 1.45]	<.001**	NA	–	–
		Depression	.16	[−0.25, 0.57]	.439	NA	–	–
Twohig and Crosby (2010)	ACT	Time	.62	[0.03, 1.21]	.039*	.56	[−0.02, 1.13]	.058
Young (2007)	CBT	IA status	.93	[0.75, 1.11]	<.001**	.66	[0.50, 0.83]	<.001**
		Time	2.38	[2.10, 2.66]	<.001**	2.65	[2.35, 2.95]	<.001**
Zhu et al. (2009) (1)	CBT	IA status	2.66	[1.98, 3.34]	<.001**	NA	–	–
		Depression	2.15	[1.57, 2.73]	<.001**	NA	–	–
		Anxiety	1.74	[1.24, 2.25]	<.001**	NA	–	–
Zhu et al. (2009) (2)	CBT & acupuncture	IA status	3.46	[2.62, 4.29]	<.001**	NA	–	–
		Depression	2.26	[1.67, 2.85]	<.001**	NA	–	–
		Anxiety	2.68	[2.01, 3.36]	<.001**	NA	–	–

Note. The table shows effect size estimates (Hedges's *g*), the 95% confidence intervals, and the significance test of changes in internet addiction status, time spent online, depression, and anxiety from before to after a psychological or pharmacological treatment of IA patients. We only included outcome variables reported in the studies. CBT = Cognitive Behavioral Therapy; ACT = Acceptance and Commitment Therapy; MCP = Multi-level Counseling Program; RT = Reality Therapy.

[a] Not available. No follow-up measure was administered in the study. Effect sizes, CIs and *p*-values could not be determined.

[b] Intergroup comparison study design.

[c] Escitalopram.

[d] Bupropion.

[e] Methylphenidate.

* $p<.05$.

** $p<.01$.

the 17 treatment conditions ($n=506$ patients), and each of the four control conditions ($n=164$ patients) included sufficient data to determine drop-out rates from pre to post-treatment. A total of 94 treatment group patients (18.58%) and four control group patients (2.44%) dropped out of treatment and control conditions, respectively. There were no studies reporting ITT analyses. The GGK quality scores for each study are shown in Table 1. Scores ranged from 5 to 15 points (out of a maximum of 20 points; $M=8.94$, $SD=2.54$). We used two independent ratings (by BD and AW), with Cohen's Kappa interrater reliability (Cohen, 1960) of $\kappa=.865$.

Fifteen of the 16 studies provided a sufficiently detailed description of the interventions and 14 adequately defined the outcome variables. Twelve studies described drop-out rates, and 12 studies described relevant baseline characteristics. Fourteen out of the 16 studies provided adequate descriptions of inclusion and exclusion criteria. Six of the studies implemented a manualized or otherwise standardized intervention and none of the studies reported a blind assessment of treatment outcome.

3.3. Quantitative data synthesis

The single intragroup or intergroup (depending on the study design) effect size estimates (Hedges's *g*) for each study and outcome, the 95% confidence intervals, and the significance test of intragroup changes or intergroup comparisons at post-treatment and follow-up are displayed in Table 2. The statistical values for all treatments combined and subgroups of treatments are displayed in Table 3.

3.3.1. Pooled intra- and intergroup effect sizes at post-treatment

The pooled intra- and intergroup effect sizes (Hedges's *g*) at post-treatment for internet addiction status ($k=13$ studies, $n=589$ participants), and anxiety ($k=5$ studies, $n=228$ participants) are displayed in Table 3. All pooled effect sizes for intragroup changes and intergroup comparisons at post-treatment were significant (see Table 3). Intergroup effect sizes for the outcome variables time spent online and depression were not available. According to Cohen's recommendations (Cohen, 1988), the effect sizes were large, with confidence intervals suggesting large effects for internet addiction status and medium-to-large effects for anxiety.

3.3.2. Intragroup effect sizes at post-treatment

The intragroup effect sizes (Hedges's *g*) at post-treatment for internet addiction status ($k=8$ studies, $n=282$ participants), time spent online ($k=6$ studies, $n=201$ participants), depression ($k=6$ studies, $n=128$ participants), and anxiety ($k=3$ studies, $n=45$ participants)

Table 3
Effect sizes for all outcome variables for any treatment and subgroups of treatments.

Outcome	Type of effect	*n*	*g*	95% CI	SE	*z*	*p*	I^2	Fail-safe *N*
Any treatment									
IA status	Intragroup changes (post)	8	1.68	[1.11, 2.26]	.29	5.74	<.001**	93.22	739
IA status	Pooled effect size (FU)	3	1.03	[0.45, 1.61]	.30	3.49	<.001**	79.98	67
IA status	IG-CG comparison (post)	5	1.51	[0.82, 2.20]	.35	4.26	<.001**	86.37	160
IA status	Pooled effect size (post)	13	1.61	[1.19, 2.04]	.22	7.39	<.001**	91.12	1600
Time	Intragroup changes (post)	6	.94	[0.17, 1.71]	.39	2.40	.016*	95.77	245
Time	Pooled effect size[g] (FU[e])	2	1.62	[−0.43, 3.66]	1.04	1.55	.121	97.48	–[a]
Depression	Intragroup changes (post)	6	.90	[0.24, 1.55]	.34	2.67	.008**	92.72	107
Anxiety	Intragroup changes (post)	3	1.70	[0.64, 2.77]	.54	3.14	.002**	92.93	93
Anxiety	Pooled effect size (FU)	1	1.02	[0.47, 1.58]	.28	3.60	<.001**	.00	NA[b]
Anxiety	IG-CG comparison (post)	2	.58	[0.22, 0.93]	.18	3.19	.001**	.00	NA[b]
Anxiety	Pooled effect size (post)	5	1.25	[0.57, 1.94]	.35	3.59	<.001**	89.96	142
Any psychological treatment									
IA status	Pooled effect size (post)	10	1.73	[1.22, 2.23]	.26	6.72	<.001**	91,45	1110
Time	Pooled effect size (post)	3	1.10	[−0.42, 2.61]	.77	1.43	.156	97.92	–[a]
Depression	Pooled effect size (post)	5	1.06	[0.29, 1.83]	.39	2.70	.007*	93.52	102
Any pharmacological treatment									
IA status	Pooled effect size (post)	3	1.26	[0.28, 2.23]	.50	2.53	.011*	90.90	42
Time	Pooled effect size (post)	3	.72	[0.49, 0.96]	.12	6.01	<.001**	.00	27
Depression	Pooled effect size (post)	1	.12	[−0.31, 0.54]	.22	.55	.582	.00	–[a]
Cognitive behavioral treatment (CBT) only									
IA status	Pooled effect size (post)	4	1.48	[0.84, 2.13]	.33	4.51	<.001**	88.14	189
Time	Pooled effect size (post)	1	2.38	[2.10, 2.66]	.14	16.78	<.001**	.00	NA[b]
Depression	Pooled effect size (post)	1	2.15	[1.57, 2.73]	.30	7.23	<.001**	.00	NA[b]
Any psychological treatment excluding CBT									
IA status	Pooled effect size (post)	6	1.90	[1.12, 2.67]	.39	4.81	<.001**	91.37	379
Time	Pooled effect size (post)	2	.36	[0.05, 0.66]	.16	2.30	.022*	3.39	NA[b]
Depression	Pooled effect size (post)	4	.79	[0.07, 1.51]	.37	2.14	.032*	91.84	40

Note. An analysis of subgroups of psychological treatments was only performed if type of treatment significantly moderated the overall effect size for that outcome variable. *n* = number of treatment conditions in the analysis; I^2 = ratio (0 to 100%) indicating the proportion of the observed variance that reflects real differences in effect sizes (values of 25%, 50%, and 75% can be considered low, moderate, and high, respectively); Fail-safe *N* = indicates the number of studies with a treatment effect of 0 that would be needed to lead to a nonsignificant overall result; pooled effect size = effect size was determined integrating intra- and intergroup designs; (post) = effect size at post-treatment; FU = effect size at follow-up; IG-CG comparison = effect size was determined taking into account the available control groups.

[a] Fail-safe *N* was not determined because *p* was not significant.

[b] Fail-safe *N* could not be determined because fewer than 3 studies were available.

* $p<.05$.

** $p<.01$.

are shown in Table 3. All intragroup changes at post-treatment were significant. According to Cohen's interpretation recommendations, the effect sizes were large with confidence intervals suggesting large effects for internet addiction status, between medium and large for anxiety, between small and medium-to-large for depression, and small-to-large for time spent online.

3.3.3. Intergroup effect sizes at post-treatment

For studies that included control groups, we determined intergroup comparison effect sizes. The intergroup effect sizes at post-treatment (Hedges's *g*) for internet addiction status ($k=5$ studies, $n=307$ participants) and anxiety ($k=3$ studies, $n=183$ participants) are displayed in Table 3. Intergroup effect sizes at post-treatment were significant with respect to internet addiction status and anxiety. Intergroup comparisons were not available for the outcome variables time spent online and depression. Effect sizes were large for internet addiction status and between medium and large for anxiety. The confidence intervals suggested large effects for internet addiction status and between small and medium-to-large effects for anxiety.

3.3.4. Pooled intra- and intergroup effect sizes at follow-up

The pooled intra- and intergroup effect sizes at follow-up (Hedges's *g*) for the outcome variables internet addiction status (three studies) and anxiety (one study) are displayed in Table 3. All effect sizes at follow-up were large and significant except for the outcome variable time spent online (which was nonsignificant). The confidence intervals suggest between small and medium-to-large effects for internet addiction status and anxiety. Follow-up data for depression was not available.

3.4. Sensitivity analysis

3.4.1. Fail-safe N

All fail-safe *N*s exceeded 5 K + 10 and, accordingly, we considered all effect sizes to be robust. The fail-safe *N*s are displayed in Table 3.

3.4.2. Trim and Fill method

The results of the Trim and Fill method suggest that the effect size estimates for all considered outcome variables at post-treatment were unbiased for both intragroup and intergroup comparisons. For intragroup changes and intergroup comparisons at follow-up, results suggest that the effect size estimates for internet addiction status were biased.

3.5. Moderator analysis

In order to take into account the variance of effect sizes from study to study (see Table 3) and to explore possible predictors of treatment outcome, we conducted a moderator analysis for all pooled effect sizes of intragroup changes and intergroup comparisons at post-treatment by using the following moderators: study quality (GGK), culture, design, mean sample age, percentage of female participants, individual vs.

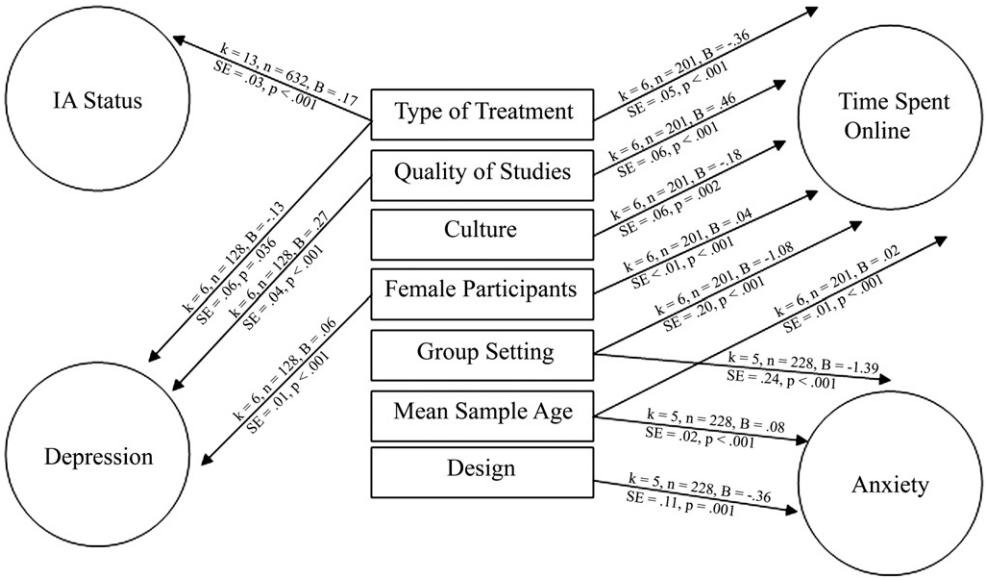

Fig. 2. Moderation (B = Estimated slope in meta regression analyses) for the four outcome variables IA status, time spent online, depression, and anxiety.

group therapy, and type of treatment (see Fig. 2). We did not assess the interrelations among variables used for moderator analyses because of the limited functional range of the software we used.

Effect sizes for internet addiction status, time spent online, and depression were moderated by type of treatment (see below). For time spent online, studies with higher validity scores, American studies (in comparison to Asian studies), studies examining individual treatments, studies examining older patients, and studies with a higher number of female participants reported larger effect sizes. For depression, studies receiving higher validity scores and studies with a higher number of female participants reported larger effect sizes. For anxiety, uncontrolled studies, studies examining individual treatments, and studies examining older patients reported larger effect sizes.

3.6. Sub-analyses on type of treatment

In light of previous findings in addiction research (Pallesen, Mitsem, Kvale, Johnsen, & Molde, 2005; Pallesen et al., 2007; Petry & Armentano, 1999; Toneatto & Ladoceur, 2003) and the fact that type of treatment was a significant moderator of treatment efficiency for internet addiction status, time spent online, and depression, we hypothesized that: (a) CBT will be a more effective treatment for internet addiction than other psychological treatments with respect to all outcome variables, and (b) psychological interventions will produce greater effect sizes than pharmacological interventions for the outcome variables (i) internet addiction status and (ii) time spent online and in equal effect sizes for (iii) depression, and (iv) anxiety. To test these hypotheses, we performed four separate analyses, one including any psychological treatment, one including only pharmacological treatments, one including any psychological treatment except for CBT, and one including CBT only. All effect sizes from these analyses are displayed in Table 3.

3.6.1. Psychological vs. pharmacological interventions

For internet addiction status, the confidence intervals overlapped for the effect sizes for any psychological treatment (95% CI: 1.22–2.23) and pharmacological treatments (95% CI: 0.28–2.23). The results of a *Q*-test for heterogeneity between subgroups yielded non-significant results ($Q = .70$, df(Q) = 1, $p = .402$), which indicates no significant differences in the efficacy of improving internet addiction status between psychological and pharmacological treatments.

The *Q*-test for heterogeneity between pharmacological treatments ($g = .72$, 95% CI: 0.49–0.96, $z = 6.01$, $p < .001$) and psychological interventions ($g = 1.10$, 95% CI: −0.42–2.61, $z = 1.43$, $p = .156$) was not significant ($Q = .23$, df(Q) = 1, $p = .632$), which suggests no significant differences in the efficacy of reducing time spent online between psychological and pharmacological treatments.

Psychological treatments ($g = 1.06$, 95% CI: 0.29–1.83, $z = 2.70$, $p = .007$) were more effective in reducing depression than were pharmacological interventions, which yielded nonsignificant results ($g = .12$, 95% CI: −0.31–0.54, $z = .55$, $p = .582$). This conclusion is strengthened by the significant results of a *Q*-test for heterogeneity ($Q = 4.39$, df(Q) = 1, $p = .036$). However, this result must be considered preliminary, as it is based on only one study of pharmacological treatment. The effect sizes for anxiety were not moderated by type of treatment and thus sub-analyses were not conducted for this outcome variable.

3.6.2. CBT in comparison to other psychological interventions

The confidence intervals for the effect size for CBT alone (95% CI: 0.84–2.13) and the effect size for all other psychological treatments (95% CI: 1.12–2.67) overlapped for internet addiction status, indicating no significant differences between CBT and the other psychological treatments in improving internet addiction status. This conclusion is strengthened by the non-significant results of the *Q*-test for heterogeneity ($Q = .65$, df(Q) = 1, $p = .421$).

For time spent online, the confidence intervals for the effect size for CBT alone (95% CI: 2.10–2.66) and the effect size for all other psychological treatments (95% CI: 0.05–0.66) did not overlap, which indicates that CBT performed significantly better than other psychological treatments. This conclusion is strengthened by the significant results of a *Q*-test for heterogeneity ($Q = 92.02$, df(Q) = 1, $p < .001$). It was not possible to assess publication bias and moderators.

For depression, the confidence intervals for the effect size for CBT alone (95% CI: 1.57–2.73) and the effect size for all other psychological treatments (95% CI: 0.07–1.51) did not overlap, which indicates that CBT performed significantly better than other psychological treatments. This conclusion is strengthened by the significant results of the *Q*-test for heterogeneity ($Q = 8.25$, df(Q) = 1, $p = .004$). It was not possible to assess publication bias and moderators for CBT treatment alone. As

noted above, the effect sizes for anxiety were not moderated by type of treatment and thus sub-analyses were not conducted.

4. Discussion

Although internet addiction has become a popular topic, little is known about its treatments and their efficacy. To (i) examine and (ii) compare the short- and long-term efficacies of psychological and pharmacological treatments for IA and (iii) to identify treatment moderators, we examined 16 studies that included 17 treatment conditions and 670 patients.

The results indicated that the pooled effect sizes for short-term efficacy for all outcome variables were large and robust, supporting our hypothesis that psychological and pharmacological interventions are effective treatments for reducing symptoms of IA, time spent online, anxiety, and depression. This had not yet been sufficiently investigated for IA.

For psychological treatments alone, the pooled effect sizes for short-term efficacy for most outcome variables were large and robust, and were maintained over follow-up. For pharmacological treatments alone, the pooled effect sizes for short-term efficacy were medium-to-large and were robust for most outcome variables; follow-up data was not available. Moderator analyses revealed that studies reporting individual treatments, a higher number of female participants, older patients, or an American sample had larger effect sizes for some outcome variables.

Closer examination revealed that the pooled effect size for pharmacological treatments was based only on three studies reporting effects of three different drugs: escitalopram (Dell'Osso et al., 2008), bupropion (Han et al., 2010), and methylphenidate (Han et al., 2009). Antidepressants are effective for drug addiction including alcoholism (Stella et al., 2008), pathological gambling (Grant & Potenza, 2006), methamphetamine dependence (Elkashef et al., 2007) and smoking (Hurt et al., 1997). For IA, the result must be considered preliminary due to a limited number of studies, especially long term follow up studies examining tolerance effects (e.g., D2 receptor down regulation). Furthermore the use of amphetamine as a treatment suggests ADHD which is indeed a subtype of Reward Deficiency Syndrome behaviors (Blum, Chen, Braverman et al., 2008). The fact that none of the treatment studies compared psychological treatments and pharmacological treatments in the same trial seems to be another gap in the literature.

The comparison of CBT and other psychological treatments showed that CBT outperformed other psychological treatments at reducing time spent online and depression. This was expected based on a comparative research on the efficacy of different psychological treatment approaches in pathological gambling (Lopez Viets & Miller, 1997; Petry & Armentano, 1999; Toneatto & Ladoceur, 2003) and recommendations by various experts (Peukert et al., 2010; Widyanto & Griffiths, 2006; Young, 1999). There were no significant differences between CBT and other psychological treatments in improving internet addiction status and anxiety. Due to the small number of studies, particularly in the sub-analyses and in long-term efficacy analyses, it is disputable whether the available literature has sufficient scope to enable the types of comparisons being made and therefore results must be regarded as preliminary.

Evidence suggests that group counseling appears to be the predominant modality for treating addiction (Fisher & Harrison, 1997), as the support, confrontation, and insight gained from other individuals experiencing similar cognitions and emotions facilitate therapeutic recovery. Our results suggest that IA patients benefit more from individual counseling. Of note, this effect was not found for the outcome variable internet addiction status. This could be caused by social anxiety, social isolation, and lack of social competence, which may constrain the process of group therapy at the beginning of an intervention. Thus, group therapy may not become beneficial until patients overcome the barriers associated with these social problems.

The higher effect size in studies with a greater proportion of female participants is an intriguing result. This effect could be influenced by the fact that women tend to use different internet applications (communication instead of information) than do men (Jackson, Ervin, Gardner, & Schmitt, 2001), which may be more easily replaced by offline activities. However, female patients were underrepresented in most studies.

Another interesting result of our moderator analysis was that American studies reported larger effect sizes than Asian studies for some outcome variables. Culture-related differences in the study procedures as well as methodological differences may have caused this outcome. In addition, the internet and especially online games seem to have an even greater fascination on people living in Asian countries, which tend to be characterized by collectivist values (Voronov & Singer, 2002). South Korean internet users dominate the entire gamut of internet activities (Rhee & Kim, 2004), having the most developed broadband network in the world, three professional gaming leagues, two gaming stadiums and two cable networks televising competitions around the clock. According to Choi and Ross (2006) young people who have been brought up within a hierarchical, family focused society find that they are able to act out individualism and socialize independently through the internet for the first time. Therefore, engaging in psychotherapy for IA might mean losing their individual (online) identity. Due to a lack of conclusive evidence of cultural differences in internet addiction and its treatments further research is highly needed in this area.

Only a few major reviews covering treatments for internet addiction have been published over the last twelve years (e.g., Petersen et al., 2009; Peukert et al., 2010; Widyanto & Griffiths, 2006). In comparison with these previous reviews, we were able to identify a number of additional treatment studies. In addition, we considered studies with Chinese full text. Since we expected the study sample to be rather small, we decided a priori to include both studies using an intergroup comparison design and studies using an intragroup change design; we addressed their possible influence on the pooled effect sizes by assessing design as a moderator variable. In addition, we conducted effect size analyses for both designs pooled together, intergroup comparison designs alone, and intragroup change designs alone. A further strength of our study in comparison with previous reviews is that we used meta-analytic methods to quantify the size of treatment effects, by using different sensitivity analyses to address the problem of publication bias in addition to the careful search of the literature to preventively minimize publication bias. We analyzed study quality as a moderator, identified outliers by constructing a box plot and excluded them from our analyses. In summary, our study is the first meta-analysis examining and comparing the short- and long-term efficacies of psychological and pharmacological treatments for IA and therefore is a first step in the development of an evidence-based treatment recommendation. Nevertheless, a number of limitations should be noted.

We integrated studies with different Internet-related problems (e.g., pornography, gaming, and surfing) in our meta-analysis. This approach is controversial because it remains unclear whether the underlying mechanisms responsible for the addictive behavior are the same for these different problems. We decided to integrate these different types of IA into one meta-analysis due to the various Internet-specific commonalities (e.g., anonymity, riskless interaction), commonalities in the underlying behavior (e.g., avoidance, fear, pleasure, entertainment), and overlapping symptoms (e.g., increased amount of time spent online, preoccupation, other signs of addiction). Restricting our review to a well-defined subtype of IA would have led to an insufficient number of studies to conduct a meta-analysis.

There is currently no firmly established diagnosis for the phenomena dealt with in this paper. The continuing debate as to whether these Internet-related phenomena should be classified as an addiction, an impulse-control disorder, or even an obsessive–compulsive disorder cannot be resolved in this paper, but there is substantial overlap with the symptoms commonly associated with behavioral addictions, and neurological similarities with other addictions. We assumed that IA qualifies as a distinct disorder rather than a symptom of another underlying pathology. There is some evidence suggesting

that comorbid disorders may occur as a consequence of internet addiction (Dong et al., 2011); this question, however, will need to be addressed and clarified by future research. However, an adequate reflection of the serious problems associated with IA needs a unique diagnosis which should be included in DSM-V.

The absence of formal diagnostic criteria holds another problem of IA research. It is a widespread approach to assess IA by using adapted DSM-IV criteria for pathological gambling, due to the commonalities between the two pathological behaviors (Beard & Wolf, 2001; Lee et al., 2012; Young, 2009). This is a controversial approach, because it remains unclear to what extent the criteria for pathological gambling are applicable to IA and its specific subtypes (Christakis, 2010). Further research is needed to clarify the validity of this approach.

We used liberal study inclusion criteria in order to achieve a sufficient study sample. As a result, we included several studies with unsatisfactory validity. As noted in the review by King et al. (2011) internet addiction treatment studies tend to lack compliance with the CONSORT guidelines (e.g., inconsistencies in the definition and diagnosis of internet addiction, a lack of randomization and adequate comparison groups). The methodological weaknesses of included studies are potentially a problem, because a meta analysis can only be as good as the studies upon which it is based (Hofmann & Smits, 2008).

Including intragroup changes in our analysis may have led to a biased estimate of the effect size due to additional influences such as natural history and regression to the mean (Barnett, van der Pols, & Dobson, 2005). However, limiting our analysis to only intergroup comparison effect sizes would have excluded the majority of studies, resulting in biased and unrepresentative estimates of the current state of evidence. Thus, we decided to report both intra- and intergroup effect sizes separately. The findings from the separate analyses of each design led to the same conclusions in the majority of cases. We considered design as a moderator, although Borenstein et al. (2009) noted that from a statistical perspective, the informative value of effect sizes is independent of the methodology used to determine such value, to address the fact that we aggregated studies with different designs in the same meta analysis. The generalizability of our results is limited by the fact that the participants included do not reflect a representative sample of the population concerned. The diversity of the treatments and assessment tools as well as the inclusion of studies using an intragroup design could also affect the generalizability of the results.

Especially the low average quality of treatment studies and the variation of assessment instruments between them (often self developed questionnaires; see Table 1) may have caused problems of validity. Most authors did not even report information about the validity of the used assessment tools or the accurate subtype of IA included in their study. For an overview of the quality of IA treatment literature see King et al. (2011).

However, we used a random effects model to integrate the effect sizes, which provides the opportunity to generalize the results into a broader context.

We did not discuss genetic ascendancies regarding IA in our review. To address this important topic, further research should consider genetic factors and their influence on IA. For this purpose patients in prospective treatment studies should be genotyped.

Notwithstanding the methodological limitations stated above the results of this study suggest that IA patients may benefit from treatments with psychological as well as pharmacological elements. Clinicians treating IA should bear in mind that treatments may be less effective for young and male patients than for older and female patients; however, the treatment effects will likely be rather large with respect to the core symptoms and most comorbid symptoms in all groups.

Given the current state of the literature in this area a meta-analysis of this type might be premature, and the results have to be regarded as very preliminary. However this study illustrates the lack of methodological sound treatment studies, offers insight into the current state of internet addiction treatment research, bridges research investigations from 'East' and 'West' and is a first step in the development of an evidence-based treatment recommendation.

Appendix A. Detailed information on quantitative data synthesis and moderator analyses

Intragroup change effect size was calculated by using the following formula: $d = \left(\frac{\overline{Y_1}-\overline{Y_2}}{S_{within}}\right)$, where $\overline{Y_1}$ is the pre-treatment sample mean, $\overline{Y_2}$ is the post-treatment sample mean, and $S_{within} = \frac{\sqrt{SD_1^2 + SD_2^2 - 2r \times SD_1 \times SD_2}}{\sqrt{2(1-r)}}$, where SD_1 is the standard deviation of the pre-treatment sample mean, SD_2 is the standard deviation of the post-treatment sample mean, and r is the correlation between pre- and post-treatment scores.

For studies reporting pre-treatment mean, post-treatment mean, sample size and t-value only, the intragroup change effect size was calculated by using the following formula: $d = \frac{t_{Obs}}{\sqrt{n}} \times \sqrt{2 \times (1-R)}$, where t_{Obs} is the observed t-value, n is the sample size, and R is the imputed R-value. In the case of studies reporting the difference in means, sample size and p-value only, the intragroup change effect size was calculated by using the following formula: $d = \frac{t}{\sqrt{n}} \times \sqrt{2 \times (1-R)}$, where t is the imputed t-value, n is the sample size, and R is the imputed R-value.

The intergroup effect sizes were computed by using the following formula: $d = \frac{\overline{X_1}-\overline{X_2}}{\sqrt{\frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2}}} \times \left(1 - \frac{3}{4df-1}\right)$, where $\overline{X_1}$ and $\overline{X_2}$ are the sample means, S_1 and S_2 are the standard deviations, and n_1 and n_2 are the sample sizes in the intervention condition and the control condition, respectively.

Hedges's g can be computed by multiplying d by a correction factor $J = 1 - \frac{3}{4df-1}$, where df is the degrees of freedom to estimate the intragroup standard deviation.

Q is determined by the following formula: $Q = \sum_{i=1}^{k} W_i Y_i^2 - \frac{\left(\sum_{i=1}^{k} W_i Y_i\right)^2}{\sum_{i=1}^{k} W_i}$, with W_i being the weight of the study, Y_i the effect size of the study, and k the number of studies included. To determine the expected value of Q, we used the degrees of freedom (df $= k-1$, with k being the number of studies included). A significant Q-test (p-value less than alpha set at .05) indicates heterogeneity in effect sizes.

We estimated the variance of the true effect between the studies (T^2) by using the following formula: $T^2 = \frac{Q-df}{C}$, where $C = \sum W_i - \frac{\sum W_i^2}{\sum W_i}$.

I^2 is determined by using the following formula: $I^2 = \left(\frac{Q-df}{Q}\right) \times 100\%$. I^2 is expressed as a ratio with a range of 0 to 100% and describes what proportion of the observed variance reflects real differences in effect sizes. Higgins et al. (2003) suggest that values of 25%, 50%, and 75% can be considered as low, moderate, and high, respectively.

Due to the small number of studies and in order to achieve a high degree of accuracy in approximating the effect sizes, we decided to aggregate studies with different designs in the same meta-analysis ("pooled intra- and intergroup effect size at post-treatment"). From a statistical perspective, the informative value of effect sizes is independent of the methodology used. We can therefore determine the effect size and variance for each study by using the appropriate formula and

then include all studies in the same analysis (Borenstein et al., 2009). In addition, we tested "design" as a moderator to ensure that the design (measuring intragroup changes or intergroup comparison) did not moderate the effect sizes for all outcome variables.

We computed the *fail-safe N* by using the following formula: $X = \frac{K\left(K\overline{Z}^2 - 2.706\right)}{2.706}$, where K is the number of studies in the meta-analysis and $\overline{Z}$ is the mean Z obtained from the K studies. The effect size can be considered to be robust if the required number of studies (X) to reduce the overall effect size to a non-significant level exceeds $5\,K + 10$ (Rosenthal, 1993).

We used the Trim and Fill method, which examines whether negative or positive trials are over or under-represented, accounting for the sample size. This information can then be used to re-calculate the effect size estimates, if the funnel plot is asymmetric. The divergence of the original effect size and the re-calculated effect size shows the level of robustness of the results.

References

American Psychiatric Association (2012). Internet use disorder. Retrieved October 12, 2012, from http://www.dsm5.org/ProposedRevision/Pages/proposedrevision.aspx?rid=573#

American Society of Addiction Medicine (2011). Public policy statement: Definition of addiction. Retrieved August 21, 2011, from http://www.asam.org/1DEFINITION_OF_ADDICTION_LONG_4-11.pdf

Bai, Y., & Fan, F. M. (2007). The effects of group counseling on internet-dependent college students. *Chinese Mental Health Journal*, *21*, 247–250.

Barnett, A. G., van der Pols, J. C., & Dobson, A. J. (2005). Regression to the mean: What it is and how to deal with it. *International Journal of Epidemiology*, *34*, 215–220.

Beard, K. W. (2005). Internet addiction: A review of current assessment techniques and potential assessment questions. *Cyberpsychology & Behavior*, *8*, 7–14.

Beard, K. W., & Wolf, E. M. (2001). Modification in the proposed diagnostic criteria for internet addiction. *Cyberpsychology & Behavior*, *4*, 377–383.

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

Blum, K., Chen, A. L., Braverman, E. R., Comings, D. E., Chen, T. J., Arcuri, V., et al. (2008). Attention-deficit-hyperactivity disorder and reward deficiency syndrome. *Neuropsychiatric Disease and Treatment*, *4*, 893–918.

Blum, K., Chen, A. L., Chen, T. J., Braverman, E. R., Reinking, J., Blum, S. H., et al. (2008). Activation instead of blocking mesolimbic dopaminergic reward circuitry is a preferred modality in the long term treatment of reward deficiency syndrome (RDS): A commentary. *Theoretical Biology & Medical Modelling*, *5*, 24.

Blum, K., Sheridan, P. J., Wood, R. C., Braverman, E. R., Chen, T. J. H., Cull, J. G., et al. (1996). The D-2 dopamine receptor gene as a determinant of reward deficiency syndrome. *Journal of the Royal Society of Medicine*, *89*, 396–400.

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2005). *Comprehensive meta-analysis, version 2* (2 ed.). Engelwood, NJ: Biostat Inc.

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis.* Chichester, UK: Wiley.

Braun, T. (2010). Geschichte und Entwicklung des Internets. *Informatik-Spektrum*, *33*, 201–207.

Byun, S., Ruffini, C., Mills, J. E., Douglas, A. C., Niang, M., Stepchenkova, S., et al. (2009). Internet addiction: Metasynthesis of 1996–2006 quantitative research. *Cyberpsychology & Behavior*, *12*, 203–207.

Cao, F. -L., Su, L. -Y., & Gao, X. -P. (2007). Control study of group psychotherapy on middle school students with internet overuse. *Chinese Mental Health Journal*, *21*, 346–349.

Cash, H., Rae, C. D., Steel, A. H., & Winkler, A. (2012). Internet addiction: A brief summary of research and practice. *Current Psychiatry Reviews*, *8*, 292–298.

Chakraborty, K., Basu, D., & Kumar, K. (2010). Internet addiction: Consensus, controversies, and the way ahead. *East Asian Archives of Psychiatry*, *20*, 123–132.

Choi, Y. S., & Ross, L. (2006). Policy and power: The Impact of the internet on the younger generation in South Korea. *Social Policy and Society*, *5*, 421–429.

Christakis, D. A. (2010). Internet addiction: A 21(st) century epidemic? *BMC Medicine*, *8*.

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, *20*, 37–46.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale: Lawrence Erlbaum Associates Inc.

Czincz, J., & Hechanova, R. (2009). Internet addiction: Debating the diagnosis. *Journal of Technology in Human Services*, *27*, 257–272.

Dell'Osso, B., Hadley, S., Allen, A., Baker, B., Chaplin, W. F., & Hollander, E. (2008). Escitalopram in the treatment of impulsive–compulsive Internet usage disorder: An open-label trial followed by a double-blind discontinuation phase. *The Journal of Clinical Psychiatry*, *69*, 452–456.

Demetrovics, Z., Szeredi, B., & Rozsa, S. (2008). The three-factor model of internet addiction: The development of the Problematic Internet Use Questionnaire. *Behavior Research Methods*, *40*, 563–574.

Dong, G., Lu, Q., Zhou, H., & Zhao, X. (2011). Precursor or sequela: pathological disorders in people with Internet addiction disorder. *In Public Library of Science One*, *6*, e14703.

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. *The Australian and New Zealand Journal of Psychiatry*, *44*, 129–134.

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*, 455–463.

Elkashef, A. M., Rawson, R. A., Anderson, A. L., Li, S. -H., Holmes, T., Smith, E. V., et al. (2007). Bupropion for the treatment of methamphetamine dependence. *Neuropsychopharmacology*, *33*, 1162–1170.

Fang-ru, Y., & Wei, H. (2005). The effect of integrated psychosocial intervention on 52 adolescents with internet addiction disorder. *Chinese Journal of Clinical Psychology*, *13*, 343–345.

Fisher, G. L., & Harrison, T. C. (1997). *Substance abuse: Information for school counselors, social workers, therapists, and counselors.* Boston: Allyn & Bacon.

Frances, A. J., & Widiger, T. (2012). Psychiatric diagnosis: Lessons from the DSM-IV past and cautions for the DSM-5 future. *Annual Review of Clinical Psychology*, *8*, 109–130.

Glass, G. V. (1976). Primary, secondary and meta-analysis of research. *Health Education Research*, *5*, 3–8.

Glombiewski, J. A., Sawyer, A. T., Gutermann, J., Koenig, K., Rief, W., & Hofmann, S. G. (2010). Psychological treatments for fibromyalgia: A meta-analysis. *Pain*, *151*, 280–295.

Grant, J. E., & Potenza, M. N. (2006). Escitalopram treatment of pathological gambling with co-occurring anxiety: An open-label pilot study with double-blind discontinuation. *International Clinical Psychopharmacology*, *21*, 203–209.

Grant, J. E., Potenza, M. N., Weinstein, A., & Gorelick, D. A. (2010). Introduction to behavioral addictions. *The American Journal of Drug and Alcohol Abuse*, *36*, 233–241.

Greenfield, D. N. (1999). *Virtual addiction: Help for netheads, cyberfreaks, and those who love them.* Oakland, CA, US: New Harbinger Publications.

Griffiths, M. (2000). Internet addiction — Time to be taken seriously? *Addiction Research*, *8*, 413–418.

Ha, J. H., Yoo, H. J., Cho, I. H., Chin, B., Shin, D., & Kim, J. H. (2006). Psychiatric comorbidity assessed in Korean children and adolescents who screen positive for internet addiction. *The Journal of Clinical Psychiatry*, *67*, 821–826.

Han, D. H., Hwang, J. W., & Renshaw, P. F. (2010). Bupropion sustained release treatment decreases craving for video games and cue-induced brain activity in patients with internet video game addiction. *Experimental and Clinical Psychopharmacology*, *18*, 297–304.

Han, D. H., Lee, Y. S., Na, C., Ahn, J. Y., Chung, U. S., Daniels, M. A., et al. (2009). The effect of methylphenidate on internet video game play in children with attention-deficit/hyperactivity disorder. *Comprehensive Psychiatry*, *50*, 251–256.

Hedges, L. V., & Olkin, I. (1984). Nonparametric estimators of effect size in meta-analysis. *Psychological Bulletin*, *96*, 573–580.

Hedges, L. V., & Vevea, J. L. (1998). Fixed- and random-effects models in meta-analysis. *Psychological Methods*, *3*, 486–504.

Higgins, J. P., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *British Medical Journal*, *327*, 557–560.

Hofmann, S. G., & Smits, J. A. (2008). Pitfalls of meta-analyses. *The Journal of Nervous and Mental Disease*, *196*, 716–717.

Holden, C. (2001). Compulsive behaviors: "Behavioral' addictions: Do they exist?". *Science*, *294*, 980–982.

Hurt, R. D., Sachs, D. P. L., Glover, E. D., Offord, K. P., Johnston, J. A., Dale, L. C., et al. (1997). A comparison of sustained-release bupropion and placebo for smoking cessation. *The New England Journal of Medicine*, *337*, 1195–1202.

Jackson, L. A., Ervin, K. S., Gardner, P. D., & Schmitt, N. (2001). Gender and the internet: Women communicating and men searching. *Sex Roles*, *44*, 363–379.

Jadad, A. R., Moore, R. A., Carroll, D., Jenkinson, C., Reynolds, D. J. M., Gavaghan, D. J., et al. (1996). Assessing the quality of reports of randomized clinical trials: Is blinding necessary? *Controlled Clinical Trials*, *17*, 1–12.

Johnson, B. T., & Eagly, A. H. (2000). Quantitative synthesis of social psychological research. In H. T. Reis, & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 496–528). London: Cambridge University Press.

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*, 4–12.

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*, 1110–1116.

Ko, C. H., Yen, J. Y., Yen, C. F., Chen, C. S., & Chen, C. C. (2012). The association between internet addiction and psychiatric disorder: A review of the literature. *European Psychiatry: the Journal of the Association of European Psychiatrists*, *27*, 1–8.

Kryspin-Exner, I., Felnhofer, A., & Kothgassner, O. D. (2011). Pandora's digital box: Mental disorders in cyberspace. *Neuropsychiatrie*, *25*, 172–182.

Lanjun, Z. (2009). The applications of group mental therapy and sports exercise prescriptions in the intervention of internet addiction disorder. *Psychological Science (China)*, *32*, 738–741.

Lee, H. W., Choi, J. S., Shin, Y. C., Lee, J. Y., Jung, H. Y., & Kwon, J. S. (2012). Impulsivity in internet addiction: A comparison with pathological gambling. *Cyberpsychology, Behavior and Social Networking*, *15*, 373–377.

Li, G., & Dai, X. -Y. (2009). Control study of cognitive–behavior therapy in adolescents with internet addiction disorder. *Chinese Mental Health Journal*, *23*, 457–470.

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gotzsche, P. C., Ioannidis, J. P. A., et al. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: Explanation and elaboration. *British Medical Journal*, *339*, b2535.

Lopez Viets, V. C., & Miller, W. R. (1997). Treatment approaches for pathological gamblers. *Clinical Psychology Review*, *17*, 689–702.

Meerkerk, G., Van Den Eijnden, R., Vermulst, A., & Garretsen, H. (2009). The Compulsive Internet Use Scale (CIUS): Some psychometric properties. *Cyberpsychology & Behavior*, *12*, 1–6.

Orzack, M. H., Voluse, A. C., Wolf, D., & Hennen, J. (2006). An ongoing study of group treatment for men involved in problematic internet-enabled sexual behavior. *Cyberpsychology & Behavior*, *9*, 348–360.

Pallesen, S., Mitsem, M., Kvale, G., Johnsen, B. -H., & Molde, H. (2005). Outcome of psychological treatments of pathological gambling: A review and meta-analysis. *Addiction*, *100*, 1412–1422.

Pallesen, S., Molde, H., Arnestad, H. M., Laberg, J. C., Skutle, A., Iversen, E., et al. (2007). Outcome of pharmacological treatments of pathological gambling: A review and meta-analysis. *Journal of Clinical Psychopharmacology*, *27*, 357–364.

Petersen, K. U., Weymann, N., Schelb, Y., Thiel, R., & Thomasius, R. (2009). Pathological internet use — Epidemiology, diagnostics, co-occurring disorders and treatment. *Fortschritte Der Neurologie Psychiatrie*, *77*, 263–271.

Petry, N. M., & Armentano, C. (1999). Prevalence, assessment, and treatment of pathological gambling: A review. *Psychiatric Services*, *50*, 1021–1027.

Peukert, P., Sieslack, S., Barth, G., & Batra, A. (2010). Internet- and computer game addiction: Phenomenology, comorbidity, etiology, diagnostics and therapeutic implications for the addictives and their relatives. *Psychiatrische Praxis*, *37*, 219–224.

Pies, R. (2009). Should DSM-V designate "internet addiction" a mental disorder? *Psychiatry*, *6*, 31–37.

Rhee, K. Y., & Kim, W. -B. (2004). The adoption and use of the internet in South Korea. *Journal of Computer-Mediated Communication*, *9*, 00-00.

Rong, Y., Zhi, S., & Yong, Z. (2005). Comprehensive intervention on internet addiction of middle school students. *Chinese Mental Health Journal*, *19*, 457–459.

Rosenthal, R. (1993). *Meta-analytic procedures for social research.* Newbury Park, CA: Sage Publications.

Shaw, M., & Black, D. W. (2008). Internet addiction: Definition, assessment, epidemiology and clinical management. *CNS Drugs*, *22*, 353–365.

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

Stella, L., Addolorato, G., Rinaldi, B., Capuano, A., Berrino, L., Rossi, F., et al. (2008). An open randomized study of the treatment of escitalopram alone and combined with γ-hydroxybutyric acid and naltrexone in alcoholic patients. *Pharmacological Research*, *57*, 312–317.

Thalemann, R., Wolfling, K., & Grusser, S. M. (2007). Specific cue reactivity on computer game-related cues in excessive gamers. *Behavioral Neuroscience*, *121*, 614–618.

Toneatto, T., & Ladoceur, R. (2003). Treatment of pathological gambling: A critical review of the literature. *Psychology of Addictive Behaviors*, *17*, 284–292.

Twohig, M. P., & Crosby, J. M. (2010). Acceptance and commitment therapy as a treatment for problematic internet pornography viewing. *Behavior Therapy*, *41*, 285–295.

Voronov, M., & Singer, J. A. (2002). The myth of individualism–collectivism: A critical review. *The Journal of Social Psychology*, *142*, 461–480.

Weinstein, A., & Lejoyeux, M. (2010). Internet addiction or excessive internet use. *The American Journal of Drug and Alcohol Abuse*, *36*, 277–283.

Widyanto, L., & Griffiths, M. D. (2006). 'Internet addiction': A critical review. *International Journal of Mental Health and Addiction*, *4*, 31–51.

Young, K. S. (1998a). *Caught in the net: How to recognize the signs of internet addiction — And a winning strategy for recovery.* New York: J. Wiley.

Young, K. S. (1998b). *Caught in the net: How to recognize the signs of internet addiction and a winning strategy for recovery.* New York: J. Wiley.

Young, K. S. (1999). Evaluation and treatment of internet addiction. *Innovations in clinical practice: A source book, Vol. 17.* (pp. 19–31)Sarasota, FL, US: Professional Resource Press/Professional Resource Exchange.

Young, K. S. (2007). Cognitive behavior therapy with internet addicts: Treatment outcomes and implications. *Cyberpsychology & Behavior*, *10*, 671–679.

Young, K. S. (2009). Internet addiction: Diagnosis and treatment considerations. *Journal of Contemporary Psychotherapy*, *39*, 241–246.

Yuan, K., Qin, W., Liu, Y., & Tian, J. (2011). Internet addiction: Neuroimaging findings. *Communicative & Integrative Biology*, *4*, 637–639.

Zhou, Y., Lin, F. C., Du, Y. S., Qin, L. D., Zhao, Z. M., Xu, J. R., et al. (2011). Gray matter abnormalities in internet addiction: A voxel-based morphometry study. *European Journal of Radiology*, *79*, 92–95.

Zhu, T. -M., Jin, R. -J., & Zhong, X. -M. (2009). Clinical effect of electroacupuncture combined with psychologic interference on patient with internet addiction disorder. *Chinese Journal of Integrated Traditional & Western Medicine*, *29*, 212–214.