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Internet-based cognitive–behavioural therapy for insomnia (ICBT-i): a meta-analysis of randomised controlled trials

Yuan-yuan Ye,[1] Ni-ka Chen,[2] Jia Chen,[3] Juan Liu,[1] Ling Lin,[1] Ya-zhen Liu,[1] Ying Lang,[1] Xun-jun Li,[1] Xin-ju Yang,[1] Xiao-jiang Jiang[1]

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X-yY and N-kC contributed equally.

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For numbered affiliations see end of article.

Correspondence to
Dr Xiao-jiang Jiang;
15923589535@163.com

ABSTRACT

Objective: To evaluate the effectiveness of internet-based cognitive–behavioural therapy for insomnia (ICBT-i) in adults.

Design: A meta-analysis of ICBT-i.

Data sources: Systematic searches of randomised controlled trials of ICBT-i were performed in the PubMed, EMBASE, PsycINFO and Cochrane Library databases up to 19 June 2016.

Review method: 2 reviewers independently performed study selection, quality assessment and data extraction. Outcomes of interest included sleep onset latency (SOL), total sleep time (TST), sleep efficiency (SE), wake after sleep onset (WASO), number of nocturnal awakenings (NWAK), and Insomnia Severity Index (ISI). RevMan 5.2 and Stata 13.0 meta-analysis software were used to perform statistical analysis.

Results: 14 records for 15 studies (1013 experimental group participants, 591 waiting list group participants) were included. The meta-analysis indicated that, at the post-test time point, SOL decreased by 18.41 min (95% CI 13.60 to 23.21), TST increased by 22.30 min (95% CI 16.38 to 28.23), SE increased by 9.58% (95% CI 7.30% to 11.85%), WASO decreased by 22.31 min (95% CI 13.50 to 31.11), NWAK decreased by 0.52 (95% CI 0.28 to 0.76), and ISI decreased by 5.88 points (95% CI 4.29 to 7.46). Additionally SOL, TST, SE, and WASO exhibited statistically significant improvements at follow-up versus before treatment.

Conclusions: ICBT-i is an effective treatment for adults with insomnia. This conclusion should be verified in further studies.

Strengths and limitations of this study

- This meta-analysis investigated the effectiveness of internet-based cognitive–behavioural therapy for insomnia (ICBT-i).
- We found strong evidence that ICBT-i can effectively and persistently improve insomnia.
- The salient features of each evaluated programme and their corresponding disclosures are presented.
- Only randomised controlled trials were included in this retrospective meta-analysis. We did not search for unpublished literature or ongoing trials. The majority of the eligible trials were conducted in Europe.

INTRODUCTION

Insomnia is the most common sleep symptom and includes difficulty in initiating sleep, interrupted sleep and/or morning awakenings.[1] Approximately 25% of adults experience unsatisfactory sleep, and 10–15% of these individuals suffer from insomnia with daytime consequences.[2] Persistent insomnia tends to increase suicide risk, alcohol and drug abuse, anxiety, depression and congestive heart failure.[2 3] It also places a tremendous burden on individuals and society.[4] Therefore, the treatment of insomnia is particularly important.

Insomnia treatment options include pharmacotherapy (such as the use of hypnotic drugs) and non-pharmacotherapy (such as the use of cognitive–behavioural therapy for insomnia, CBT-i).[5] Hypnotic drugs produce quick symptomatic relief, but these improvements are not sustained over time.[6] Additionally, most hypnotic drugs are associated with multiple adverse side effects, such as headache, daytime dysfunction, withdrawal rebound, dependency and tolerance.[7] CBT-i is an effective multimodal intervention for insomnia. This intervention mainly includes sleep restriction, stimulus control, cognitive restructuring, sleep hygiene education and relaxation.[8] Numerous studies have shown that CBT-i improves sleep and produces similar short-term outcomes to pharmacological interventions. Additionally, these benefits are sustained over time.[9 10] However, the clinical application of traditional CBT-i is limited due to high cost, lack of therapists, and geographical remoteness.[11] To overcome these limitations, the internet has been employed to deliver CBT-i. Internet-based

CBT-i (ICBT-i) is a highly structured, content-specific, low-cost, interactive, and flexible therapeutic approach. Therefore, ICBT-i has gained popularity and become a valuable method for treating insomnia.

A systematic review of ICBT-i published in 2012 showed that the treatment has significant effects on sleep onset latency (SOL), number of nocturnal awakenings (NWAK), sleep efficiency (SE), and Insomnia Severity Index (ISI), but its effects on wake after sleep onset (WASO), total sleep time (TST), and time in bed (TIB) were not significant.[12] However, only four randomised controlled trials (RCTs) were included in the referenced meta-analysis; therefore, the effects of ICBT-i may have been underestimated. Consequently, the current study re-evaluated the efficacy of employing internet-based cognitive–behavioural therapy (ICBT) to treat insomnia, as well as the long-term effects of ICBT-i.

MATERIALS AND METHODS

Database search

This meta-analysis was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria.[13] PubMed, EMBASE, PsycINFO and the Cochrane Library were systemically searched up to 19 June 2016. The search terms were (internet OR website OR web OR online OR computer OR self-help OR self-administer OR self-care OR self-instruct OR self-management) AND (cognitive therapy, behavioural therapy OR cognitive–behavioural therapy OR CBT) AND (sleep problem OR sleep disorder OR insomnia) AND (randomised controlled trial OR RCT). The search strategy of PubMed is shown in online supplementary S1 file. The reference list of each study included in this review was also manually searched.

Inclusion and exclusion criteria

The following inclusion criteria were employed: (1) the participants were adults (≥18 years); (2) the participants had a clinical diagnosis of insomnia corresponding to Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V), DSM-IV or International Classification of Sleep Disorders, version 2 (ICSD-2) or sleep difficulty occurring three or more nights per week and lasting more than 4 weeks; (3) at least one group received components of ICBT-i for at least two sessions. CBT-i was defined as multimodal therapy consisting of at least four components, including sleep restriction, stimulus control, cognitive restructuring, sleep hygiene education, and relaxation; (4) at least one main outcome of SOL, TST, SE, or WASO was reported; (5) the study was a RCT. The following exclusion criteria were employed: (1) trials not published in English; (2) duration of therapy <4 weeks; (3) insufficient data to calculate the effect size (ES); and (4) the study was a duplicate publication.

Data extraction

Two reviewers searched for relevant publications independently. After duplicate publications were removed, two authors independently assessed titles, abstracts and full articles based on inclusion and exclusion criteria. Relevant data were retrieved and screened by two authors independently and then cross-checked to ensure accuracy and consistency. Any disagreement was resolved by consensus. The following information was recorded: (1) study characteristics, including first author's name, publication year, study location, and follow-up duration; (2) baseline characteristics, including sample size, the mean age with SD, gender, and diagnostic criteria of insomnia; (3) intervention characteristics, including therapeutic components and intervention duration; (4) outcome measurements, including the mean scores with SDs for SOL, TST, SE, and WASO (pretest, post-test and follow-up), as well as NWAK and ISI.

Quality assessment

The quality of each eligible RCT was assessed using Cochrane Collaboration's tool for assessing risk of bias (J Higgins, S Green. Assessing risk of bias in included studies. Cochrane Handbook for Systematic Reviews of Interventions Version 5.0.0. 2008). The criteria consisted of the following items: (1) random sequence generation, (2) allocation sequence concealment, (3) blinding of participants and personnel, (4) blinding of outcome assessment, (5) incomplete outcome data, and (6) other potential sources of bias. High risk of bias was defined as having enough information to determine that the risk was high, low risk of bias was defined as having enough information to determine that the risk was low, and unclear risk of bias was defined as not having enough information to determine the risk. Two authors independently evaluated the bias risk according to these criteria, and any disagreement was resolved by discussion with X-jJ.

Data analysis

RevMan 5.2 and Stata 12.0 software were used for statistical analysis. At the post-test time point, the mean difference (MD) and 95% CI were calculated for the means and SDs of SOL, TST, SE, WASO, NWAK, and ISI. When studies included a control group (waiting list, no treatment or treatment as usual), between-group ES values were calculated based on post-test differences between the experimental and control groups. If no control group (waiting list, no treatment or treatment as usual) was included, then the within-group ES was calculated based on the difference between pretest and post-test values for the experimental group. At the follow-up time point, the within-group ES was calculated. If significant heterogeneity existed between studies (I^2 value >50% and p value <0.1), a random effects model was used; otherwise, a fixed effects model was used.

Sensitivity analysis and publication bias

STATA 12.0 software was used to perform a sensitivity analysis, which entailed removing the eligible studies one by one and examining the overall ES. A funnel plot (using RevMan 5.2) and Egger's test (using STATA 12.0) were used to detect the publication bias.

RESULTS

Qualified studies and study characteristics

The search process used is shown in figure 1. A total of 1147 potentially relevant records were obtained from PubMed (201 records), EMBASE (588 records), PsycINFO (265 records), and the Cochrane Library (123 records). Of these, 102 records were removed as duplicates, 962 records were excluded following screening of titles and abstracts, and 81 records contained conference abstracts. In total, 32 full-text records were assessed. Of these, 11 records[14–24] did not report sufficient data to calculate the main ES, 3 records[25–27] did not provide sufficient information regarding the diagnosis of insomnia, 2 records[28 29] were non-RCTs, and 2 records[30 31] were excluded because they included participants who were <18 years old. Finally, 14 records[32–45] that comprised 15 studies were included.

The main characteristics of the studies included in the meta-analysis are presented in table 1. Eight records used a waitlist control, while the study by Espie *et al*[35] used the usual treatment group as a control. This group actually was a waitlist group. The trials were conducted in Sweden (4 trials),[32 42 43 45] the Netherlands (5 trials),[36 38 41 44] Canada (2 trials),[34 40] the USA (2 trials),[33 37] the UK (1 trial),[35] and China (1 trial).[39] The intervention durations ranged between 5 and 9 weeks. Stimulus control, sleep restriction, sleep-health education, and cognitive restructuring were applied to the experimental group in each study. There were 1013 participants in the experimental group and 591 in the control group. The sample sizes of the eligible studies ranged from 14 to 216. At the post-test time point, 67.95% participants reported sleep parameters in the ICBT-i group, and 78.60% reported them in the control group. The average attrition rate was 28.16% in both groups.

Quality assessment

The quality of the included studies is shown in online supplementary S2 file. All but two[32 44] discussed randomisation method. Allocation concealment was reported in six records.[35 40–43 45] No record described complete blinding of all participants and personnel. Only one study[39] reported complete blinding of outcome assessment. Of the included studies, the outcome data were reported completely, and there was no selective reporting bias.

Post-test effects of ICBT-i on sleep

Fifteen studies reported the dates of SOL, TST, and SE, and 9 of them reported post-test effects compared with a waiting list control group. The effects of ICBT-i on SOL, TST, and SE are presented in figures 2–4. The total improvements in SOL (18.41 min), TST (22.30 min), and SE (9.58%) were significant. Eleven

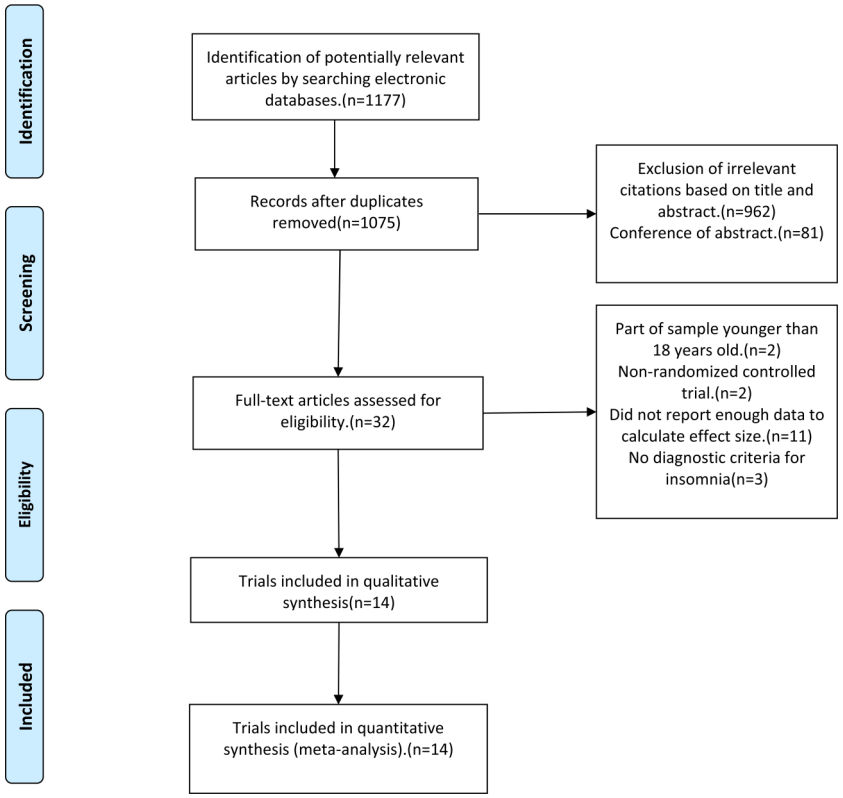

Figure 1 Flow diagram for study selection process used in this meta-analysis.

Table 1 Study characteristics

Author, year	Group	N (% F)	Mean age (SD)	Components	Comorbidity	Duration, weeks	Follow-up	Insomnia Definition	Country
Ström, 2004	Internet	30 (66.7)	46.2 (11.6)	SHE-CR-SC-SR-RLX	None	5	_	DSM-IV	Sweden
	Waiting list	51 (62.7)	43.9 (11.4)	Waiting					
Ritterband, 2009	Internet	22 (81.8)	44.68 (10.61)	SHE-CR-SC-SR	None	9	6 months	DSM-IV-TR	America
	Waiting list	22 (72.7)	45.05 (11.67)	Waiting					
Vincent, 2009	Internet	59 (67.8)	–	SHE-CR-SC-SR-RLX	None	5	4 weeks	DSM-IV	Canada
	Waiting list	59 (66.1)	–	Waiting					
Espie, 2012	Internet	55 (72.7)	50.7 (13.8)	SHE-CR-SC-SR-RLX	None	6	8 weeks	DSM-V	England
	Treatment as usual	54 (70.4)	49.1 (13.7)	Waiting					
	Imagery relief therapy	55 (76.4)	47.3 (13.0)	SHE-HD-IT-SPD-BC					
Lancee, 2012	Internet	214 (68.7)	52.2 (11.4)	SHE-CR-SC-SR-RLX-PI	None	6	18 weeks, 48 weeks	DSM-IV-TR	Netherlands
	Waiting list	200 (68.0)	51.9 (12.2)	Waiting					
	Paper-and-pencil	203 (74.4)	51.2 (12.8)	SHE-CR-SC-SR-RLX-PI					
Ritterband, 2012	Internet	14 (100)	53.7 (10.8)	SHE-CR-SC-SR	Cancer	9	_	DSM-IV-TR	America
	Waiting list	14 (71.4)	59.6 (12.3)	Waiting					
Lancee, 2013	Internet	133 (73.7)	47.38 (11.83)	SHE-CR-SC-SR-RLX	None	6	6 months	DSM-IV-TR	Netherlands
	Internet+email	129 (76.7)	49.33 (13.19)	SHE-CR-SC-SR-RLX					
Ho, 2014	Internet	104 (67.3)	38.6 (11.8)	SHE-CR-SC-SR-RLX	None	6	12 weeks	DSM-V	China
	Waiting list	105 (75.2)	39.9 (12.7)	Waiting					
	Internet+telephone	103 (70.9)	36.9 (13.0)	SHE-CR-SC-SR-RLX					
Holmqvist, 2014	Internet	39 (71.8)	–	SHE-CR-SC-SR-RLX	None	6	8 weeks	Author-defined	Canada
	Telephone	34 (79.4)	–	SHE-CR-SC-SR-RLX					
van Straten, 2014	Internet	59 (59.3)	48.7 (13.8)	SHE-CR-SC-SR-RLX	None	6	8 weeks	DSM-IV	Netherlands
	Waiting list	59 (81.4)	50.1 (11.9)	Waiting					
Blom, 2015a	Internet	22 (36.4)	46.1 (13.6)	SHE-CR-SC-SR	Depression	9	6 months, 12 months	DSM-V	Sweden
	ICBT for depression	21 (65%)	48.2 (11.0)	ICBT for depression					
Blom, 2015b	Internet	24 (33.0%)	56.1 (10.2)	SHE-CR-SC-SR-RLX	None	8	6 months	AASM	Sweden
	Group	24 (62.5%)	52.6 (16.6)	SHE-CR-SC-SR-RLX					
Lancee, 2015	Internet	36 (83.3%)	47.47 (14.37)	SHE-CR-SC-SR-RLX	None	6	3 months, 6 months	DSM-V	Netherlands
	Waiting list	27 (74.1%)	49.98 (13.71)						
Kaldo, 2015	Internet	73 (81.0)	47 (15.2)	SHE-CR-SC-SR-RLX	None	8	6 months, 12 months	AASM, ICSD	Sweden
	Internet-based control	75 (76.0)	49 (15.6)	SHE- RLX-SM-Mind					

AASM, American Academy of Sleep Medicine; BC, breathing control; CR, cognitive restructuring; DSM-IV-TR, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision; F, female; HD, hierarchy development; ICBT, internet-based cognitive–behavioural therapy; ICSD, International Classification of Sleep Disorders; IT, imagery training; Mind, mindfulness; PI, paradoxical intention; RLX, relaxation; SC, stimulus control; SHE, sleep hygiene education; SM, stress management; SPD, scheduled pseudodesensitization; SR, sleep restriction.

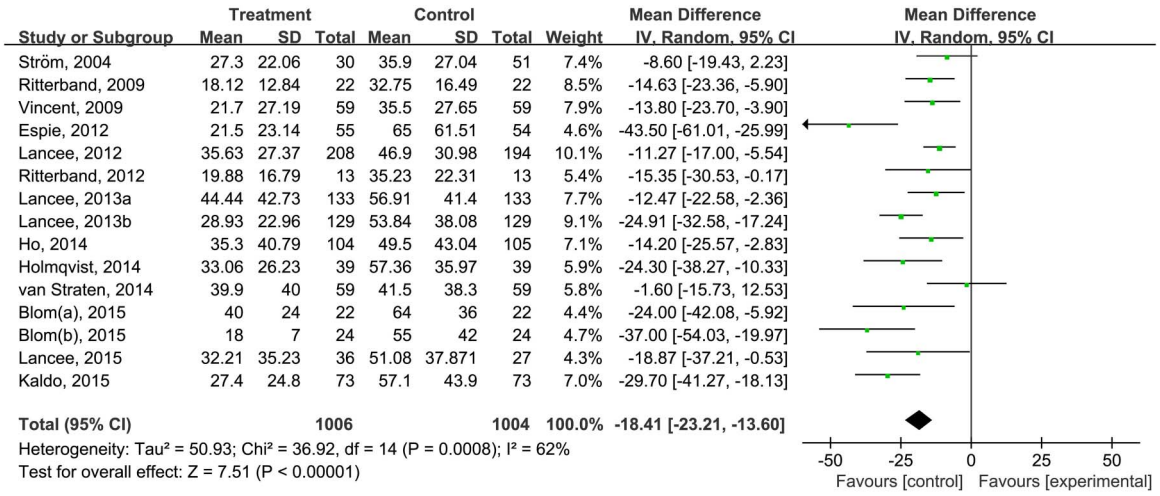

Figure 2 Meta-analysis of the effect of internet-based cognitive–behavioural therapy for insomnia (ICBT-i) on sleep onset latency.

studies (eight of them containing a waiting list control group) reported WASO, with a MD of 22.31 (figure 5). ICBT-i also significantly reduced NWAK (MD=−0.52, −0.76 to −0.28) and ISI (MD=−5.88, −7.46 to −4.29).

Follow-up effects of ICBT-i on sleep

The effects of short-term follow-up were calculated in the ICBT-i groups by examining the changes that occurred between pretest and follow-up. In this study, we defined the short-term follow-up period as 8 weeks to <6 months after completion of the intervention. The changes were significant for SOL (−20.13 (−26.23 to −14.03)), TST (44.12 (21.03 to 67.20)), SE (12.06 (6.73 to 17.39)) and WASO (−30.98 (−44.81 to −17.15)).

Compared with the pretest values, at the 6-month follow-up, ICBT-i remained significantly effective in terms of SOL (−19.48 (−24.44 to −14.53)), TST (35.44 (20.23 to 50.64)), SE (10.04 (8.44 to 11.64)) and WASO (−30.96 (−37.91 to −24.02)).

Sensitivity analysis and publication bias

Sensitivity analysis of ICBT-i on SOL, TST, SE and WASO at the post-test time point was performed, and the results were stable (figure 6). The funnel plots were symmetrical (figure 7), and Egger's test (SOL, p=0.130; TST, p=0.826; SE, p=0.445; WASO, p=0.489) revealed no significant publication bias for ICBT-i with regard to SOL, TST, SE or WASO.

DISCUSSION

The present meta-analysis demonstrated that ICBT-i is an effective treatment for insomnia, as it produces meaningful improvements in several sleep-related parameters. The effects of ICBT-i on SOL, TST, SE and WASO remained significant at follow-up. The results show that ICBT-i for insomnia is effective over the short

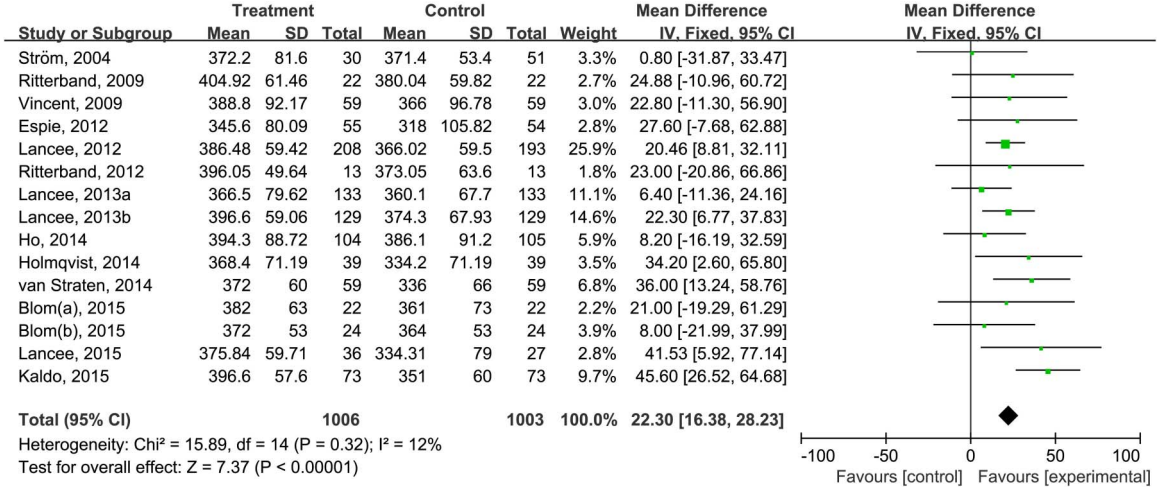

Figure 3 Meta-analysis of the effect of internet-based cognitive–behavioural therapy for insomnia (ICBT-i) on total sleep time.

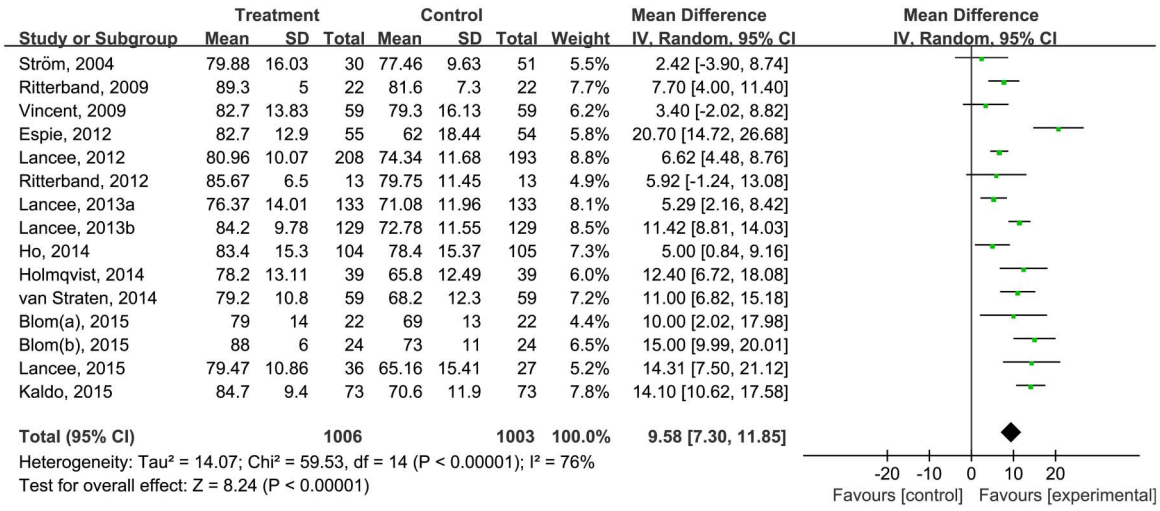

Figure 4 Meta-analysis of the effect of internet-based cognitive–behavioural therapy for insomnia (ICBT-i) on sleep efficiency.

term (5–9 weeks) and leads to sustained sleeping improvements.

Using internet-based programmes to deliver CBT-i makes effective treatment more widely available to patients with insomnia. As with traditional methods in which therapy is delivered via face-to-face interactions with specialised psychologists,[46] ICBT-i participants can also obtain feedback during treatment. The ICBT-i approach also benefits from lower cost and higher efficiency.[47] Furthermore, at any time and place, a patient can have access to treatment to learn relaxation skills and behavioural strategies at their own pace and to communicate with their therapist.[48] Owing to the differences in delivery programmes, while the effects of ICBT-i were significant, the outcomes varied considerably. Each programme had its own salient characteristics that produced different levels of efficacy. The features of each programme and their corresponding disclosures were as follows.

(1) *The ICBT-i trial by Ström et al*: This study used a text-based intervention programme that could be extended for 5 weeks. The participants were invited to ask questions through emails if problems emerged. A sleep schedule was submitted by the participants weekly using a sleep diary. All relaxation instructions were followed with a slideshow or the ability to download sound files. The within-group ES values for ICBT-i on SOL, TST, WASO and SE were −11.00, −22.11, 34.40 and 10.44, respectively. The trial showed low ES on most of the sleep parameters, and the adherence rate (60%) could be explained by the poor interactive design.

(2) *The ICBT-i trial by Ritterband et al*: This study used the SHUTi (Sleep Healthy Using the Internet, http://www.shuti.net) programme, which consisted of six 45-min to 60-min treatment cores that could be extended for 9 weeks. The intervention presented information through the use of text, graphics, animations, vignettes, quizzes, automated emails, and brief games. During the midweek period, the participants were reminded to enter their sleep diaries and implement the learnt strategies, and they were also required to complete each core before a new one became available. The within-group ES values for ICBT-i on SOL, WASO, TST

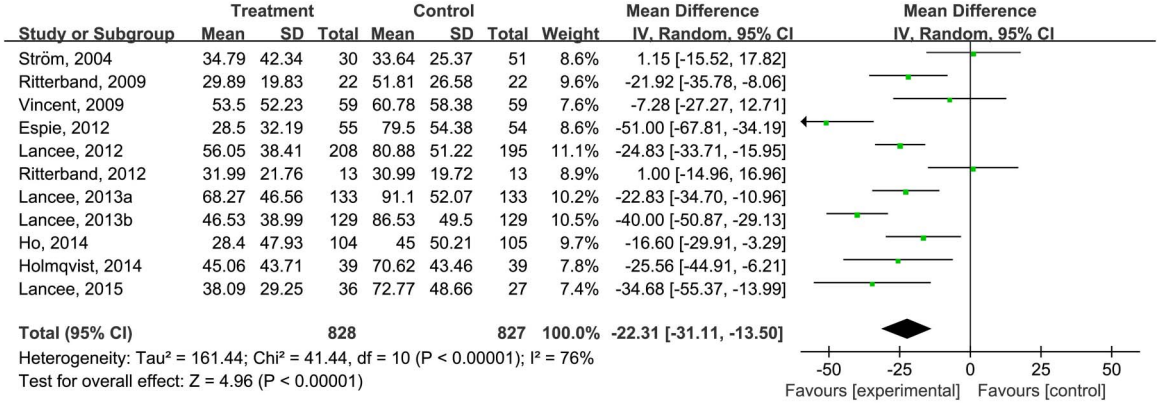

Figure 5 Meta-analysis of the effect of internet-based cognitive–behavioural therapy for insomnia (ICBT-i) on wake after sleep onset.

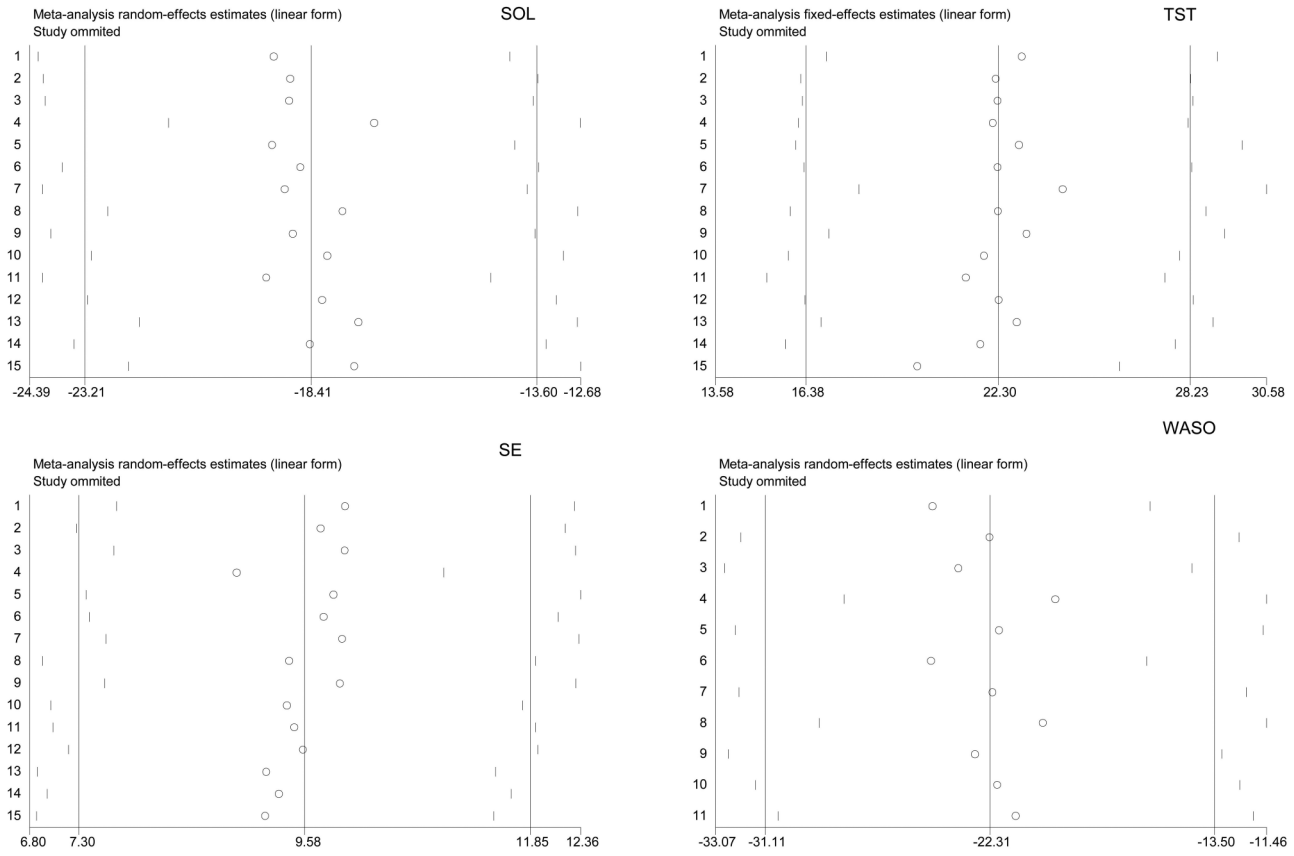

Figure 6 Sensitivity analysis. SE, sleep efficiency; SOL, sleep onset latency; TST, total sleep time; WASO, wake after sleep onset.

and SE were −16.99, −30.84, 44.96 and 12.78, respectively. The trial showed large ES values for most of the sleep parameters, and the adherence rate could be explained by the highly interactive programme design.

(3) *The ICBT-i trials by Vincent and Holmqvist*: These studies used the RETURN2SLEEP programme, which was a 5-week intervention. The intervention presented information through the use of audiovisual clips, graphs, and MP3 files. The submission of weekly adherence logs was reinforced through text messages. Following the completion of each online module, weekly homework was assigned on corresponding topics such as stimulus control and sleep restriction. The within-group ES values for ICBT-i on SOL, WASO, TST and SE were −18.10, −21.20, 40.19 and 9.39, respectively.

(4) *The ICBT-i trial by Espie et al*: This study used an internet application (http://www.sleepio.com) that involved a 6-week intervention. The participants received treatment cores delivered by an animated virtual therapist. The virtual therapist conducted a progress review with the participant, explored the diary data submitted during the week, evaluated the participant's current sleep status and pattern, and measured the progress achieved against the goals that were previously set. The participants were invited to ask questions through emails, telephone, and an online community forum if problems emerged. Additionally, they could set automated mobile text message and/or email prompts as reminders. The within-group ES values for ICBT-i on SOL, WASO, TST and SE were −26.40, −48.40, 39.00 and 19.50, respectively.

(5) *The ICBT-i trials by Lancee*: In the 2012 study, an internet application that involved a 6-week intervention was used. Each module contained instructions and an exercise. The participants had the opportunity to email the first author. In the 2013 study, an additional internet application (http://www.slaapgezonder.nl) was added. In this web application, all the exercises were integrated, making it possible to track the progress and the exercise activities of the patients. The participants were able to progress to the next module only if they fully completed the previous module. The participants were randomised to an internet-delivered intervention for insomnia with or without email support. The ES values for the sleep parameters and adherence rate in the email support group were higher than in the group without support.

(6) *The van Straten trial*: This study was conducted in 2014 and used an internet application that involved a 6-week intervention. Every lesson contained information, examples of other people carrying out the treatment, and homework. After a participant finished the homework, the coach received a notification. Within three working days, the coach provided online feedback on the homework. The patients could also send separate

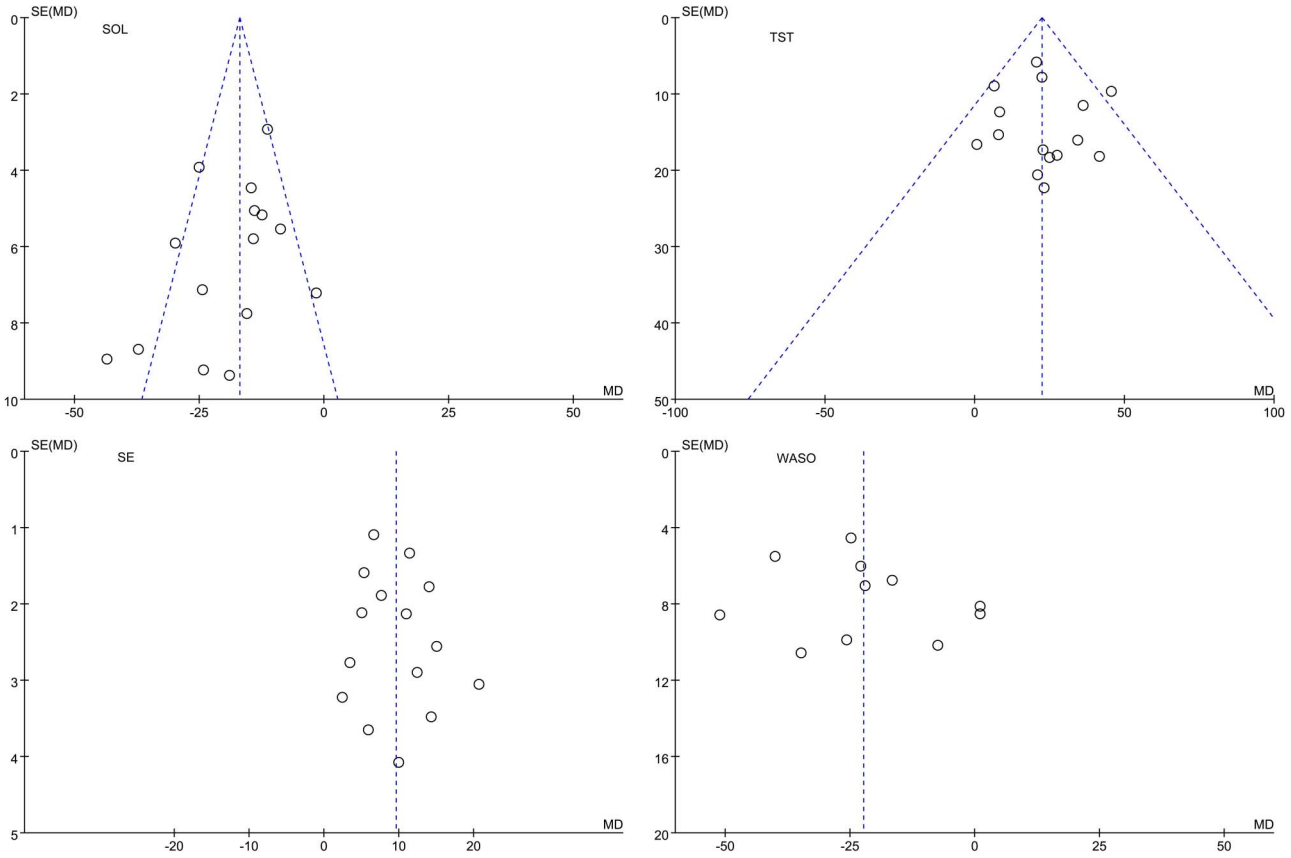

Figure 7 Funnel plot of publication bias. SE, sleep efficiency; SOL, sleep onset latency; TST, total sleep time; WASO, wake after sleep onset.

emails to the coach. At the start of the study, feedback took ~20–30 min per person per lesson. During the study, as the coaches became more experienced, feedback took an average of 15 min per person per lesson.

(7) *The ICBT-i trial by Ho et al*: This study used an internet application (http://www.sleephk.com) that lasted for 6 weeks, with treatment materials delivered once per week. An extra week of flexibility per session was allowed on request. The intervention presented information through the use of text, diagrams, audio clips, vignettes, quizzes, automated emails, and brief games. At the beginning of each session, the participants were shown their progress in preceding weeks using tables and bar charts. The participants were only allowed to proceed to the next session if they returned their sleep diary after email reminders and if they spent more than 10 min per week on the programme. The within-group ES values for ICBT-i on SOL, WASO, TST and SE were −8.20, −13.80, 16.80 and 4.40, respectively. The trial showed low ES values for most of the sleep parameters, and the adherence rate could be explained by the poor interactive programme design.

(8) *The ICBT-i trials by Blom and Kaldo*: These studies used an internet application that lasted for 8–9 weeks. The participants submitted their homework via a secure messaging system. A therapist received their messages and then reviewed their answers, work sheets and sleep diaries, providing written feedback and finally granting access to the next module. If a participant was inactive for 7 days, the therapist sent a mobile phone text message encouraging the participant to get in touch and continue treatment. The within-group ES values for ICBT-i on SOL, TST and SE were −30.26, 27.59 and 13.87, respectively.

In the meta-analysis, compared with the pretest period, significant post-test changes were found for SOL (−20.24 min), TST (29.36 min), SE (11.10%) and WASO (−28.93 min). The ES values for SOL, SE, and WASO did not differ between post-test, short-term follow-up, and 6-month follow-up. The ES of TST at short-term follow-up was greater than those at post-test. This may be because TST increased as time elapsed or because of some other time effect.

There was heterogeneity when we calculated the combined ES values of some parameters, and we evaluated the impacts of several considerations. First, the delivery programmes differed. Each programme had its own salient characteristics that produced different levels of efficacy. Second, the dropout rate differed between studies (ranging from 0 to 41.35%). Third, the use of ICBT-i varied in terms of number and duration of therapy sessions. Such variations might result in different

efficacies for improving sleep-related parameters and comorbid symptoms. Fourth, the sample sizes in some studies were too small. Fifth, only some of the studies included relaxation therapy. Sixth, combined intergroup and intragroup ES values were calculated. There are also some limitations in our review. First, the number of studies and the sample sizes of those studies were both small. In addition, we only included studies published in English, and we did not track unpublished studies.

In summary, in this meta-analysis, we demonstrated that ICBT-i is an effective treatment that produces clinically meaningful improvements. These benefits appear to be maintained over time. To achieve better understanding of this approach; however, additional high-quality studies are needed.

Author affiliations
[1]Department of Neurology, Institute of Surgery Research, Daping Hospital, Third Military Medical University, Chongqing, China
[2]Department of Neurology, PLA 187 Hospital, Haikou, China
[3]Department of Neurology, PLA 123 Hospital, Bengbu, China

Contributors Y-yY, N-kC and X-jJ conceived and designed the experiments. Y-yY, N-kC and JL performed the experiments. JC, Y-yY, N-kC and LL analysed the data. Y-zL, YL, and X-jY contributed to the reagents/materials/analytic tools. Y-yY and N-kC wrote the paper. Y-zL, YL, and X-jY contributed to the analytic tools.

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Provenance and peer review Not commissioned; externally peer reviewed.

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