General Psychiatry

Assessing the effectiveness of internet-based interventions for mental health outcomes: an umbrella review

Mi Zhang,[1,2] Chuan Fan,[3] Lijun Ma,[2] Huixue Wang,[2] Zhenyue Zu,[2] Linxi Yang,[2] Fenglan Chen,[2] Wenzhuo Wei,[2] Xiaoming Li [1,2]

To cite: Zhang M, Fan C, Ma L, *et al*. Assessing the effectiveness of internet-based interventions for mental health outcomes: an umbrella review. *General Psychiatry* 2024;**37**:e101355. doi:10.1136/gpsych-2023-101355

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/gpsych-2023-101355).

MZ and CF contributed equally.

MZ and CF are joint first authors.

Received 18 September 2023
Accepted 13 June 2024

[1]Research Centre for Translational Medicine, the Second Affiliated Hospital, Anhui Medical University, Hefei, Anhui, China
[2]Department of Medical Psychology, School of Mental Health and Psychological Science, Anhui Medical University, Hefei, Anhui, China
[3]Department of Psychiatry, the First Affiliated Hospital of Anhui Medical University, Hefei, Anhui, China

Correspondence to
Professor Xiaoming Li;
psyxiaoming@126.com

ABSTRACT

Internet-based interventions (IBIs) for behavioural health have been prevalent for over two decades, and a growing proportion of individuals with mental health concerns prefer these emerging digital alternatives. However, the effectiveness and acceptability of IBIs for various mental health disorders continue to be subject to scholarly debate. We performed an umbrella review of meta-analyses (MAs), conducting literature searches in PubMed, Web of Science, Embase, Cochrane and Ovid Medline from their inception to 17 January 2023. A total of 87 MAs, reporting on 1683 randomised controlled trials and 295 589 patients, were included. The results indicated that IBIs had a moderate effect on anxiety disorder (standardised mean difference (SMD)=0.53, 95% CI 0.44 to 0.62) and post-traumatic stress disorder (PTSD) (SMD=0.63, 95% CI 0.38 to 0.89). In contrast, the efficacy on depression (SMD=0.45, 95% CI 0.39 to 0.52), addiction (SMD=0.23, 95% CI 0.16 to 0.31), suicidal ideation (SMD=0.23, 95% CI 0.16 to 0.30), stress (SMD=0.41, 95% CI 0.33 to 0.48) and obsessive–compulsive disorder (SMD=0.47, 95% CI 0.22 to 0.73) was relatively small. However, no significant effects were observed for personality disorders (SMD=0.07, 95% CI −0.13 to 0.26). Our findings suggest a significant association between IBIs and improved mental health outcomes, with particular effectiveness noted in treating anxiety disorders and PTSD. However, it is noteworthy that the effectiveness of IBIs was impacted by high dropout rates during treatment. Furthermore, our results indicated that guided IBIs proved to be more effective than unguided ones, playing a positive role in reducing dropout rates and enhancing patient adherence rates. PROSPERO registration number: CRD42023417366.

INTRODUCTION

Internet-based interventions (IBIs) are any psychological interventions facilitated via the internet, which serves as a medium of delivery.[1] This not only encompasses methods such as telecommunication (eg, phone calls, text messages) but also includes a range of internet-facilitated therapies such as online psychoeducational courses, cognitive–behavioural therapy (CBT), mobile applications, emails, video conferencing, social media platforms and online chat systems.[2] While a substantial number of individuals with mental health challenges still opt for face-to-face (FTF) treatment, there is an emerging preference for computer-assisted alternatives. These options potentially diminish lengthy waiting lists (WLs), bolster convenience and confidentiality, and decrease the stigma associated with seeking mental health treatment.[3] These digital platforms offer round-the-clock treatment or support and allow users the flexibility to self-determine their treatment pace. Further, the interactive and adaptive nature of the internet provides a variety of multimedia engagement options, catering to individual users' specific needs and interests.[4] Such advantages have contributed to an escalating interest in using IBIs.[5]

IBIs have undergone substantial development in recent years.[6] A burgeoning body of evidence demonstrates the efficacy of IBIs in treating depression[7 8] and anxiety disorders,[9 10] with outcomes commensurate with those of traditional FTF therapy. Furthermore, meta-analytic evidence corroborates the efficacy of these interventions for an array of mental health conditions, including post-traumatic stress disorder (PTSD),[11 12] substance use disorders,[13 14] obsessive–compulsive disorder (OCD),[15] personality disorders[16] and suicidal ideation.[17 18] Collectively, the significance of IBIs and their capacity to enhance healthcare provision has garnered widespread recognition.[19]

Numerous meta-analyses (MAs) have been conducted to evaluate the effects of IBIs on mental health.[18 20 21] However, these MAs have primarily focused on the population, intervention, comparator and outcome framework for specific issues, constraining their research scope to single intervention measures and omitting other potentially efficacious interventions.[22] While it is essential to formulate precise research questions for conducting rigorous studies, real-world clinical practice

is considerably more complex, entailing varied populations, treatment methodologies, outcomes and adverse effects. Despite the proliferation of research on IBIs, there is notable heterogeneity among studies, which impedes meaningful comparisons and interpretations.[23] Moreover, variations in inclusion criteria, outcomes and other attributes that define the quality of MAs for IBIs restrict the practical utility and influence of this intricate and multifaceted body of evidence. An umbrella review can mitigate these limitations to a certain extent by critically appraising and synthesising existing meta-analytic evidence based on predefined criteria.[24] Additionally, umbrella reviews represent the pinnacle of evidence-based research,[25] occupying the summit of the evidence hierarchy.[26]

Our primary measure of efficacy is disease-specific symptom reduction, while adherence, dropout rate and patient satisfaction are considered suitable indicators of treatment acceptability. To our knowledge, no umbrella review currently exists that collates evidence from MAs of randomised controlled trials (RCTs) assessing the efficacy and acceptability of IBIs for various mental health conditions. Consequently, the objective of this umbrella review is to distill a substantial volume of data into clinically actionable information, with the ultimate goal of providing evidence-based recommendations for clinical practice.

Search strategy

We conducted a comprehensive search of the PubMed, Web of Science, Embase, Cochrane and Ovid Medline databases from their inception to 17 January 2023 (see online supplemental table 1 for the complete search strategy). Two independent authors carried out screening of titles and abstracts, data extraction and quality assessment using predefined Excel spreadsheets. Any discrepancies were resolved by a third author, who performed a tertiary review of the extracted data. The study protocol was preregistered at PROSPERO: CRD42023417366.

Inclusion and exclusion criteria

Our inclusion criteria included: (1) MAs of RCTs and (2) studies using IBIs, defined as any mental health treatments administered through online or mobile technologies. Our focus was particularly on four types of IBIs: phone/short message service support, applications, social media and websites. These platforms have emerged as significant tools in modern mental health treatment, making them a crucial focus of our research. An additional inclusion criterion was (3) studies addressing any mental health conditions amenable to treatment through IBIs. This broad scope allowed us to delve into the vast potential of IBIs across a range of psychological issues. Finally, the last criterion was (4) studies presenting pertinent outcome data, including metrics such as efficacy, dropout rate, adherence, remission rate, response and satisfaction. These metrics enabled us to conduct a comprehensive assessment of the impact of IBIs across multiple dimensions.

We excluded articles that: (1) did not exclusively focus on RCTs and (2) lacked quantitative synthesis, as this precluded a meaningful and accurate comparison of findings across studies.

Included disorders, interventions and comparisons

The scope of mental health conditions examined in this study encompassed depression, anxiety disorders, addiction, PTSD, suicidal ideation, stress, OCD and various personality disorders. The spectrum of psychotherapeutic interventions reviewed included behavioural activation (BA), CBT, exposure therapy, problem-solving therapy, dialectical behaviour therapy, interpersonal therapy, psychodynamic therapy, supportive therapy, social skills training, acceptance and commitment therapy (ACT), mindfulness therapy, cognitive remediation therapy, cognitive training, psychoeducation, attentional bias modification, motivational interviewing, internet-based trauma-focused writing sessions, person-centred therapy, exposure and response prevention, motivational enhancement therapy and behavioural couple therapy.

Control groups were classified as active controls, encompassing FTF and treatment as usual. In contrast, inactive controls comprised those on a WL, receiving no treatment or a placebo (PBO) or functioning as an information control (IC).

Outcomes

The coprimary outcome of this study focused on the attenuation of disease-specific primary symptoms, gauged through the average effect size of alterations in mental health symptoms post intervention.

Secondary outcomes encompassed study-defined treatment response, remission rate, dropout rate, adherence and satisfaction. The term ‘remission’ often describes a state where disease symptoms are nearly absent. However, it is important to note that while not all patients achieve remission, some may still be classified as ‘responders’, indicative of a clinically significant reduction in disease symptoms. The dropout rate was determined by the number of participants who failed to provide data post treatment. Adherence definitions varied across and within reviews. The most prevalent measurement of adherence is the ratio of completed sessions to the maximum number of sessions; alternatively, some studies measured the percentage of participants who completed all treatment modules. Satisfaction reports furnished insights into user experiences with IBIs.

Quality of evidence

The methodological quality of MAs is evaluated by using the Assessment of Multiple Systematic Reviews (AMSTAR) tool.[27] This instrument, comprising 11 items, demonstrates robust face and content validity

in assessing the methodological quality of systematic reviews. Following evaluation, methodological quality was classified into low (<4), medium (4–7) and high (>7) categories.[24]

Credibility of evidence

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) system offers explicit criteria to rate the credibility of evidence, incorporating elements such as the risk of bias, imprecision, inconsistency, indirectness and publication bias.[28 29] The resulting GRADE evidence is categorised into four levels: high, medium, low and very low.

Statistical analysis

Our analysis is predicated on the largest MA available for each mental health condition. Specifically, when multiple MAs had evaluated the same disorder, we prioritised the one incorporating the largest number of studies. Subsequently, we incorporated these independent MAs into a second-order MA framework,[30] aiming to comprehensively calculate the overall weighted effect of IBIs on mental health outcomes. All analyses and forest plots were conducted using Comprehensive Meta-Analysis (V.3) with a random effects model.

We extracted pertinent outcome indicators reported in each MA, focusing primarily on the effect size and 95% CI of the target symptoms relevant to the diseases in question. We employed the standardised mean difference (SMD) as a metric for continuous outcomes. Primary outcome indicators were converted into SMDs (if there were no continuous primary outcomes, we converted ORs to SMDs), while secondary outcome indicators retained their original data. To facilitate consistent and straightforward comparisons, we standardised effect sizes: SMD>0 favours the intervention, while SMD<0 favours the control group. We adopted Cohen's convention to denote effect sizes: SMD values of 0.2, 0.5 and 0.8 correspond to small, medium and large effect sizes, respectively.[31]

Search results

The initial search produced 4532 records. After removing duplicates and assessing titles and abstracts, this number was reduced to 259. Ultimately, 87 MAs satisfied the inclusion criteria for the umbrella review. The search process is illustrated in figure 1.

Research characteristics

Online supplemental table 2 presents the primary characteristics of the 87 included MAs. To offer lucid and succinct information, the table elucidates details such as the number of RCTs and patients, intervention measures, types of controls, outcome indicators and AMSTAR scores. The number of original studies incorporated in each MA varied significantly, ranging from 6 to 125. The inherent heterogeneity in research design also indirectly led to a substantial variation in sample sizes, spanning from 340 to 17 464.

Quality and credibility of included evidence

Among the 87 MAs of RCTs, the median AMSTAR Score was 8, with an interquartile range (IQR) of 7–8. The overall quality score across all effect sizes was high for 51 MAs (58.62%) and moderate for 36 (41.38%). According to the GRADE system, out of the 135 pieces of evidence reviewed, the credibility of the evidence was high for 10 MAs, moderate for 18, low for 42 and very low for 65. The results are presented in online supplemental tables 3 and 4, respectively.

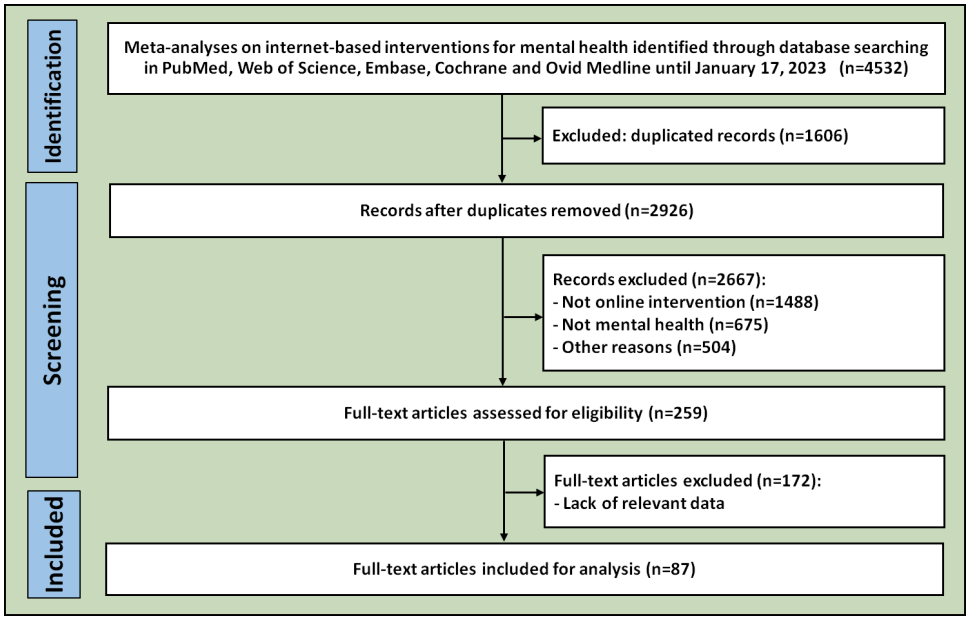

Figure 1 Preferred reporting items for systematic reviews and meta-analyses flowchart.

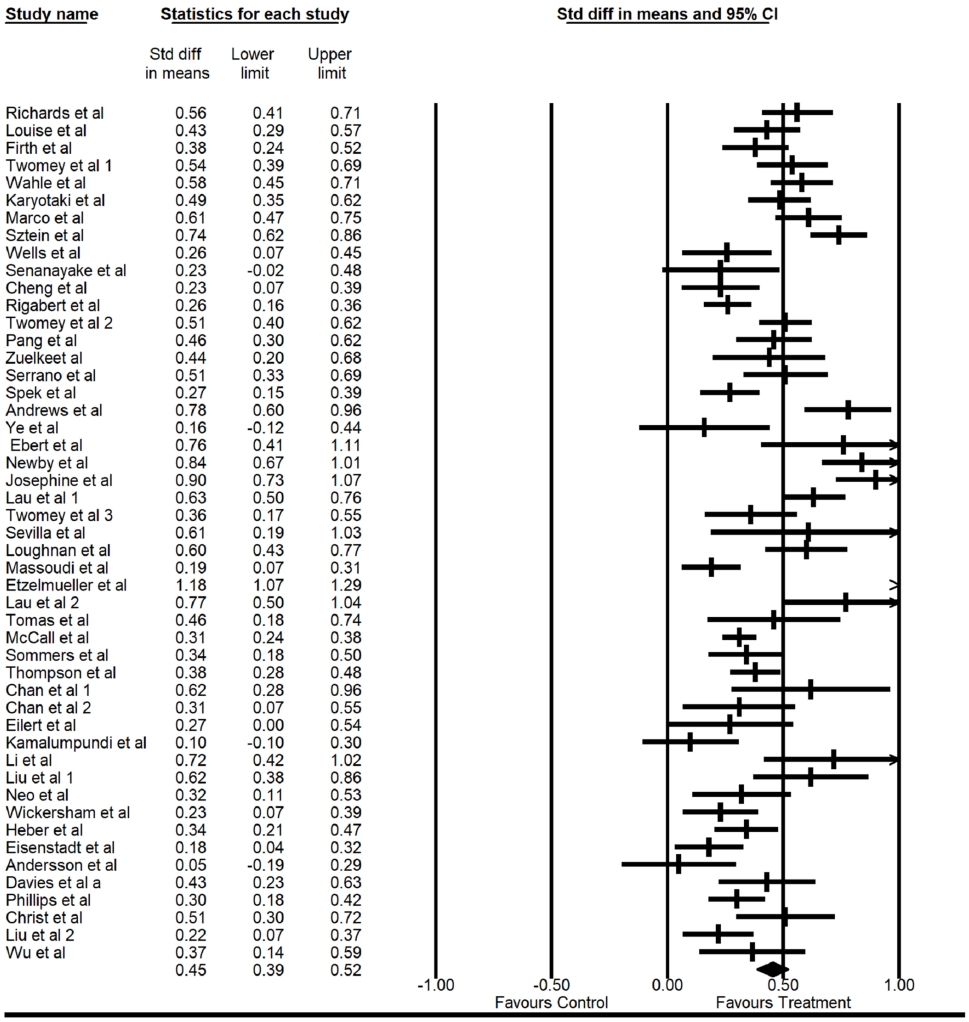

Figure 2 Effectiveness of internet-based interventions on depression.

Internet intervention effect

Depression

In the largest MA of depressive disorders,[32] IBIs demonstrated a significant inclination toward reducing depressive symptoms (SMD=0.58, 95% CI 0.45 to 0.71, p<0.001). When considering all the included MAs, relative to the control group, IBIs for depression yielded a small effect size (SMD=0.45, 95% CI 0.39 to 0.52, p<0.001). Comparisons with inactive control groups revealed a moderate effect size of IBIs, with an SMD of 0.60 (95%CI 0.48 to 0.71, n=17). However, compared with active control groups, the effect size was smaller, with an SMD of 0.24 (95% CI 0.20 to 0.28, n=14). Additionally, IBIs exerted a minor impact on mild depression (SMD=0.39, 95% CI 0.10 to 0.69, n=3) while demonstrating a moderate impact on severe depression (SMD=0.63, 95% CI 0.54 to 0.71, n=3). Figure 2 and online supplemental figures 1 and 2 present the corresponding forest plots.

Five studies reported the dropout rate for depressive disorders, culminating in a combined rate of 47.59% (5981/12 567). Adherence was reported in three MAs. van Ballegooijen *et al*[33] compared adherence to guided internet-based cognitive behaviour therapy (ICBT) with FTF CBT. Results indicated that, on average, participants in FTF CBT completed 83.9% of their treatment, a figure not significantly different from participants in guided ICBT (80.8%, p=0.590). However, the percentage of total intervention completers was significantly higher in FTF CBT (84.7%) than in ICBT (65.1%, p<0.001). Based on intervention adherence levels, one study[34] categorised participants into two groups: adherence≤90% and adherence>90%. Subgroup analysis results indicated that the intervention effect was superior in the high-adherence group, with a significant difference between the two groups. These findings suggest that adherence rates can vary between different modes of therapy (eg, FTF CBT vs ICBT) and between guided and unguided ICBT. Additionally, higher levels of adherence to the intervention may correlate with improved outcomes.

Remission and response are regarded as the preferred outcome criteria for depression treatment.[35 36] Karyotaki *et al*[37] employed individual participant data MAs to report the remission and response rates of IBIs for depression. The intervention group demonstrated significantly higher response (OR=2.49, 95% CI 2.17 to 2.85) and remission rates (OR=2.41, 95% CI 2.07 to 2.79) compared with the

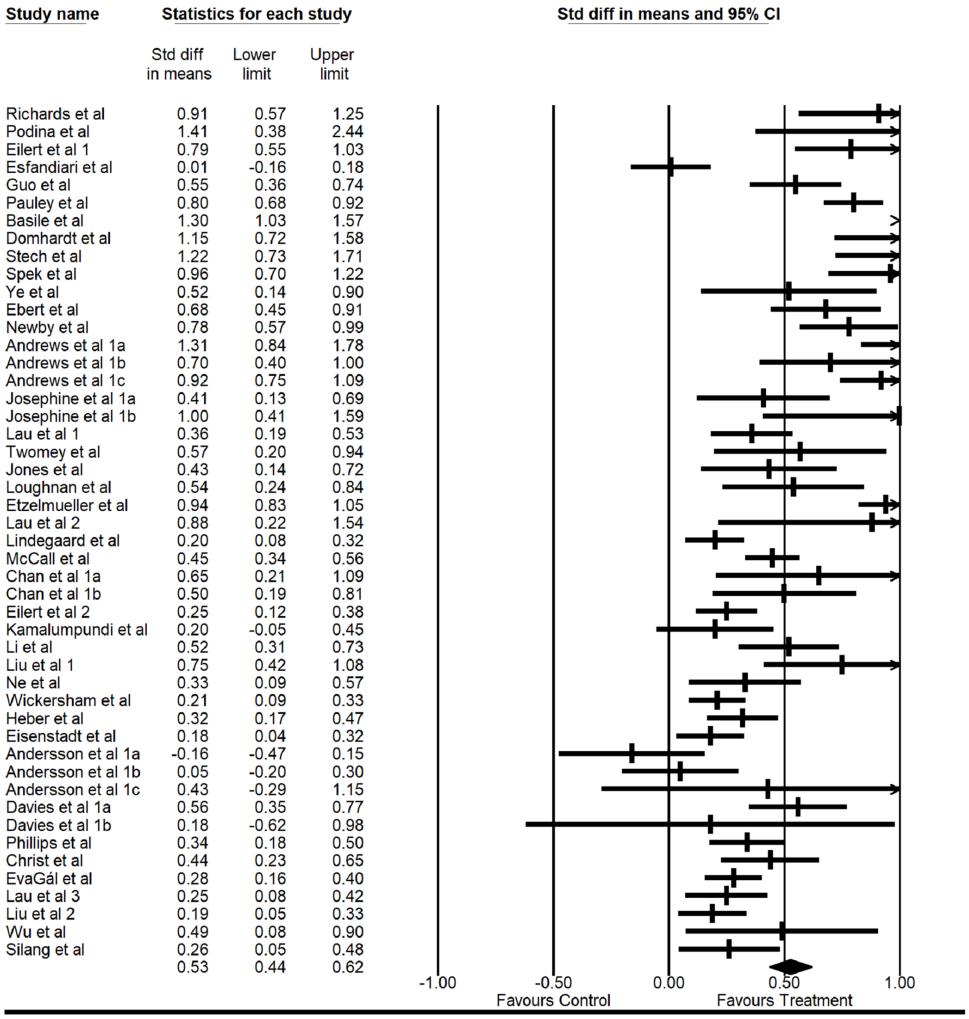

Figure 3 Effectiveness of internet-based interventions on anxiety disorder.

control group. Zuelke *et al*[38] assessed user satisfaction with IBIs for psychological issues. Their report indicated moderate-to-high average levels of user satisfaction, with the majority of service users finding the interventions both comprehensible and beneficial.

Anxiety disorder

The largest MA on anxiety disorders was conducted by Pauley.[39] This study found a large pooled effect size of SMD=0.80 (95% CI 0.68 to 0.93), favouring IBIs. Considering all included MAs related to anxiety disorders, IBIs displayed a medium effect size (SMD=0.53, 95% CI 0.44 to 0.62, p<0.001). When compared with inactive control groups, IBIs demonstrated a moderate effect size on anxiety, with an SMD of 0.63 (95% CI 0.48 to 0.77, n=13). In contrast, when compared with active control groups, the SMD was 0.16 (95% CI 0.04 to 0.28, n=11). The forest plots are depicted in figure 3 and in the online supplemental figures 3 and 4.

The dropout rate of three studies on anxiety disorders was reported, and the pooled result was 23.6%. Among the three studies, adherence rates were also reported. A study revealed that 55.9% of the patients completed all treatment sessions.[39] Another study showed that 79% (range: 50% to 95%) of the subjects completed the whole intervention.[40] In addition, there is another study where the proportion of participants completing the entire ICBT programme ranges from 8% to 84%.[41] Only one MA[42] revealed that IBIs can improve the remission rate of anxiety disorders (RR=3.63, 95% CI 1.59 to 8.27).

Post-traumatic stress disorder

For PTSD, the largest MA reported a small effect size in comparison to active controls (SMD=0.36, 95% CI 0.19 to 0.53).[12] When considering all included MAs, in comparison to the control group, IBIs for PTSD showed a medium effect size (SMD=0.63, 95% CI 0.38 to 0.89).

When compared with inactive control groups, IBIs demonstrated a moderate impact on PTSD, with an SMD of 0.75 (95% CI 0.64 to 0.86, n=4). However, no significant difference was observed compared with active control groups, with an SMD of 0.06 (95% CI −0.16 to 0.29, n=2). The forest plots are shown in figure 4A and in the online supplemental fgures 5 and 6. Dropout rates were examined across four MAs, yielding a pooled rate of 23.78%.

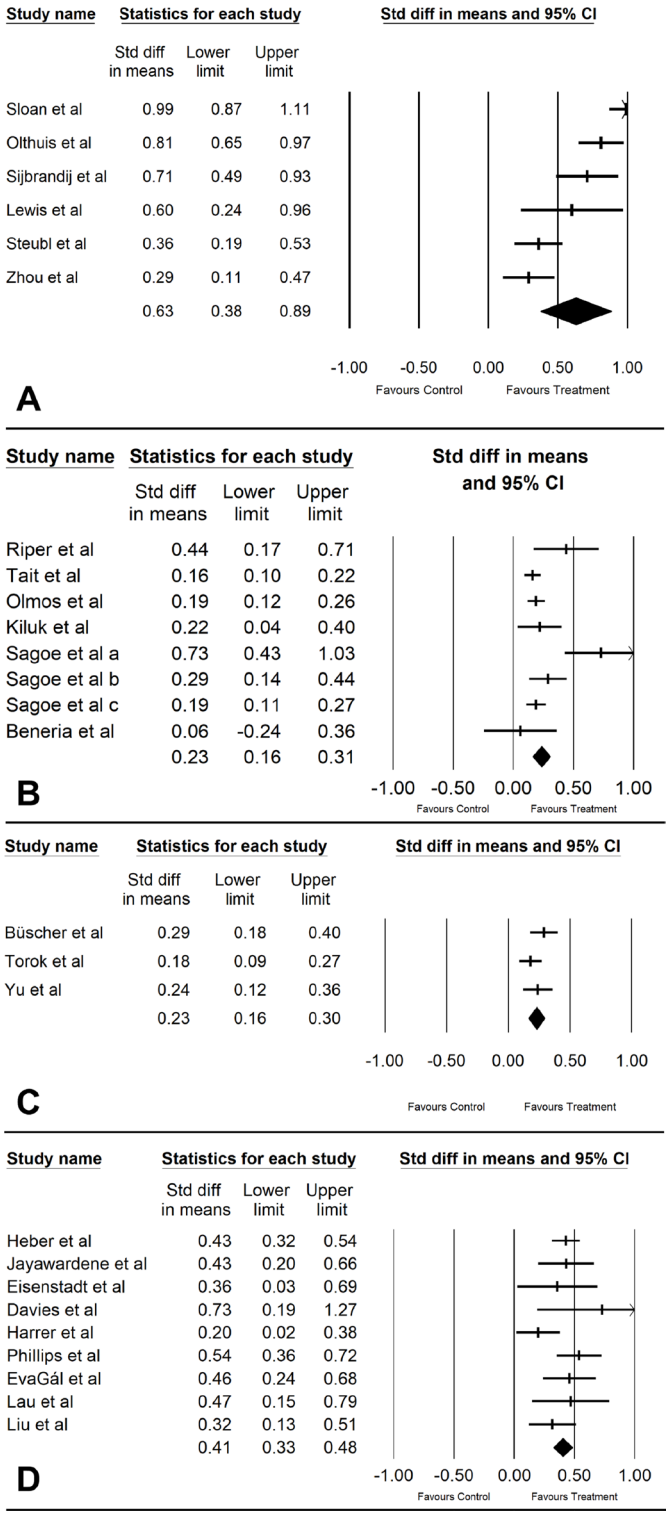

Figure 4 Effectiveness of internet-based interventions on post-traumatic stress disorder (PTSD), addiction, suicide and stress. (A) Effectiveness on PTSD. (B) Effectiveness on addiction. (C) Effectiveness on suicide. (D) Effectiveness on stress.

Addiction

This umbrella review encompasses three categories of addiction: cannabis use (n=3), alcohol use (n=2) and gambling problems (n=1). Regarding addiction, the largest MA indicated that IBIs had a smaller effect on cannabis use compared with the control group (SMD=0.06, 95% CI 0.24 to 0.36).[14] When considering all types of addiction, IBIs exhibited a statistically significant, although smaller, effect in comparison to the control group (SMD=0.23, 95% CI 0.16 to 0.31, p<0.001). Figure 4B presents the forest plot. Additionally, a study revealed significant disparities in dropout rates, ranging from 0% to 42%.[43]

Suicide

The largest MA on suicide prevention was conducted by Torok *et al*,[18] which used self-guided digital interventions and demonstrated a small effect size (SMD=0.18, 95% CI 0.1 to 0.27). Considering all included MAs on online suicide prevention, a small effect size was reported (SMD=0.23, 95% CI 0.16 to 0.30, p<0.001). This is illustrated in figure 4C.

Adherence was reported in three MAs. Buscher *et al*[17] summarised data from three trials, with adherence rates ranging from 45.2% to 92.7%. This suggests that participants completed at least half of the modules, with an average adherence rate of 64.6%. The percentage of participants who did not complete the modules ranged from 6.5% to 22.4%, with an average rate of 12.1%. Additionally, a study that used a self-guided digital intervention[18] reported moderate programme completion rates (at least half of the intervention modules), ranging from 34% to 93%. Regarding completion rates in an ICBT context, the average completion rate for the percentage of modules successfully finished stood at 56.8%. Notably, a significant proportion—28.4% of individuals—completed all assigned modules. This study also uncovered a positive association between human support interventions and enhanced participant adherence.[44]

Stress

In the case of stress, the largest MA reported a small effect size for the control group (SMD=0.43, 95% CI 0.31 to 0.54). Furthermore, preliminary evidence from follow-up data suggests that the stress alleviation effect can be sustained for up to 6 months.[45] Taking into account all MAs, a small effect size was discovered for the impact of IBIs on stress (SMD=0.41, 95% CI 0.33 to 0.48, p<0.001).

Compared with inactive control groups, IBIs demonstrated a moderate effect size on stress (SMD=0.58, 95% CI 0.31 to 0.85, n=3). In contrast, no significant difference was observed compared with active control groups (SMD=0.10, 95% CI −0.24 to 0.43, n=3). The forest plots are shown in figure 4D, as well as in the online supplemental figures 7 and 8.

Obsessive–compulsive disorder

Only one MA on OCD was included in the study.[15] Compared with WL or PBO, the application of self-help interventions yielded a small effect (SMD=0.47, 95% CI 0.22 to 0.73, p<0.001) compared with the WL or PBO. The research report points out that compared with the

inactive control group, unguided IBIs achieved a higher effective response rate in the short term (RR=1.93, 95% CI 1.16 to 3.21).

Personality disorder

Regarding IBIs for personality disorders, there exists only one MA focused on borderline personality disorder.[16] This study revealed that smartphone applications do not significantly influence the symptoms of borderline personality disorder (SMD=0.07, 95% CI −0.13 to 0.26, p=0.390). The reported dropout rate in the study varied between 0.0% and 56.7% (M=22.5, 95% CI 12.4 to 32.6).

Subgroup analysis

We undertook a subgroup analysis of the study to examine the effect sizes of moderating factors and their influence on outcomes, holding all other variables constant. The types of subgroups analysed included: (1) type of psychotherapy, (2) type of guidance, (3) type of control condition (active control vs inactive control) and (4) type of analysis (intention to treat vs completers only).

Concerning the specific types of IBIs, CBT was the most prevalent approach,[46] succeeded by mindfulness, psychoeducation and ACT. Compared with CBT, these therapies have been subjected to less research scrutiny. The subgroup analysis revealed that CBT-based interventions (including standalone CBT and CBT in conjunction with other therapies) elicited reductions in mental symptoms compared with the control group. In instances where CBT was the sole therapy employed, its efficacy was moderate (SMD=0.55, 95% CI 0.47 to 0.64). However, when CBT was amalgamated with other therapies, it exhibited a small effect size (SMD=0.39, 95% CI 0.23 to 0.55). Given the limited number of studies[1 34 47] reporting the efficacy of CBT combined with other therapies (with two studies reporting higher efficacy than standalone CBT and two reporting lower), any related conclusions should be drawn cautiously. Additionally, we were unable to definitively discern which components were most effective when CBT was integrated with other approaches. Moreover, other therapies such as mindfulness (SMD=0.43, 95% CI 0.31 to 0.55), ACT (SMD=0.30, 95% CI 0.22 to 0.39) and psychodynamic therapy (SMD=0.35, 95% CI 0.17 to 0.52) displayed small effect sizes. No significant differences were observed when comparing BA (SMD=0.18, 95% CI −0.24–0.60) and psychoeducation (SMD=0.35, 95% CI −0.21–0.82) with control groups. The forest plot is displayed in online supplemental figure 9.

IBIs can be delivered either with support, known as guided intervention, or without support, referred to as unguided or self-guided intervention. The findings indicate that IBIs conducted under guidance exhibit significantly greater improvement overall than their unguided counterparts, with SMDs of 0.53 (95% CI 0.41 to 0.64) and 0.33 (95% CI 0.27 to 0.39), respectively. This underscores the crucial value of guided interventions in therapeutic processes. Further subgroup analyses reinforce this trend's universality across various mental health disorders. For depression treatment, guided IBIs demonstrate an SMD of 0.65 (95% CI 0.59 to 0.71), significantly higher than the SMD of 0.46 (95% CI 0.30 to 0.62) for unguided IBI. Similarly, in addressing anxiety symptoms, guided IBIs continue to show stronger effects (SMD=0.70, 95% CI 0.45 to 0.95), although unguided IBIs are also effective (SMD=0.62, 95% CI 0.45 to 0.79). For PTSD patients, the therapeutic benefit of guided IBI is particularly pronounced (SMD=0.88, 95% CI 0.71 to 1.05), significantly surpassing the SMD of 0.50 (95% CI 0.22 to 0.78) for non-guided IBI. For stress management, guided intervention also achieves higher effects (SMD=0.73, 95% CI 0.54 to 0.93) than the SMD of 0.33 (95% CI 0.20 to 0.46) for unguided intervention. For cannabis use, the difference in effectiveness between guided and non-guided interventions is relatively modest. The non-guided IBI showed an SMD of 0.15 (95% CI 0.06 to 0.23), whereas the guided IBI demonstrated a slightly improved SMD of 0.17 (95% CI 0.07 to 0.26). The corresponding forest plots are illustrated in online supplemental figures 10–14.

Online supplemental figure 15 presents the impact of IBIs when considering only the completers, with an effect size of SMD=0.31 (95% CI 0.18 to 0.44). When exclusively accounting for studies using intention-to-treat analysis, similar results were observed, with an effect size of SMD=0.26 (95% CI 0.14 to 0.38).

DISCUSSION

In our comprehensive assessment of IBIs, we included evidence from 87 MAs encompassing 1683 RCTs and 295 589 patients. This umbrella review presents the most comprehensive summary of existing RCT evidence regarding IBIs for conditions such as depression, anxiety disorders, PTSD, suicide, stress, addiction, OCD and personality disorders. The expansive literature reviewed in this article amalgamates data on efficacy, adherence, remission, response and dropout rates, as well as patient satisfaction levels, thus providing a valuable resource to inform future research. As a rapidly evolving research field, IBIs cannot be exhaustively encompassed in a single umbrella review. Our findings suggest that IBIs display moderate efficacy in treating anxiety and PTSD, whereas they have smaller effects on depression, addiction, suicide, OCD and stress. Efficacy on borderline personality disorder appears non-significant.

Indeed, different disorders necessitate distinct treatment approaches, affecting the applicability and efficacy of IBIs. For instance, suicidal ideation presents a complex and critical scenario, given its strong association with profound emotional instability, compromised cognitive function and intense suicidal inclinations,[48] frequently co-occurring alongside diagnoses of various mental health conditions.[47] Consequently, individuals with suicidal ideation require a high level of professional expertise and prompt intervention.[49] While IBIs bring forth distinctive benefits in addressing several aspects of

mental health, it is essential to recognise their potential limitations when dealing with acute emergencies and providing instant crisis management. The role of IBIs in these circumstances must be considered in conjunction with appropriate professional support systems to ensure optimal care. Additionally, when considering individuals with addictive disorders, their struggles with controlling impulses and breaking psychological dependencies[50] often severely impede their capability to adhere diligently to and successfully conclude online therapeutic programmes. Within the domain of stress management, stress is essentially a psychological reaction to life's adversities and transitions, and efficacious management calls for a comprehensive strategy incorporating psychological, physiological and environmental factors. Notably, however, IBIs' inadequacies in offering instant oversight and individualised direction can potentially weaken their performance in mitigating stress. This deficiency is strikingly illustrated in our subgroup analysis of guided versus unguided interventions, which underscores that guided stress management demonstrates a pronounced superiority over its unguided counterpart, with this distinction being particularly evident compared with other mental health problems. Last, the treatment of personality disorders and OCD necessitates a profound understanding of patients' emotional, cognitive and behavioural patterns. Often complex and protracted, this process typically occurs in a safe, stable, trusting therapeutic environment. Specifically, the treatment process for personality disorders is typically intricate and prolonged,[51] making both pharmacological and psychological treatments for borderline personality disorder contentious topics.[52]

Although our study reveals that IBIs have shown positive impacts on diverse aspects of mental health when compared with inactive control groups, it does not provide robust substantiation for its efficacy in reducing symptoms associated with PTSD or stress management when contrasted with interventions from active comparator groups. This outcome was not surprising, as it highlighted the inherent difference in the design of the control groups. This finding was anticipated, given that participants in the active control group were actively engaged in an intervention, whereas those in the inactive control group were not.[53] This fact underscores that, when faced with a control group receiving effective active therapy, IBIs did not demonstrate overwhelming advantages over existing standard treatments in improving symptoms of PTSD and stress.

Additionally, our research delves deeply into the significant differences in dropout rates across various studies and contexts, emphasising the crucial importance of considering these variations when assessing the effectiveness and acceptability of IBIs. Notably, we observed a relatively high dropout rate of approximately 29.1% (0.0%–47.8%) for IBIs. A thorough analysis of the reasons for dropout revealed potential factors such as the cumbersome use of intervention media, inadequate response to specific issues and needs, limited customisation and flexibility in treatment, and patients' lack of experience using internet resources.

By comparing dropout rates under conditions with and without guidance (see online supplemental table 5), we observed that the presence of human support can significantly reduce dropout rates, sometimes by as much as 30%–40%.[8] This provides preliminary evidence supporting the positive role of guidance in lowering dropout rates and improving patient adherence. In subgroup analyses targeting different mental disorders, regardless of the disease type, evidence suggests that interventions with guidance conditions generally yield more favourable overall treatment outcomes compared with those without guidance. However, the effectiveness of intervention measures is not solely determined by patient compliance but by many factors, such as the pathophysiological characteristics of patients, baseline disease status and intervention methods.

The overall quality of included evidence for most research outcomes was rated relatively low, mainly due to the methodological challenges intrinsic to IBIs. The remote delivery and self-administered nature of these interventions make it challenging to adhere strictly to RCT protocols, particularly regarding maintaining full blinding. These challenges affect the assessment of evidence quality and lead to lower ratings. In addition, the significant heterogeneity among studies led to a downgrade of the strength of evidence. To explore this heterogeneity, we conducted a detailed subgroup analysis based on different conditions, aiming to reveal the differentiated therapeutic effects of IBI under various conditions.

Notably, the subgroup analysis indicated that IBIs had a greater impact on severe depression (moderate effect size) than on mild depression (small effect size), possibly because individuals with severe depression may prioritise and adhere more closely to treatment regimens.[34] Regrettably, severity-based distinctions were lacking in MAs focusing on other mental health conditions.

Growing evidence supports the notable effectiveness of guided IBIs,[54] as evidenced by this umbrella review's subgroup analysis, which confirms that guided interventions consistently outperform outcomes for unguided ones. Such guidance typically includes regular progress tracking and timely adjustments based on feedback often facilitated via email, interactive apps, online therapy platforms, virtual communities and forums. Further exploration and optimisation of these support strategies could greatly enhance the precision and effectiveness of IBIs in catering to individual patient needs.

Moreover, ICBT often exhibits comparative or even superior therapeutic effects compared with traditional psychotherapies. The National Institute for Health and Clinical Excellence has recommended it for Health and Clinical Excellence as a first-line treatment for anxiety.[55] Additionally, an umbrella review has confirmed its equivalence to FTF treatment.[54]

In conclusion, while IBI has made positive strides in mental health treatment, its effectiveness and acceptability

remain closely linked to the type of disorder, the severity of illness, treatment goals, personalisation of intervention methods and the availability of appropriate professional support. Therefore, when advancing the application of IBI, it is crucial to fully consider the uniqueness of each mental disorder and incorporate comprehensive and personalised treatment strategies to achieve optimal therapeutic outcomes.

Several limitations of this umbrella review warrant discussion, as they have implications for interpreting the aggregated evidence. First, this review made a binary distinction between IBIs with guidance and those without, without considering the nature or frequency of the guidance provided. This distinction is noteworthy, as the guidance can vary substantially, and there are also disparities in the qualifications and training of individuals who offer such guidance. Second, including results from different studies that employed diverse measurement scales may increase the risk of bias. Third, when evaluating psychological interventions for OCD and personality disorders, only one MA was available. Regarding evidence quality and research methodology, the quality rating for personality disorders is high, but the credibility evidence rating is moderate. In addition, although research on OCD has received a high-quality rating, the evidence rating is relatively low, revealing that current research evidence is not sufficient to strongly support the significant advantages of IBI over other intervention methods in the treatment of OCD. Last, our subgroup analysis was limited to seven treatment methods, as the included MAs did not distinguish the effectiveness of different treatment approaches, which constrained our further data processing.

Despite these limitations, the findings from this comprehensive umbrella review have significant implications for clinical practice. Although translating evidence into practice remains complex, the current review offers actionable insights. To begin with, our results underscore the effectiveness of IBIs, especially ICBT, in treating certain mental health conditions such as anxiety and PTSD. Given that these interventions can be delivered digitally, expanding the capabilities of healthcare providers to administer and support such treatments might be a potent implementation strategy.[3 19] This can be instrumental in ensuring that IBIs are implemented sustainably, ethically and with sufficient quality.[56] Furthermore, in keeping with local cultures and traditions, programmes to foster cooperation between specialist mental health providers and community care providers could be developed to enhance access to mental healthcare.[57] However, the research on using telemedicine in mental healthcare settings within communities is limited.[58] Our findings also call for a responsive approach to addressing a broad range of mental health conditions. The umbrella review demonstrates that IBIs can be effective for several mental health disorders. Therefore, these interventions could be integrated into mental health programmes in diverse settings, including regions affected by humanitarian crises, where such resources are often lacking.[59] Overall, our analysis confirms that IBIs are effective treatments with high levels of patient satisfaction. Lastly, despite promising results, the review also highlights the need for caution. The relatively high dropout rates in IBIs require attention, and further research is needed to address this challenge and ensure the effective and sustainable implementation of these interventions. This includes research into the optimal frequency and type of guidance for patients using IBIs to optimise adherence and outcomes.

CONCLUSION

In summary, the results from this review signify that IBIs can substantially mitigate a broad spectrum of mental health issues, with particular effectiveness noted in treating anxiety disorders and PTSD. These findings underscore the potential utility of IBIs as an effective intervention for individuals grappling with these mental health problems. We will continue to focus on the most recent research to refine and update this umbrella review.

Our analysis also revealed that guided IBIs tend to outperform their unguided counterparts in effectiveness. Specifically, ICBT has demonstrated the most optimal therapeutic outcomes, exceeding other forms of psychological therapies. Notwithstanding these positive findings, it is necessary to contemplate the effectiveness of IBIs in the context of the relatively high dropout rates observed among participants during treatment.

The future trajectory of IBIs points towards more technologically advanced, accessible and secure delivery modes. Anticipations are high that artificial intelligence and machine learning will increasingly assume central roles in customising treatments to individual needs and forecasting therapeutic outcomes. In essence, the future of IBI research appears to be headed towards a model of mental healthcare delivery that is more personalised, evidence-based and secure.

Contributors MZ designed the study and drafted the manuscript. MZ, LM, HW, ZZ, LY, FC, WW and CF contributed to the database preparation and double-checking. MZ, LM, HW and CF did the data analyses. XL designed the study and revised the manuscript. All authors commented on and approved the draft and final manuscripts.

Funding This work was supported by Anhui Province University Scientific Research Projects (2023AH040086) and Key Laboratory of Philosophy and Social Science of Anhui Province on Adolescent Mental Health and Crisis Intelligence Intervention (SYS2023B08).

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iD
Xiaoming Li http://orcid.org/0000-0002-5228-1372

REFERENCES

1 Zhou Y, Bai Z, Wu W, *et al*. Impacts of internet-based interventions for veterans with PTSD: a systematic review and meta-analysis. *Front Psychol* 2021;12:711652.
2 Hanach N, de Vries N, Radwan H, *et al*. The effectiveness of telemedicine interventions, delivered exclusively during the postnatal period, on postpartum depression in mothers without history or existing mental disorders: a systematic review and meta-analysis. *Midwifery* 2021;94:102906.
3 Marks IM, Cavanagh K, Gega L. Computer-aided psychotherapy: revolution or bubble? *Br J Psychiatry* 2007;191:471–3.
4 Proudfoot J, Klein B, Barak A, *et al*. Establishing guidelines for executing and reporting internet intervention research. *Cogn Behav Ther* 2011;40:82–97.
5 Mohr DC, Siddique J, Ho J, *et al*. Interest in behavioral and psychological treatments delivered face-to-face, by telephone, and by internet. *Ann Behav Med* 2010;40:89–98.
6 Lau Y, Cheng JY, Wong SH, *et al*. Effectiveness of digital psychotherapeutic intervention among perinatal women: a systematic review and meta-analysis of randomized controlled trials. *World J Psychiatry* 2021;11:133–52.
7 Josephine K, Josefine L, Philipp D, *et al*. Internet- and mobile-based depression interventions for people with diagnosed depression: a systematic review and meta-analysis. *J Affect Disord* 2017;223:28–40.
8 Richards D, Richardson T. Computer-based psychological treatments for depression: a systematic review and meta-analysis. *Clin Psychol Rev* 2012;32:329–42.
9 Arnberg FK, Linton SJ, Hultcrantz M, *et al*. Internet-delivered psychological treatments for mood and anxiety disorders: a systematic review of their efficacy, safety, and cost-effectiveness. *PLoS One* 2014;9:e98118.
10 Olthuis JV, Watt MC, Bailey K, *et al*. Therapist-supported internet cognitive behavioural therapy for anxiety disorders in adults. *Cochrane Database Syst Rev* 2016;3:CD011565.
11 Sloan DM, Gallagher MW, Feinstein BA, *et al*. Efficacy of telehealth treatments for posttraumatic stress-related symptoms: a meta-analysis. *Cogn Behav Ther* 2011;40:111–25.
12 Steubl L, Sachser C, Baumeister H, *et al*. Mechanisms of change in internet- and mobile-based interventions for PTSD: a systematic review and meta-analysis. *Eur J Psychotraumatol* 2021;12:1879551.
13 Sagoe D, Griffiths MD, Erevik EK, *et al*. Internet-based treatment of gambling problems: a systematic review and meta-analysis of randomized controlled trials. *J Behav Addict* 2021;10:546–65.
14 Beneria A, Santesteban-Echarri O, Daigre C, *et al*. Online interventions for cannabis use among adolescents and young adults: systematic review and meta-analysis. *Early Interv Psychiatry* 2022;16:821–44.
15 Imai H, Tajika A, Narita H, *et al*. Unguided computer-assisted self-help interventions without human contact in patients with obsessive-compulsive disorder. *J Med Internet Res* 2022;24:e35940.
16 Ilagan GS, Iliakis EA, Wilks CR, *et al*. Smartphone applications targeting borderline personality disorder symptoms: a systematic review and meta-analysis. *Bord Pers Disord Emot Dysregul* 2020;7:12.
17 Büscher R, Torok M, Terhorst Y, *et al*. Internet-based cognitive behavioral therapy to reduce suicidal ideation: a systematic review and meta-analysis. *JAMA Netw Open* 2020;3:e203933.
18 Torok M, Han J, Baker S, *et al*. Suicide prevention using self-guided digital interventions: a systematic review and meta-analysis of randomised controlled trials. *Lancet Digit Health* 2020;2:e25–36.
19 van Gemert-Pijnen JEWC, Nijland N, van Limburg M, *et al*. A holistic framework to improve the uptake and impact of eHealth technologies. *J Med Internet Res* 2011;13:e111.
20 Karyotaki E, Efthimiou O, Miguel C, *et al*. Individual patient data M-A: internet-based cognitive behavioral therapy for depression a systematic review and individual patient data network meta-analysis. *JAMA Psychiatry* 2021;78:361–71.
21 Sommers-Spijkerman M, Austin J, Bohlmeijer E, *et al*. New evidence in the booming field of online mindfulness: an updated meta-analysis of randomized controlled trials. *JMIR Ment Health* 2021;8:e28168.
22 Ortega A, Lopez-Briz E, Fraga-Fuentes MD. From qualitative reviews to umbrella reviews. In: Biondi-Zoccai G, ed. *Umbrella reviews: evidence synthesis with overviews of reviews and meta-epidemiologic studies*. Cham: Springer International Publishing, 2016: 21–41.
23 Barak A, Klein B, Proudfoot JG. Defining internet-supported therapeutic interventions. *Ann Behav Med* 2009;38:4–17.
24 Correll CU, Cortese S, Croatto G, *et al*. Efficacy and acceptability of pharmacological, psychosocial, and brain stimulation interventions in children and adolescents with mental disorders: an umbrella review. *World Psychiatry* 2021;20:244–75.
25 Aromataris E, Fernandez R, Godfrey CM, *et al*. Summarizing systematic reviews: methodological development, conduct and reporting of an umbrella review approach. *Int J Evid Based Healthc* 2015;13:132–40.
26 Liu HX, Hu DH, Yin HQ. Umbrella review - a new method related to evidence-based medical analysis. *Zhonghua Liu Xing Bing Xue Za Zhi* 2020;41:261–6.
27 Shea BJ, Grimshaw JM, Wells GA, *et al*. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. *BMC Med Res Methodol* 2007;7:10.
28 Guyatt GH, Oxman AD, Vist GE, *et al*. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ* 2008;336:924–6.
29 Guyatt G, Oxman AD, Akl EA, *et al*. GRADE guidelines: 1. Introduction-GRADE evidence profiles and summary of findings tables. *J Clin Epidemiol* 2011;64:383–94.
30 Leichsenring F, Steinert C, Rabung S, *et al*. The efficacy of psychotherapies and pharmacotherapies for mental disorders in adults: an umbrella review and meta-analytic evaluation of recent meta-analyses. *World Psychiatry* 2022;21:133–45.
31 Cohen J. Statistical power analysis for the behavioral sciences. *Comput Environ Urban Syst* 1990;14:71.
32 Wahle F, Bollhalder L, Kowatsch T, *et al*. Toward the design of evidence-based mental health information systems for people with depression: a systematic literature review and meta-analysis. *J Med Internet Res* 2017;19:e191.
33 van Ballegooijen W, Cuijpers P, van Straten A, *et al*. Adherence to internet-based and face-to-face cognitive behavioural therapy for depression: a meta-analysis. *PLoS One* 2014;9:e100674.
34 Pang Y, Zhang X, Gao R, *et al*. Efficacy of web-based self-management interventions for depressive symptoms: a meta-analysis of randomized controlled trials. *BMC Psychiatry* 2021;21:398.
35 Keller MB. Past, present, and future directions for defining optimal treatment outcome in depression: remission and beyond. *JAMA* 2003;289:3152–60.
36 Rush AJ, Kraemer HC, Sackeim HA, *et al*. Report by the ACNP task force on response and remission in major depressive disorder. *Neuropsychopharmacology* 2006;31:1841–53.
37 Karyotaki E, Ebert DD, Donkin L, *et al*. Do guided internet-based interventions result in clinically relevant changes for patients with depression? An individual participant data meta-analysis. *Clin Psychol Rev* 2018;63:80–92.
38 Zuelke AE, Luppa M, Löbner M, *et al*. Effectiveness and feasibility of internet-based interventions for grief after bereavement: systematic review and meta-analysis. *JMIR Ment Health* 2021;8:e29661.
39 Pauley D, Cuijpers P, Papola D, *et al*. Two decades of digital interventions for anxiety disorders: a systematic review and meta-analysis of treatment effectiveness. *Psychol Med* 2023;53:567–79.
40 Domhardt M, Letsch J, Kybelka J, *et al*. Are internet- and mobile-based interventions effective in adults with diagnosed panic disorder and/or agoraphobia? A systematic review and meta-analysis. *J Affect Disord* 2020;276:169–82.
41 Stech EP, Lim J, Upton EL, *et al*. Internet-delivered cognitive behavioral therapy for panic disorder with or without agoraphobia: a systematic review and meta-analysis. *Cogn Behav Ther* 2020;49:270–93.
42 Ye X, Bapuji SB, Winters SE, *et al*. Effectiveness of internet-based interventions for children, youth, and young adults with anxiety and/or depression: a systematic review and meta-analysis. *BMC Health Serv Res* 2014;14:313.
43 Riper H, Spek V, Boon B, *et al*. Effectiveness of E-self-help interventions for curbing adult problem drinking: a meta-analysis. *J Med Internet Res* 2011;13:e42.
44 Büscher R, Beisemann M, Doebler P, *et al*. Digital cognitive-behavioural therapy to reduce suicidal ideation and behaviours: a systematic review and meta-analysis of individual participant data. *Evid Based Mental Health* 2022;25:e8–17.

45 Heber E, Ebert DD, Lehr D, *et al*. The benefit of web- and computer-based interventions for stress: a systematic review and meta-analysis. *J Med Internet Res* 2017;19:e32.
46 Pots WTM, Fledderus M, Meulenbeek PAM, *et al*. Acceptance and commitment therapy as a web-based intervention for depressive symptoms: randomised controlled trial. *Br J Psychiatry* 2016;208:69–77.
47 Liu RT, Walsh RFL, Sheehan AE, *et al*. Prevalence and correlates of suicide and nonsuicidal self-injury in children: a systematic review and meta-analysis. *JAMA Psychiatry* 2022;79:718–26.
48 de Beurs D, Bockting C, Kerkhof A, *et al*. A network perspective on suicidal behavior: understanding suicidality as a complex system. *Suicide Life Threat Behav* 2021;51:115–26.
49 Bachmann S. Epidemiology of suicide and the psychiatric perspective. *Int J Environ Res Public Health* 2018;15:1425.
50 Yau YHC, Potenza MN. Gambling disorder and other behavioral addictions: recognition and treatment. *Harv Rev Psychiatry* 2015;23:134–46.
51 Leichsenring F, Rabung S. Long-term psychodynamic psychotherapy in complex mental disorders: update of a meta-analysis. *Br J Psychiatry* 2011;199:15–22.
52 Leichsenring F, Fonagy P, Heim N, *et al*. Borderline personality disorder: a comprehensive review of diagnosis and clinical presentation, etiology, treatment, and current controversies. *World Psychiatry* 2024;23:4–25.
53 Andersson G, Cuijpers P. Internet-based and other computerized psychological treatments for adult depression: a meta-analysis. *Cogn Behav Ther* 2009;38:196–205.
54 Andersson G, Carlbring P, Titov N, *et al*. Internet interventions for adults with anxiety and mood disorders: a narrative umbrella review of recent meta-analyses. *Can J Psychiatry* 2019;64:465–70.
55 Twomey C, O'Reilly G, Byrne M. Computerised cognitive behavioural therapy: helping Ireland log on. *Ir J Psychol Med* 2013;30:29–56.
56 Lorente-Català R, Gili M, López-Del-Hoyo Y, *et al*. Implementation of a psychological online intervention for low to moderate depression in primary care: study protocol. *Internet Interv* 2022;30:100581.
57 Segal SP, Badran L, Rimes L. Accessing acute medical care to protect health: the utility of community treatment orders. *Gen Psychiatr* 2022;35:e100858.
58 Chang JE, Lai AY, Gupta A, *et al*. Rapid transition to telehealth and the digital divide: implications for primary care access and equity in a post-COVID era. *Milbank Q* 2021;99:340–68.
59 Cai C, Yin C, Tong Y, *et al*. Development of the life gatekeeper suicide prevention training programme in china: a delphi study. *Gen Psychiatr* 2023;36:e101133.

Mi Zhang is currently a master's degree candidate in the Department of Medical Psychology at the School of Mental Health and Psychological Science, Anhui Medical University, China. Her main research interests include psychological counselling and intervention strategies for mental disorders, as well as the neuro-mechanisms of hypnosis.