Abstract

Background

Cognitive Behavioural Therapy (CBT) has been proven to be effective for anxiety and depression in children and young people (CYP). Over the past 20 years there have been several attempts at delivering CBT through apps, online software, videogames, but also with a therapist via phone or videoconferencing platforms, with promising results for the "technology-assisted" versions. However, most research, have compared online CBT to waiting lists, and not many studies looked at the effectiveness of face-to-face (f2f) CBT vs technology-assisted CBT.

Methods

Adopting the PRISMA guidelines, we evaluated 1849 citations and identified 10 eligible studies. Studies were identified through the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, PubMed/MEDLINE, Web of Science, and Scopus.

Results

Ten studies met our inclusion criteria. The studies included a variety of technology-assisted forms of CBT, including videoconferencing and online CBT. Of these, seven looked at the effectiveness of technology-assisted CBT for anxiety in CYP, and seven looked at depression. The meta-analyses had low heterogeneity and showed that technology-assisted CBT was non-inferior to f2f CBT for anxiety and depression in CYP (d=0.06 and 0.12 respectively).

Conclusions

Technology-assisted CBT may be a valid alternative for the treatment of anxiety and depression in CYP. Future studies should consider what specific delivery modalities are most cost-effective.

Introduction

Cognitive behavioural therapy (CBT) focuses on the relationship between thoughts, emotions and behaviours. It is a directive, time-limited, and structured approach based on the cognitive model of mental illness developed in the 60s (Beck, 1970). It is currently the most widely researched psychotherapeutic approach, and its strong evidence base is reflected in national clinical guidelines, which recommend it as a treatment for many common mental health disorders in a variety of clinical populations (NICE, 2013, 2020, 2022). There is a plethora of evidence that shows that group and individual CBT represents an effective psychological treatment for a range of difficulties, including anxiety disorders and depression in children and young people (Cartwright-Hatton et al., 2004; James et al., 2020; Oud et al., 2019).

Due to its structured nature, CBT has been subject to several adaptations over the course of the years, which included CBT implemented or delivered with the use of technology, such as computerised CBT, internet-assisted CBT, CBT delivered via telephone or videoconferencing software, CBT apps and videogames (Donker et al., 2019; Matsumoto et al., 2021; Schuurmans et al., 2015). For present purposes, these adapted versions will be referred to as "technology-assisted CBT". The use of digital technologies in mental health may have several advantages such as potentially increasing access for difficult-to-reach populations (Aboujaoude & Salame, 2016; Emily, 2016) Additionally, when carefully designed, technological interventions may be more appealing or accessible for young users, thus improving adherence, an important predictor of clinical outcomes (Wozney et al., 2017).

Some of these technology-assisted alternatives to traditional CBT have often been proven to be feasible in the adult population (Kinderman et al., 2016; Steel et al., 2011) as well as in the paediatric population (Babiano-Espinosa et al., 2019). In terms of effectiveness, two previous meta-analyses (Andersson et al., 2014; Carlbring et al., 2018) showed that guided internet-based and internet-based CBT produce equivalent overall effects to f2f CBT in treating psychiatric and somatic conditions in adults.

There have been a number of studies that have suggested that technology-assisted CBT interventions may be clinically effective in CYP as well. However, most of these studies, including existing meta-analyses did not compare technology-assisted CBT to f2f CBT specifically, but a variety of conditions in the control arm, including waitlist (Ebert et al., 2015; Higinbotham et al., 2020; Pennant et al., 2015; Smith et al., 2015;

Vigerland et al., 2016; Wickersham et al., 2022) . This is important because comparing an intervention to a waitlist control may potentially inflate effect estimates in intervention studies (Cunningham et al., 2013; Hart et al., 2008). A systematic review on this topic is particularly relevant now, where over two years of global pandemic with consequent increase in MH difficulties in CYP may have stimulated research on the topic. Indeed, most of the studies in the above-mentioned reviews were completed in the pre-pandemic period. To our knowledge, there has only been one recent meta-analysis that compared the effectiveness of technology-assisted CBT vs f2f CBT for anxiety and depression in CYP is (Howes et al., 2021). However, their search was limited to 30th May 2021, and authors did not include studies where patients were younger than 10. Our study should build on this by providing more up-to-date evidence and including younger children.

The aim of the present study is to conduct an up-to-date systematic review and meta-analysis on the effectiveness of technology-assisted CBT vs f2f CBT for anxiety and depression in CYP. There are several reasons why this study is important at the present moment. First, anxiety and depression are some of the most common mental health problems experienced by CYP, and these conditions have been significantly exacerbated by the COVID-19 pandemic (Bevilacqua et al., 2023). As such, it is important to continue to learn what approaches and treatment modalities are effective for this population. Second, as a consequence of the mental health crisis associated with the COVID-19 pandemic, mental health services have suffered a concerning workload increase and are struggling to provide the care and support that CYP need (Zangani et al., 2022). Therefore, it is of crucial importance to investigate whether there are more efficient ways to respond to the rising demands for mental health care. One of these ways may be represented by more accessible and flexible alternatives to f2f therapy, such as technology-assisted forms of CBT. The results of the present meta-analysis may help guide clinicians and policy makers to improve mental health service provision for CYP.

Method

The present systematic review and meta-analysis was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (Page et al., 2021) and was pre-

registered on PROSPERO (CRD42023390247). We ran a search through multiple scientific databases including the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, PubMed/MEDLINE, Web of Science, and Scopus. The complete search strategy was run on the 1st of November 2023, and it is shown below:

(computer cognitive behavi* therapy OR technology* cognitive behavi* therapy OR online cognitive behavi* therapy) AND (Anxiety OR depression) AND (children or adolescents or youth or child or teenager) AND trial*

Literature database age delimiters were applied to target the central inclusion criterion of young people aged 0–19 (studies which included slightly older participants were accepted as long as they still included adolescents). The studies were evaluated against our inclusion criteria. These were:

- The study design had to be a randomised control trial;
- The intervention group had to include a form of technology-assisted CBT (including but not limited to CBT delivered via telephone, videoconferencing and/or any other platform other than f2f, online CBT, or CBT-derived app or videogame);
- If more than two control groups were present (e.g., online CBT vs waitlist control vs and f2f CBT) then the study had to include data (e.g., mean and standard deviation at post treatment) that allowed for a formal comparison between the intervention group and the f2f CBT group.
- The outcomes had to include anxiety and/or depression (measured by standardised instruments and/or clinical diagnosis);
- Age range of participants in both control and intervention arms had to be 18 or below;
- Only articles in English were included;

The bibliographies and authors of eligible studies were then snowball-searched for additional eligible papers (including previous systematic reviews that may have included relevant studies). The study selection process, cross-validated by five cooperating reviewers, first screened studies based upon their titles and abstracts, and then screened studies based upon a review of full manuscripts. At least two reviewers screened each study. Discrepancies were discussed and, where possible, resolved by consensus after

referring to the protocol; if necessary a third reviewer was consulted. A PRISMA flow-chart outlining the study selection process is displayed in Figure 1.

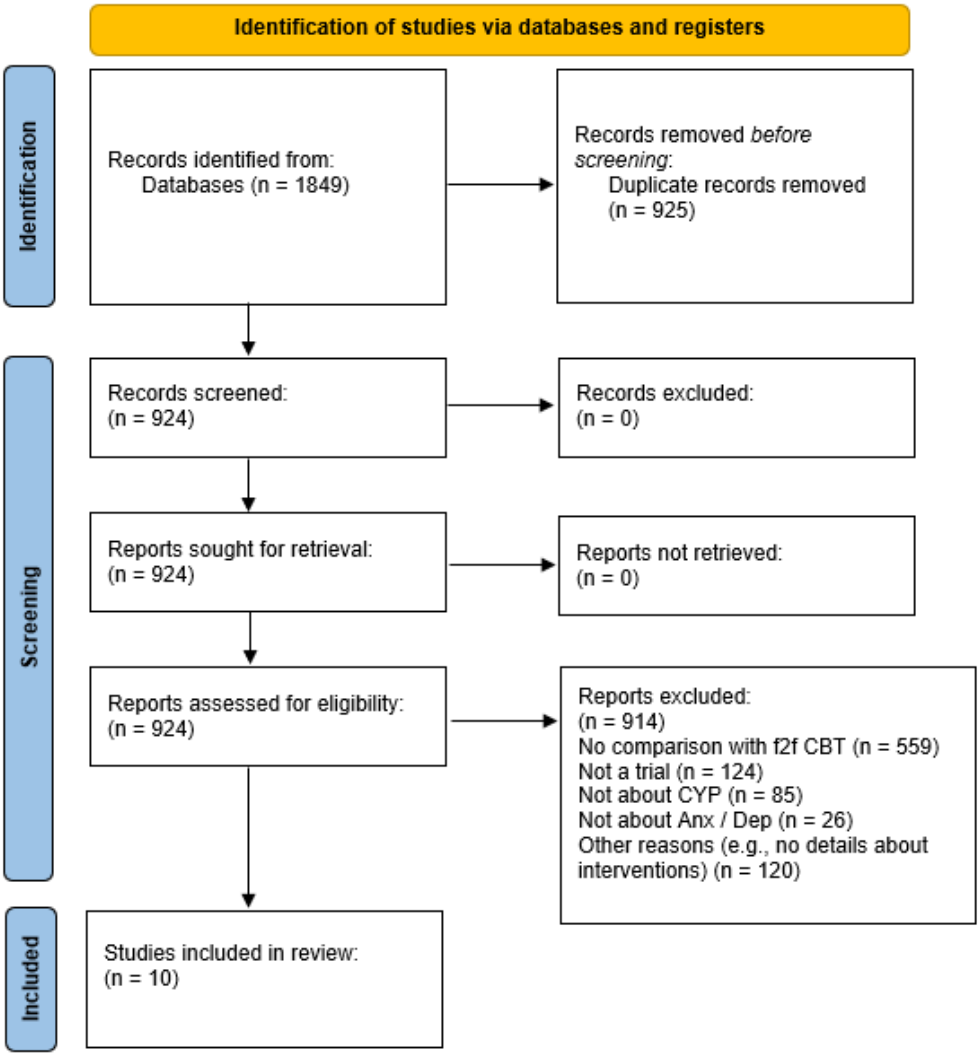

Figure 1. PRISMA flow chart

The following variables were extracted for each study: country where the study was conducted, age range of the participants (with males and females count or percentage where possible), total sample size, details of the intervention delivered in the intervention and control arm, list of outcome measures, mean and standard deviation of outcome measures at baseline and endline (intervention arm), and mean and standard deviation of outcome measures at baseline and end line (control arm). Study authors were contacted where the necessary information was not available in the manuscript.

The quality of the trials included was assessed using an adapted version of a tool developed to assess the methodological validity of trials evaluating psychological interventions (Cuijpers et al., 2010) and taking into account the criteria listed by the Cochrane Collaboration (Chambless & Hollon, 1998; Higgins et al., 2019). Based on the original paper, below there is a list of adapted criteria used for the rating process. A study was considered to be of high quality when the authors reported that (1) participants met diagnostic criteria for an anxiety disorder or depression as assessed with a diagnostic tool, based on a diagnostic system such as DSM or ICD; (2) a treatment manual was used (i.e., published manual, or specifically designed for the study); (3) therapists were trained for the specific psychological intervention or had sufficient prior experience with the specific psychological intervention; (4) treatment integrity was checked during the study either by regular supervision during the treatment phase and/or by independent protocol adherence ratings (e.g., statistical analysis of quantitative fidelity measures); (5) relevant data were analysed and reported with intention-to-treat (ITT) analyses; (6) included at least 50 participants in the comparison between treatment and control groups; (7) randomisation was conducted by an independent party (e.g., independent person, computer programme, or sealed envelopes); (8) outcome assessors were blinded to treatment allocation (when only self-reports were used, it was assumed that this criterion was met). If a publication reported that ITT analyses were performed but only completer results were reported, we rated this item as low quality. Generally, when no or insufficient information was provided concerning a quality criterion, we rated it as negative. A study is considered of high quality when all criteria are met.

Table 1. Quality ratings for all studies included.

	Q1. Anx / Dep diagnosis	Q2. Treatment manual	Q3. Therapist training	Q4. Treatment integrity checks	Q5. ITT analysis	Q6. Statistical power	Q7. Random group allocation	Q8. Blind outcome assessments	**Q sum score 0-8**
Aspvall et al., 2021	1	1	1	0	0	1	0	1	**5**
Khanna & Kendall., 2010	1	1	0	1	0	0	1	0	**5**
Martinez et al., 2019	1	1	0	1	1	1	1	1	**7**
Nelson et al., 2003	1	0	0	1	1	0	1	1	**5**
Poppelaars et al., 2016	0	1	1	0	1	1	1	1	**6**
Sethi et al; 2010	0	1	0	1	1	0	1	0	**4**
Spence et al., 2006	1	1	1	1	1	1	1	0	**7**
Spence et al., 2011	1	1	1	1	1	1	1	1	**8**
Sportel et al., 2013	1	1	0	1	0	1	1	1	**6**
Turner et al., 2014	1	1	1	1	1	1	1	1	**8**

Two random effects meta-analyses (one for anxiety and one for depression) were run to obtain standardised mean differences between the intervention and control group at earliest follow-up (or endline). To do this, M and SD at the endline for the intervention and control arm of each study were extracted. Data were analysed using the *metafor* package (Vibhakar et al., 2019) in R. Some studies employed multiple outcome measures for the same construct (anxiety and depression) and to keep levels of heterogeneity low, the outcome measure that was most commonly used across studies was selected (separately for anxiety and depression). Given that not all studies made use of the same outcome measure, a choice was made to give priority to clinical/diagnostic measures, followed by self-report or parent-reported questionnaires. This is because the present research has a clinical focus, and diagnostic measures offer a better discriminatory

power over research measures in recognising clinically significant levels of anxiety and depression. Where possible, we used continuous data in order to maximise the information used to run the meta-analyses.

Random-effects meta-analyses were run to compute pooled effect sizes (Cohen's d) and confidence intervals. Past research indicates that random-effects models are more conservative and should be preferred over fixed-effects models as it allows for calculation of measures of heterogeneity (Cochran's Q) across studies (Sedgwick, 2015) for each meta-analysis (Hunter & Schmidt, 2000). To test for significant differences in effect sizes across groups, an observation on whether the confidence intervals overlapped was carried out (where non-overlap was interpreted as a significant difference between effect sizes). This is considered a stringent method and provides a conservative estimate of significant differences (Schenker & Gentleman, 2001). A publication bias analysis was not deemed appropriate as we only included 7 studies in each meta-analysis.

Results

A total of ten studies met criteria for inclusion in the meta-analysis. Seven studies included measures of anxiety or anxiety disorders and seven included measures of depression. For what concerns the anxiety tools employed in the different trials, two studies made use of the CY-BOCS (Goodman et al., 1991), three made use of the ADIS-P (Silverman & Albano, 1996), one made use of the STAI (Spielberger et al., 1973), and one made use of the anxiety score of the DASS-21 (Lovibond & Lovibond, 1995). We note that OCD is not classified as an anxiety disorder in the DSM-5, but we included it due to its relevance within the context of a global pandemic. For depression, three studies made use of the CDI, two made use of the BDI (Beck et al., 1961), one made use of the RADS-2 (Reynolds, 2004) and one made of the depression score of the DASS-21. The above are all validated and widely used measures of anxiety and depression. The trials were, for the most part, relatively small, with their total analytic samples ranging from 9–108 per arm across anxiety and depression.

For what concerns the control arms, one study included group CBT, two studies included school CBT, one study included parent and child CBT, and three included individual CBT. Duration ranged from 3 to 16 weeks (5 to 16 sessions). For what concerns the intervention arm, one study included CBT via videoconferencing, one included therapist-guided computerised CBT, five included an internet-delivered CBT programme, one included telephone-delivered CBT, one included internet-delivered CBT training on cognitive bias modification (CBM). The descriptive characteristics of the included trials are presented in table 2.

Table 2. Characteristics of all studies included

Author/year	Country	Age range	Sample size	Intervention arm	Control arm	Outcome measures	INTERVENTION Baseline M SD	INTERVENTION Endline M SD	CONTROL Baseline M SD	CONTROL Endline M SD
Nelson et al., 2003	USA	8-14, M=10.3	28 (20 males)	8 weeks, video-conferencing CBT with child and parent	8 weeks, f2f CBT with child and parent	Depression: **CDI**	14.36 (9.85)	6.71 (4.78)	13.57 (8.75)	11.64 (11.63)
Martinez et al., 2019	Chile	15-19, M= 16.2	216 (51 males)	8 weeks, therapist-guided Ccbt (YPSA-M)	Enhanced usual care intervention which included a brief cognitive behavioral or interpersonal-based interventions	Depression: **BDI**	25.7 (8.5)	13.2 (9.4)- 4 months; 12.0 (9.2)- 6 months	**25.5** (7.9)	**4** months: 17.1 (10.2); 6 months : 14.7 (9.9)
Aspvall et al., 2021	Sweden	07 -17, M=13.4	152 (58 males)	Stepped care: internet-delivered CBT for 16 weeks	F2f CBT for 16 weeks	OCD: **CY-BOCS** score	23.9 (3.6)	13.6 (5.9) - post-treatment 13.6 (6.7) - 3mts follow-up 11.6 (6.4) - 6 mts follow-up	23.0 (3.7)	12.8 (7.1) - post-treatment 11.8 (7.1) - 3mts follow-up 10.6 (7.6) - 6 mts follow-up
Khanna and Kendall., 2010	USA	7–13, M= 10.1	49 (33 males)	Camp Cope-A-Lot (CCAL): 12-session computer-assisted intervention based on CBT;	Individual Cognitive Behavioral Therapy (ICBT): twelve 50-min individual CBT sessions over 12 weeks	Anxiety: **ADIS-P**, CGAS, MASC; Depression: **CDI**	CCAL: **ADIS-P** 5.7 (0.87), CGAS 53,8 (7.5), MASC 50.5 (12.8), **CDI** 27.2 (4.4);	CCAL: **ADIS-P** 2.9 (1.0), CGAS 68.2 (7.0), MASC 35.2 (12.3), **CDI** 21.3 (10.7);	**ADIS-P** 5.8 (1.2), CGAS 54.1 (12.1), MASC 48.9 (14.5), **CDI** 25.2 (8.3)	**ADIS-P** 3.1 (1.6), CGAS 69.9 (7.7), MASC 35.8 (13.1), **CDI** 22.7 (9.1)
Poppelaars et al., 2016	Netherlands	11-16, M=13.35	208 (50 in SPARX and 50 in OVK)	SPARX	OVK (school-based CBT)	Depression: **RADS-2**	69.33 (8.37)	57.88 (12.57**)**	66.94 (7.09)	59.33 (13.27)

Sethi et al; 2010	Australia	15-25, M=19.47	38 (25 females & 13 males)	5 sessions over 3 weeks of online CBT	5 sessions over 3 weeks of f2f CBT	Depression Anxiety Stress Scale **(DASS-21)**; Kessler Psychological Distress Scale (K10); ATQ 30	**Dep** 16.4 (9.2); **Anx** 11.1 (9); K10 23.5 (8.1); ATQT 77.6 (28.1)	**Dep** 15.7 (4.2); **Anx** 8.6 (4.1); K10 17.8 (5.9); ATQT 68.2 (17.4)	**Dep** 19.8 (5.1); **Anx** 12.2 (5.9); K10 19.3 (4.9); ATQ 90.6 (10.8)	**Dep** 7.2 (3.1); **Anx** 8 (3.2); K10 13.8 (2.4); ATQ 59.5 (8.7)
Turner et al; 2014	UK	11-18, M= 14.5	72 (38 males)	14 sessions of TCBT	14 sessions of f2f CBT	OCD: **CY-BOCS**; Depression: **BDI-Y**;	**CY-BOCS** 25.64 (3.86); **BDI-Y** 14.58 (8.73);	**CY-BOCS** 12.99 (8.56); **BDI-Y** 11.08 (11.28);	**CY-BOCS** 24.11 (4.2); **BDI-Y** 14.44 (8.77);	**CY-BOCS** 11.72 (7.06); **BDI-Y** 10.98 (10.16);
Sportel et al., 2013	Netherlands	12-15 years	240 Intervention = 86 Control = 84 (66 males)	20 session Internet-based Cognitive Bias Modification (CBM)	10 session at school group CBT with homework	RCADS social phobia, **STAI**, Single target Automatic Threat-related Associations	RCADS 13.64 (4.95); **STAI** 41.09 (13.94); stIAT -0.02 (0.35)	RCADS 11.34 (5.42); **STAI** 35.51 (11.47); stIAT -0.01 (0.27)	RCADS 13.11(4.26); **STAI** 41.82 (13.28); stIAT -0.03 (0.29)	RCADS 12.35 (4.84); **STAI** 34.76 (10.82); stIAT -0.11 (0.29)
Spence et al., 2006	Australia	7-14 (M = 9.93, SD = 1.74)	72	CBT clinic partly delivered via the Internet. Same as clinic but 50% delivered online	Clinic based treatment (10 group child sessions and 6 group parent sessions) for 60 minutes weekly	**ADIS-P**; **CDI;** SCAS-C; SCAS-P;	**ADIS-P** 5.81 (0.96); SCAS-C 41.30(21.22); RCMAS T 53.70 (13.35); **CDI** T 55.07 (12.79); SCAS-P 31.67(9.42); CBCL-Int T 67.85(8.86)	**ADIS-P** 2.40 (2.20); SCAS-C 27.25(16.82); RCMAS T 45.33(13.48); **CDI** T 46.96 (10.52); SCAS-P 21.02(12.12); CBCL-Int T 61.36(8.62)	**ADIS-P** 6.00 (1.02); SCAS-C 32.14(14.49); RCMAS T 52.43 (9.67); **CDI** T 48.45(6.97); SCAS-P 34.82(8.48); CBCL-Int T 67.07 (7.65)	**ADIS-P** 2.00 (2.34); SCAS-C 22.25(11.72); RCMAS T 41.00 (8.00); **CDI** T 42.50 (4.31); SCAS-P 19.53 (7.91); CBCL-Int T 56.89(10.12)
Spence et al., 2011	Australia	12-18 (M=13.98, SD=1.63)	115	BRAVE for teenagers online (12 weeks)	BRAVE clinic manualised for teenagers online (12 weeks)	**(ADIS-P)**	**ADIS-P** 5.91 SE (0.13)	**ADIS-P** 3.85 SE(0.29)	**ADIS-P** 6.30 SE(0.13)	**ADIS-P** 4.08 SE(0.29)

Footnote: ADIS-C/P, Anxiety Disorders Interview Scale (child & parent); ATQ30, Automatic Thoughts Questionnaire; BDI, Beck Depression Inventory; CDI, Children's Depression Inventory; CY-BOCS, Children's Yale-Brown Obsessive Compulsive Scale; DASS-21, Depression Anxiety Distress Scale; K-SADS, Kiddie Schedule for Affective Disorder and Schizophrenia; OCD, obsessive-compulsive disorder; RADS-2; RCADS, Revised Children's Anxiety and Depression Scale; SCAS-C, Spence Children's Anxiety Scale—Child version; SCAS-P, Spence Children's Anxiety Scale—Parent version; STAI, Spielberger State Trait Anxiety Inventory; Reynolds Adolescent Depression Scale-Second Edition; RCMAS, Revised Children's Manifest Anxiety Scale; SCAS; Spence Children's Anxiety Scale.

Two studies met all the 8 criteria in the quality assessment and can be considered “high quality” based on the original paper where the quality assessment tool was presented (Cuijpers et al., 2010). Two studies scored 7, two scored 6, two scored 5 and two scored 4.

Seven studies examined anxiety, with an overall standardised mean difference of 0.06 (95% CI -0.10 – 0.23). The heterogeneity was low with a Q of 1.10 ($p= 0.89$). Seven studies examined depression and displayed similar non-significant results to the anxiety meta-analysis, with an overall standardised mean difference of 0.12 (95% CI -0.42 – 0.46). The heterogeneity was low with a Q of 9.77 ($p= 0.08$). The study effects at endline for anxiety are displayed in Figure 2 and for depression in Figure 3.

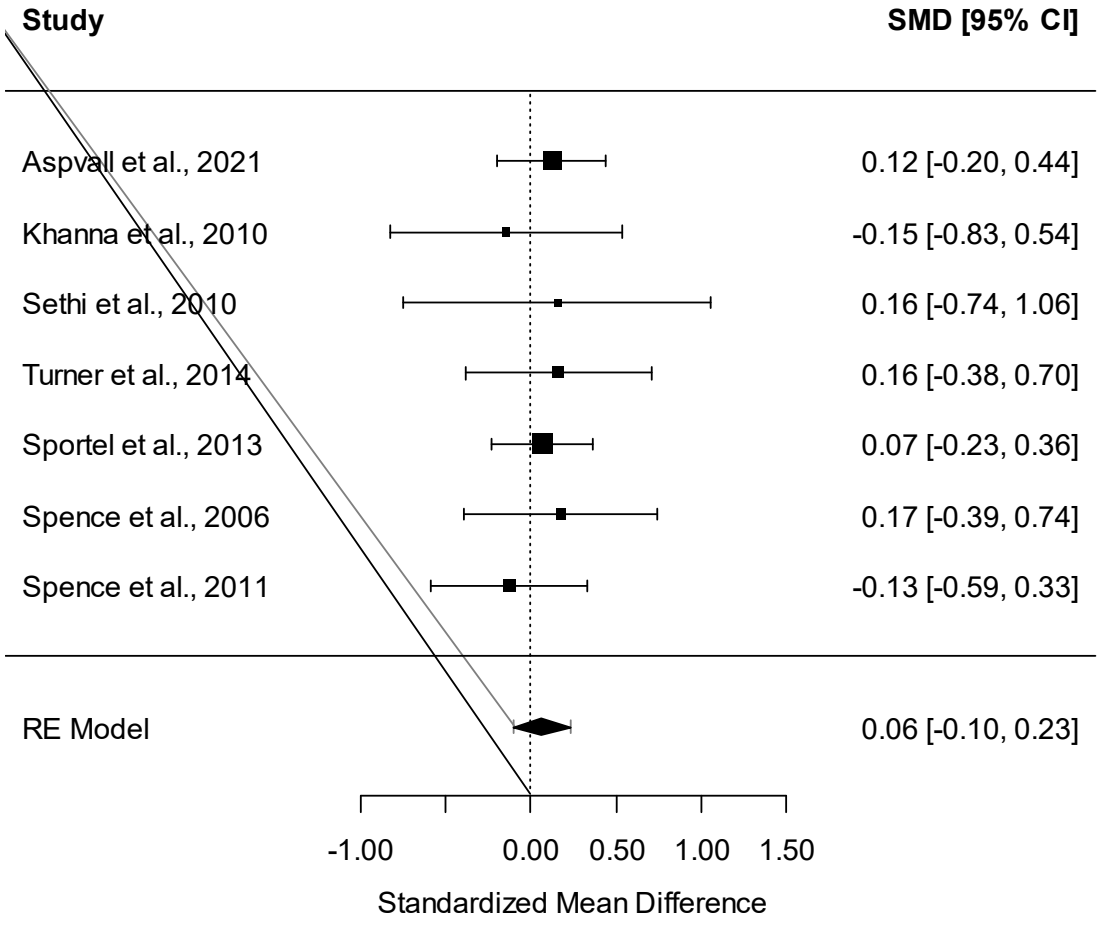

Figure 2. Forest plot showing effect sizes in each study comparing effectiveness of technology-assisted CBT (on the left) vs face-to-face CBT (on the right) in improving anxiety in children and young people.

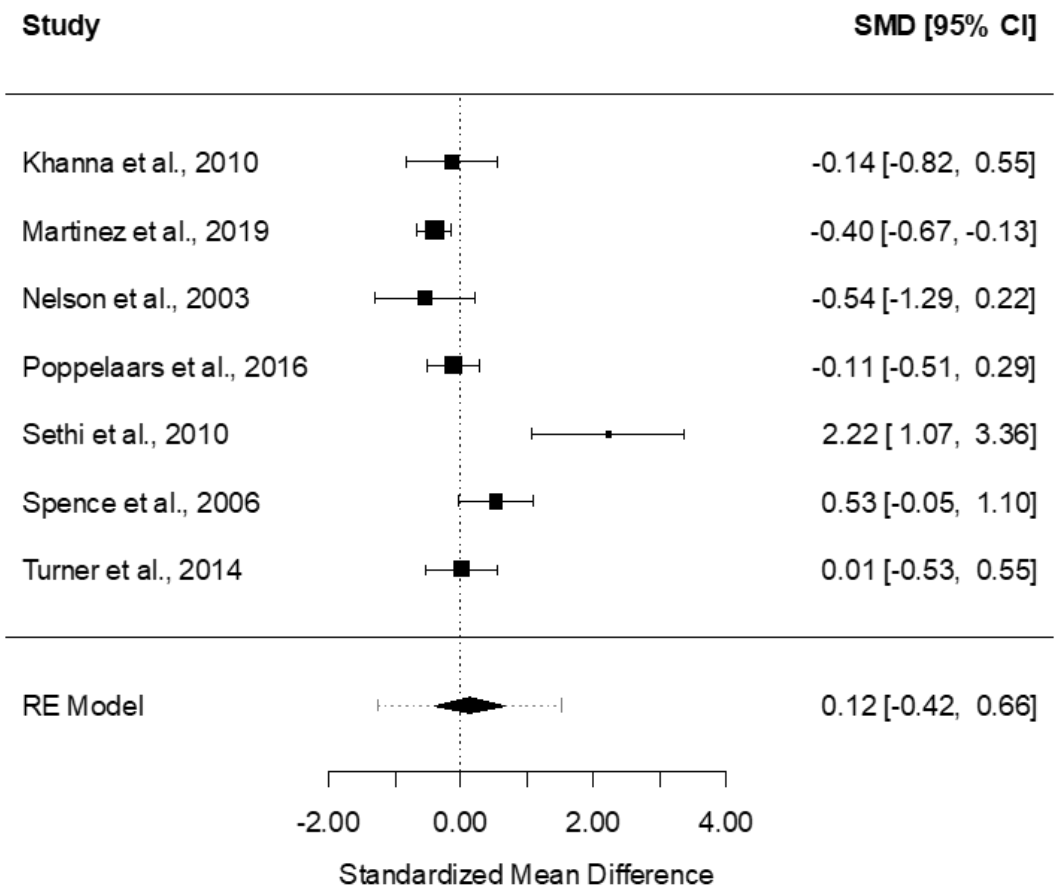

Figure 3. Forest plot showing effect sizes in each study comparing effectiveness of technology-assisted CBT (on the left) vs face-to-face CBT (on the right) in improving depression in children and young people.

Two sensitivity analyses were run. One in the anxiety meta-analysis, where the two OCD-specific studies were removed (Aspvall et al., 2021; Turner et al., 2014), and one in the depression meta-analysis, were an outlier (Sethi et al., 2010) was removed. The overall results size did not change. The overall effect size (the diamond at the bottom of the figures) crossed the standardised mean difference of zero, indicating no significant differences in terms of effectiveness between f2f CBT compared to technology-assisted CBT.

Discussion

The present systematic review and meta-analysis provides an updated synthesis of trials that compared the effectiveness of technology-assisted CBT vs f2f CBT for anxiety and depression in CYP. We found ten articles that met our inclusion criteria, with only two meeting all criteria to be considered "high quality". Overall, the results from the meta-analysis suggested that for both anxiety and depression in CYP, technology-assisted CBT was not inferior to f2f CBT in terms of its effectiveness. This finding is in line with similar works that compared computerised CBT for adolescents and young adults with anxiety and/depression vs passive controls (Ebert et al., 2015) and also in meta-analyses that compared the effectiveness of internet-based vs f2f cognitive therapy with adult population (Carlbring et al., 2018). This study adds further evidence that technology-assisted CBT may be a valuable alternative to f2f CBT when treating CYP with anxiety or depression. This systematic review and meta-analysis is particularly relevant in the post-pandemic world, with increased demands on youth mental health workers, and may help inform the digital transformation hailed in the NHS Long Term Plan (Alderwick & Dixon, 2019).

As briefly mentioned in the introduction, we became aware of a similar study while working on the present systematic review and meta-analysis (Howes et al., 2021). Five of the six studies included in their rapid review are also present in ours. However, one of the studies they included (Merry et al., 2012) seemed to have provided counselling and not f2f CBT in the control arm. Also, they did not include five studies that seemed relevant and that are included in the present work (Khanna & Kendall, 2010; Martínez et al., 2019; Nelson et al., 2003; Sportel et al., 2013; Turner et al., 2014). This is potentially because their definition of the intervention arm was more restricted and homogeneous than ours, and because their search started in 2010. However, we argue that these studies are helpful in providing data to answer the question whether technology-assisted CBT is as effective as (or at least non-inferior to) face-to-face CBT. We acknowledge that we did not find

studies that were published after May 2021 (which is when Howes et al. conducted the search), and in this sense we are not adding more up-to-date data to that presented by them.

This work is not without limitations. Firstly, it is essential to highlight that the present meta-analysis included a diverse group of interventions under the umbrella term "technology-assisted CBT". This did not cause significant levels of heterogeneity in the formal analysis, but that does not mean that the actual experience of having a therapist on the phone is the same as following an online CBT programme. Secondly, the data in the individual studies did not allow for further sensitivity analyses that may have yielded useful data for mental health services. These include additional comparisons such as children vs adolescents, and males vs females. In addition, most trials selected for the meta-analysis included adolescents, rather than children. Hence, our findings should not be generalised to younger populations (e.g., below 12). Thirdly, there were no studies from Asia or Africa included in the meta-analysis, making the results difficult to generalise to these populations. Also, we did not search unpublished data, making the study selection vulnerable to publication bias. Finally, we recognise that the number of studies for both the anxiety and depression meta-analyses were relatively small, suggesting that future studies should try to include a larger number of individual trials and / or overall participants.

In conclusion, this study suggests non-inferiority of technology-assisted compared to f2f CBT for depression in CYP. Knowing what intervention modalities are associated with the best outcomes may be quite relevant for mental health services, particularly considering the worryingly growing demand caused by the COVID-19 pandemic. Future studies should address this aspect by grouping one specific intervention modality (e.g., telephone-delivered CBT, or videoconferencing CBT, or CBT apps) and compare it to f2f CBT. Ideally, future research should also investigate, where possible, whether there are specific aspects of an intervention such as frequency and duration of therapy, which are predictive of positive outcomes. Based on the present results, it is plausible to argue that the effectiveness of CBT for anxiety and depression in CYP may not heavily rely on

intervention modality, and it is hypothesised that other factors may be relevant from a therapeutic/clinical standpoint (e.g., content, structured approach etc.). Furthermore, the effectiveness of technology-assisted CBT is not strongly associated with the demographic characteristics of the clinical population considered or their specific MH difficulties. This is corroborated by the fact that other meta-analyses including different populations (e.g., adults) with a variety of MH difficulties (e.g., somatic and psychiatric disorders) showed similar results to ours (Andersson et al., 2014; Carlbring et al., 2018).

- CBT is the treatment of choice for CYP suffering with anxiety and depression;
- Due to its nature, CBT has been subject to several adaptations, including technology-assisted CBT such as online CBT, CBT apps and CBT videogames;
- These CBT adaptations have proven to be feasible and effective in several populations, but there are no systematic reviews that compared their effectiveness against f2fCBT for anxiety and depression in CYP;
- Our study shows that technology-assisted CBT is comparable to f2f CBT in terms of its effectiveness for anxiety and depression in CYP

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