






Does Videoconferencing-Based Cognitive Behavioral Therapy for Anxious Youth Work? A Systematic Review of the Literature

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Opinion statement

While videoconferencing has become a common tool for remote communication in health-related services such as psychotherapy, scientific evidence for its outcomes is scarce in the population of youth with problematic anxiety. This paper reviews the primary and secondary outcomes of cognitive behavioral therapies (CBT) delivered via videoconferencing for youth with subclinical or clinical anxiety. Quantitative and qualitative studies focusing on youth (aged 7 to 20), anxiety, CBT, and videoconferencing were systematically searched on Embase, PubMed, PsycINFO, and ERIC databases. Eight studies met the inclusion criteria, of which seven were extracted for quantitative data. Out of the seven studies, only one study was quasi-experimental with an

in-person CBT comparison group, while another study was a small-scaled randomized controlled trial with a waitlist control group. The pooled sample size was 213 children and adolescents. Significant changes in primary (i.e., anxiety symptoms and severity) and secondary outcome measures (e.g., global functioning and life interference) at post-treatment of videoconferencing-based CBT were reported, but lacking a control group in a majority of the studies reduces the finding's validity. Satisfaction, treatment completion rate, and therapist's fidelity were rarely reported but found to be high in some studies. None of the studies reported negative effects specific to videoconferencing-based CBT. The current evidence for this topic is somewhat limited in terms of quantity and quality. Replication studies in low- and middle-income countries are also lacking. More well-designed trials are needed to provide more conclusive evidence for the videoconferencing modality, which may help scale up psychological interventions for a highly prevalent problem such as youth anxiety in remote or low-income areas.

Introduction

During the adolescence period (13 to 18 years of age), many major changes in biological, psychological, and social aspects happen such as puberty, development of sexual and social identities, decreased dependence on parents, and increased connections with peers, making adolescents more susceptible to anxiety than children and adults [1–3]. Furthermore, structural and functional changes in the adolescent brain result in a developing, immature prefrontal cortex responsible for emotional, cognitive, and behavioral control, while highly activated neural activities found in the amygdala heighten emotional reactivity. Perhaps, this disparity in the developmental process of different brain regions makes adolescents particularly more sensitive and vulnerable to anxiety than children and adults, as their regulatory competence from the prefrontal cortex is yet to catch up with the highly sensitive “fear circuit,” including the amygdala, insula, and hippocampus [1, 2, 4]. Global prevalence rates suggest that around one in three adolescents demonstrate elevated anxiety symptoms [5, 6].

While effective, evidence-based psychotherapies for anxiety are available, up to 80% of young people cannot get access to them [7] due to stigma, distance, and travel difficulties [8]. This inaccessibility problem can be addressed if psychotherapies are delivered to homes of adolescents using information communication

technologies (ICT). As such, videoconferencing has been increasingly used to overcome this gap, especially since the outbreaks of the COVID-19 pandemic [9]. The current scientific evidence for this practice in anxious adolescents needs to be systematically reviewed to evaluate its effectiveness and inform future directions. Videoconferencing refers to the integrated use of audio and video content for synchronous, real-time communication. It is differentiated with asynchronous, delayed communication such as those delivered through websites, text messages, and emails [10]. Compared to other ICT-based approaches to psychotherapies such as web based, smartphone app based, or video game based with minimal or no contact between therapists and clients (i.e., guided or unguided self-help), videoconferencing-based psychotherapies require minimal adaptation and technical development, less time for interface training, and more direct contact with therapists to develop a sense of therapeutic alliance [10]. In low- and middle-income countries with centralized healthcare systems, adolescents residing far from urban areas are often inaccessible to mental healthcare clinics. In such context, videoconferencing-based therapies can help scale up treatments for a highly prevalent mental health problem in adolescents such as anxiety. On the other hand, clients residing in metropolitan cities can also gain

benefits from videoconferencing-based mental health-care. The nature of anxiety symptoms per se can be a barrier to getting access to in-person, face-to-face care because anxious patients often wish to avoid anxiety-provoking situations that may worsen their symptoms, such as being in crowds, seeing phobia-related stimuli, or having traffic-related fears while traveling to clinics [11, 12]. For adolescents who are often occupied with schooling schedules and dependent on caregivers for traveling, videoconferencing-based psychotherapy can be a good option.

Among different treatment approaches, cognitive behavioral therapy (CBT) is considered to be compatible with technology-based modality due to its highly structured and systematic content [13]. Although the application of videoconferencing in CBT interventions for mental health in general is not a new topic with a fair amount of empirical studies, systematic literature reviews previously published, studies on videoconferencing-based therapies that specifically target anxiety in young clients are sparse. A quick search for systematic reviews published within the past 10 years suggests that they vary in terms of scope but have a common characteristic: they either lacked a focus or often could not identify much experimental evidence for the adolescent population who suffers from anxiety. For example, Backhaus and colleagues [11] did a generic systematic review without restrictions on the types of study (controlled, non-controlled), type of therapy (CBT, non-CBT programs), formats of therapy (individual, group, family), populations (children, adolescents, adults), or diagnosis (depression, anxiety, eating disorder, addictions). None of their eight included studies had a children or adolescent sample, although it was found that videoconferencing-based therapies seemed to produce comparable outcomes to in-person, face-to-face therapies. The lack of focus on the youth population was acknowledged in another review by Slone and colleagues [14]. In their article that included all ICT-based psychological interventions for children and adolescents (i.e., videoconferencing, website, and telephone), only two included studies examined anxiety treatments for children and adolescents [15, 16], although both of them utilized asynchronous communication via websites instead

of real-time videoconferencing. In 2014, Duncan and colleagues [17] narrowed down the scope to investigate videoconferencing-based psychological services for youth residing in rural areas, including psychological assessments and treatments, and for a range of diagnoses such as attention-deficit/hyperactivity disorder, addiction, depression, and anxiety. Similarly, this review found no videoconferencing studies that specifically targeted anxiety. Later in 2017, Wolters and colleagues [18] identified three studies [19–21] that focused on videoconferencing-based interventions for pediatric obsessive-compulsive disorder (OCD). All of these studies had very small sample sizes (ranging from 5 to 31 participants). However, as OCD has been separated from anxiety disorders since the DSM-V, these findings cannot be generalized to adolescents with other types of anxiety. The more recent review by Berryhill and colleagues [12] identified three studies that included a youth sample being treated with videoconferencing-based therapies for anxiety disorders, inclusive of OCD and PTSD. However, these studies' designs have low validity to conclude effectiveness (two case studies with $n=1$: age=8, OCD [22]; age=13, PTSD [23], and one uncontrolled study with $n=16$, mean age=10.06, anxiety disorders [24]). While adolescent anxiety studies were underrepresented, the overall conclusion favors the videoconferencing approach as it produces comparable outcomes to the in-person, face-to-face modality [12]. Taken together, the objective of this paper is to provide a systematic review of the current studies investigating videoconferencing-based CBT intervention for adolescents who demonstrate subclinical and clinical anxiety symptoms. Specifically, it aims to examine the study characteristics (how the current studies on this topic were designed to provide evidence), participants' characteristics (the target population that was sampled in the studies), intervention outcomes (short-term and long-term effectiveness of videoconferencing-based interventions), process measures (therapeutic alliance, client's satisfaction, and homework completeness in videoconferencing-based interventions), and negative effects (the challenges and adverse events that may happen in delivering anxiety interventions via videoconferencing).

Method

Search strategy

This systematic review follows the PRISMA guidelines [25]. The literature search was performed from November 2022 to July 2023, on Embase, PubMed, PsycINFO, and ERIC databases. The search keys included are as follows (see Table 1 for search keys used in different databases):

1. anxiety OR anxious OR panic OR phobi*; AND
2. videoconferen* OR video* OR telehealth OR telemental OR tele* OR web* OR cyber* OR online* OR ehealth* OR ethod* OR e-health* OR e-therapy*; AND
3. cognitive behavioral therapy OR cognitive behavioural therapy OR cognitive-behavioral therapy OR cognitive-behavioural therapy OR cognitive therapy OR cognitive-therapy OR CBT; AND
4. adolescen* OR youth OR pediatric OR paediatric OR high school OR teen OR student.

As preliminary search revealed that the literature in this topic was limited, we decided to broaden the age range to include studies that had children in late childhood (7 to 12 years) and adolescents (13 to 20 years) as participants. The term “youth” is thus used to describe this age range. Moreover, no restrictions were applied to research designs. The to-be-included studies, however, needed to focus only on the videoconferencing technology and examine a CBT intervention for anxiety symptoms, whether clinical or subclinical, including generalized anxiety, separation anxiety, social anxiety, panic, and specific phobia.

Thus, the inclusion criteria were (1) having any research methods, experimental (with or without a comparison group), or non-experimental (cross-sectional, qualitative, or commentary); (2) reporting on the outcomes of the CBT approach to target subclinical (i.e., elevated) or clinical anxiety symptoms as primary (i.e., most serious anxiety problem), secondary (i.e., less serious anxiety problem if there are comorbid anxieties), or comorbid symptoms (i.e., anxiety that co-exists with other mental or physical conditions, except depression); (3) targeting clients in late childhood and adolescence from 7 to 18 years of age; and (4) involving a videoconferencing medium (e.g., Skype, Zoom) to deliver real-time (i.e., synchronous communication) intervention.

Studies were excluded if they were meta-analyses, systematic review, or protocols, studies that investigated programs targeting obsessive-compulsive disorder (OCD) or post-traumatic stress disorder (PTSD); studies adopting non-CBT interventions (e.g., interpretation bias modification) or interventions targeting mental health or well-being in general and not specific to anxiety; studies evaluating interventions as prevention and not treatment; studies with a non-children and adolescent sample (e.g., parents, therapists); and studies adopting other ICT technologies to deliver CBT that were self-help and not synchronous such as website, smartphone applications, CD-ROM, and video games (Fig. 1).

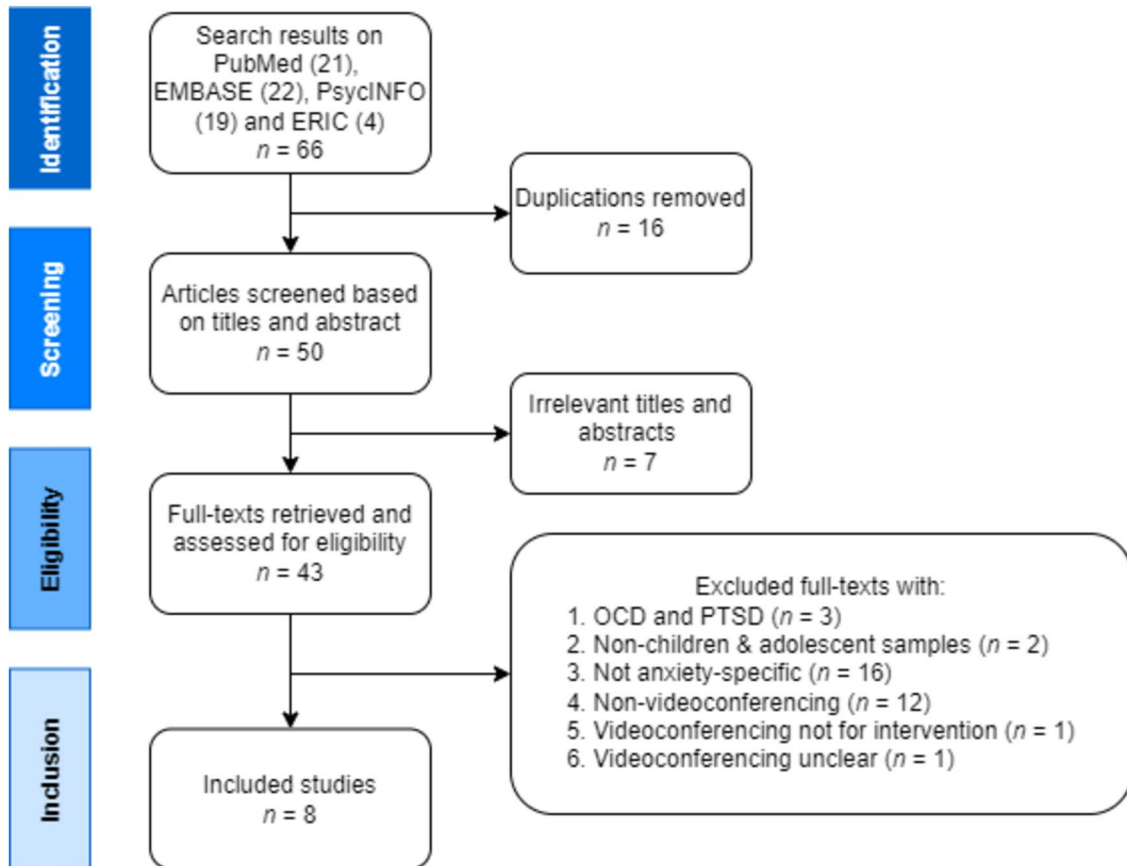


Fig. 1 The study selection process.

Data extraction

The search was performed independently by two of the authors, and data was extracted into spreadsheets with consensus from all authors. The PICO framework (Participants, Intervention, Comparison, and Outcome for quantitative studies) and PICO (Population, phenomenon of Interest, and Context for qualitative studies) [26] were used to extract data from the selected studies. The extracted data included (1) study characteristics (e.g., country, sample size, study design, comparison group, settings, name of technologies), (2) participants' characteristics (e.g., age, psychological symptoms), (3) intervention characteristics (e.g., number of session, name of intervention program), (4) treatment outcomes (measurements; primary and secondary outcomes at short-term and long-term measurements) and their moderators/mediators, and (5) process outcomes (measurements, cost evaluations, negative effects, treatment satisfaction, homework completeness, and therapist's fidelity).

Results

The search strings produced 66 results, in which 57 studies were excluded (Fig. 1) and eight studies met the inclusion criteria [24, 27–33]. There was one study of Chavira and colleagues [34] that did not explicitly mention whether the telephone-assisted mode of intervention involved videoconferencing or non-video calls, and thus was excluded. Moreover, one study [35] investigated videoconferencing-based translational training for child therapists to deliver CBT in-person, which was also excluded. Of eight included studies, one was a small-scaled RCT with a passive waitlist control group [28], one was a quasi-experimental, non-randomized study with an in-person CBT comparison group [31], three were pilot studies with pre-post intervention design without a comparison group [24, 27, 30], one was a case series [32], one was a case study [33], and one was a commentary article [29]. While Ganho-Ávila et al. [33] discussed a videoconferencing-based cognitive therapy program, the content of their intervention shared some similar components with CBT such as psychoeducation and behavioral experiments and thus was included for review. This was the only one efficacy study on videoconferencing-based cognitive therapy that could be found on the databases. In sum, quantitative data were extracted from seven studies [24, 27, 28, 30–33], and qualitative data were extracted from two studies [29, 33].

Quantitative data

Study and participant characteristics

The total sample size of the seven studies is relatively small, with 213 children and adolescents. All but three studies [30, 32, 33] investigated CBT interventions for anxiety with full components, including psychoeducation, cognitive restructuring, coping skills, and exposure, ranging from 10 to 16 weeks. The full-course CBT anxiety interventions adopted in these quantitative studies were Cool Kids (individual), Coping Cat (individual), and Facing your Fears (group). The study of Uysal et al. [30] assessed a 4-week anxiety management program that delivered only psychoeducation and relaxation components; the study of Cabrera et al. [32] evaluated a CBT-based booster session for youths experiencing a recurrence after completing a full-course CBT intervention previously, whereas the study of Ganho-Ávila et al. [33] reported a case being treated via videoconferencing by a cognitive therapy program. Only one out of seven studies included an in-person, face-to-face CBT as a comparison group [31], while only one (another) study included a waitlist control [28]. These study characteristics suggest that the current evidence for this topic is drawn from simple, small-scaled quantitative studies and thus is limited in terms of validity and generalization.

Regarding participant characteristics in the seven studies, their age ranged from 7 to 20 years, with the pooled average age was 13.13 years. Six studies were conducted in high-income countries (USA, Australia, and Portugal) while one was in an upper-middle-income country (Turkey) [30]. Five studies investigated clinical samples of young patients being diagnosed with a range of anxiety disorders [24, 27, 31–33], one investigated a clinical sample of autism spectrum disorder patients with comorbid anxiety [28], and one investigated a non-clinical sample who reported elevated negative psychological effects of COVID-19, including anxiety symptoms [30]. Although the sample size included for this review is small, the participants' characteristics here were rather diverse, with clinical, non-clinical, and comorbid symptoms being included. This information is summarized in Table 2.

Short-term and long-term outcomes of videoconferencing-based CBT

Detailed descriptions of the treatment outcomes are presented in Table 3. In terms of measurements, the Anxiety Disorders Interview Schedule (ADIS) with the Clinician Severity Rating Scale (CSR) was commonly used as a primary measure in clinical samples. In sub-clinical samples, self-reported measurements including the Screen for Anxiety and Related Emotional Disorders in Children (SCARED), the Spence Children's Anxiety Scale (SCAS), and the Revised Child Anxiety Depression Scale (RCADS) were administered. All but one study [32] had at least one secondary outcome measure, such as thoughts and beliefs, global functioning, life interference, parent's sense of competence, or teenager's self-reported coping skills. Regarding time points of data collection, only Carpenter et al. [27] and Ganho-Ávila et al. [33] reported long-term measures at 3-month follow-up, while the rest of the studies only had post-treatment measurements.

In terms of intervention outcomes, all seven studies reported significant changes with moderate to large effect sizes in primary anxiety symptoms at post-treatment. Secondary outcomes also seemed to be significantly impacted. Only two studies with clinical samples [24, 27] reported remission rates. For primary anxiety diagnosis (i.e., the most serious anxiety diagnosis), the pooled average remission rate was 72.15% [62.5–81.8%] of all treatment completers (i.e., those who completed all sessions). For secondary anxiety diagnoses (in participants that had more than one anxiety diagnosis), the pooled average remission rate was 51.95% [31.2–72.7%] of all treatment completers. The study that had a longer intervention duration (16 weeks, [27]) reported higher remission rates for both primary and secondary anxiety diagnoses (81.8% and 72.7%, respectively), while the study with a 12-week intervention [24] reported lower remission rates (62.5% and 31.2%, respectively). The effect of videoconferencing-based intervention seemed to maintain up to 3-month follow-up after 16 sessions [27] or 3-month follow-up after 10 sessions and two boosters [33]. However, generalizability of this finding is limited as it was reported in only two studies with small sample sizes and no comparison group.

Table 2. Characteristics of study designs, participants, and interventions of the included studies

#	Authors	Study type	Sample size	Country	Mean age (range)	Problems	CBT program	Mode of contact/ software	Format	Number of sessions	Full components of CBT?	Setting*	Comparison group
1	Cabrera et al. (2023) [32]	Case series	3	USA	(10–15)	Clinical SAD, specific phobia, GAD	Child and Adolescent Strategies for Anxiety (CASA)	HIPAA-compliant videoconferencing (name not mentioned)	Individual	1 (booster)	(booster only)	Home	None
2	Carpenter et al. (2018) [27]	Multiple-baseline (2–4 weeks interval), pilot trial, pre-post intervention	13	USA	(7–14)	Clinical GAD, SAD, SOD	Coping Cat	Encrypted software with videoconferencing and screen sharing	Individual	16	(psycho-education, exposure, cognitive strategies)	Home	None
3	Ganho-Ávila et al. (2022) [33]	Clinical case study	1	Portugal	17	Clinical SOD	CT@TeenSAD	Zoom	Individual	10+2 (booster)	No (only psycho-education and cognitive strategies)	Home	None
4	Gittins Stone et al. (2023) [31]	Quasi-experimental, non-randomized	130	USA	13.81 (8–19)	Clinical SOD, specific phobia, GAD, agoraphobia, PD, SAD, OCD	Name not mentioned	HIPAA-compliant videoconferencing (name not mentioned)	Group	16	(psycho-education, exposure, cognitive strategies)	Home	In-person group-based CBT with psycho-pharmacology
5	Hepburn et al. (2016) [28]	Pilot RCT	33	USA	(7–19)	ASD with elevated anxiety symptoms	Facing Your Fears	ooVoo	Group	12	(psycho-education, exposure, cognitive strategies)	Home	Passive waitlist
6	McLellan et al. (2017) [24]	Pilot trial, pre-post intervention	16	Australia	(9–12)	Clinical GAD, SAD, SOD, specific phobia, panic disorder	Cool Kids	Adobe Connect	Individual	10	(psycho-education, exposure, cognitive strategies)	School	None
7	Peros et al. (2021) [29]	Commentary	NA	NA	A&YA	SOD	NA	Zoom	Group	NA	No (only exposure)	Home	NA
8	Uysal et al. (2022) [30]	Pilot trial, pre-post intervention	17	Turkey	(14–20)	Negative psychological impact of COVID-19, including anxiety and depressive symptoms	Anxiety and Depression Management Psycho-education Programs	Zoom	Group	4	(only psycho-education)	Home	None

* For the treatment group who received videoconferencing-based interventions

A&YA adolescents and young adults, ASD autism spectrum disorders, C&A children and adolescents, GAD generalized anxiety disorder, HIPAA Health Insurance Portability and Accountability Act (USA), NA not applicable, OCD obsessive-compulsive disorder, PD panic disorder, RCT randomized controlled trial, SAD separation anxiety disorder, SOD social anxiety disorder

Table 3. Short-term and long-term outcomes of videoconferencing-based interventions for anxious youth in quantitative studies

#	Study	Outcome measures	Short-term outcomes (baseline to post-intervention)	Long-term outcomes	Outcome predictors, moderators, and mediators
1	Cabrera et al. (2023) [32]	<p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> -Screen for Anxiety and Related Emotional Disorders in Children (SCARED) <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> -Post-intervention was 2 weeks after the booster session -In all three cases, RCIs of parent-reported anxiety were above the z-score cutoff (2.16, 1.97, and 3.54), indicating clinically significant change at post-intervention from parents' reports -In all three cases, RCIs of child-reported anxiety were below the cutoff (0.37, 0, and 1.30), indicating no clinically significant change at post-intervention from youths' reports 	NR	NR
2	Carpenter et al. (2018) [27]	<p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> -Clinician Severity Rating (CSR) from the Anxiety Disorders Interview Schedule (ADIS) <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> -Clinical Global Impression Scale (CGI) -Multidimensional Anxiety Scale for Children (MASC) -Child Behavior Checklist (CBCL) -Family Accommodation Checklist and Interference Scale (FACILIS) 	<ul style="list-style-type: none"> -<i>Remission rate:</i> free of primary diagnosis; 81.8% of treatment completers; free of all anxiety: 72.7% of treatment completers -Significant changes with large effect sizes in CSI (Cohen's $d = -1.68$), CGI (Cohen's $d = -1.76$), and CGAS (Cohen's $d = 1.55$) -Significant reduction with large effect sizes in mother's report for MASC (Cohen's $d = -1.23$) and CBCL (Cohen's $d = -1.56$) -Significant reduction with large effect sizes in parental accommodation for child (Cohen's $d = -1.61$) 	<p><i>Three-month follow-up:</i></p> <ul style="list-style-type: none"> -Significant changes and large effect sizes were maintained for all primary and secondary outcomes (CSI Cohen's $d = -1.22$, CGI Cohen's $d = -2.52$, CGAS Cohen's $d = 1.59$, MASC Cohen's $d = -1.19$; CBCL anxiety Cohen's $d = -1.57$, FACILIS Cohen's $d = -1.19$) 	NR

Table 3. (continued)

#	Study	Outcome measures	Short-term outcomes (baseline to post-intervention)	Long-term outcomes	Outcome predictors, moderators, and mediators
3	Ganho-Ávila et al. (2022) [33]	<p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> -Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID) <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> -Social Anxiety Scale for Adolescents (SAS-A) -Social Thoughts and Beliefs Scale (STABS) -Self-Focused Attention Scale for Adolescents (SFASA) -Safety Behaviors in Social Situations Scale for Adolescents (SBSSS-A) 	<ul style="list-style-type: none"> -Significant RCI's indicated significant reduction in most self-reported symptoms 	<p><i>Three-month follow-up:</i></p> <ul style="list-style-type: none"> -RCI's indicated that the reduction in symptoms was maintained up to 3 months later for most symptoms, except for safety behavior which the authors speculated to be due to life circumstances during the follow-up period 	NR
4	Gittins Stone et al. (2023) [31]	<p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> -Spence Children's Anxiety Scale (SCAS) <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> -Child Anxiety Impact Scale (CAIS) 	<ul style="list-style-type: none"> -Significant reduction in child self-reported anxiety symptoms in both in-person (Cohen's $d=1.14$) and videoconferencing (Cohen's $d=0.87$) CBT groups -Significant reduction in caregiver-reported child anxiety in both in-person (Cohen's $d=1.17$) and videoconferencing (Cohen's $d=1.23$) CBT groups -Significant reduction in child self-reported functional impairments in both in-person (Cohen's $d=0.75$) and videoconferencing (Cohen's $d=0.96$) CBT groups -Significant reduction in in caregiver-reported functional impairments in both in-person (Cohen's $d=1.06$) and videoconferencing (Cohen's $d=1.01$) CBT groups 	<ul style="list-style-type: none"> -Significant reduction in child self-reported anxiety symptoms in both in-person (Cohen's $d=1.14$) and videoconferencing (Cohen's $d=0.87$) CBT groups -Significant reduction in caregiver-reported child anxiety in both in-person (Cohen's $d=1.17$) and videoconferencing (Cohen's $d=1.23$) CBT groups -Significant reduction in child self-reported functional impairments in both in-person (Cohen's $d=0.75$) and videoconferencing (Cohen's $d=0.96$) CBT groups -Significant reduction in in caregiver-reported functional impairments in both in-person (Cohen's $d=1.06$) and videoconferencing (Cohen's $d=1.01$) CBT groups 	<ul style="list-style-type: none"> -When controlling for baseline anxiety level upon admission, no significant differences in child-reported and caregiver-reported anxiety and functional impairment at post-treatment was found between two treatment groups

Table 3. (continued)

#	Study	Outcome measures	Short-term outcomes (baseline to post-intervention)	Long-term outcomes	Outcome predictors, moderators, and mediators
5	Hepburn et al. (2016) [28]	<p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> -Screen for Anxiety and Related Emotional Disorders in Children (SCARED) <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> -Parenting Sense of Competence Scale (PSOC) 	<ul style="list-style-type: none"> -Significant interaction effect of group \times time with large effect size $\eta^2 = 0.22$ -Significant increase in parenting sense of competence for treatment group 	NR	NR
6	McLellan et al. (2017) [24]	<p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> -Clinician Severity Rating (CSR) from the Anxiety Disorders Interview Schedule (ADIS) <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> -Spence Children's Anxiety Scale (SCAS) -Strengths and Difficulties Questionnaire (SDQ) -Short Mood and Feelings Questionnaire (SMFQ) -Child Anxiety Life Interference Scale (CALIS) 	<ul style="list-style-type: none"> -Remission rate: free of primary diagnosis: 62.5% (10/16); free of all anxiety: 31.2% (5/16) -Significant reduction with large effect sizes in self-report of anxiety symptoms by child (Cohen's $d = 5.96$) and parent (Cohen's $d = 2.31$) -Significant reduction with large effect sizes in life interference reported by child (Cohen's $d = 2.93$) and parent (Cohen's $d = 1.70$) -Significant reduction with large effect sizes in externalizing problems and depressive symptoms reported by both child and parent 	NR	NR
7	Uysal et al. (2022) [30]	<p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> -Revised Child Anxiety Depression Scale (RCADS) <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> -The Teenagers' Coping Skills Scale (KidCope) 	<ul style="list-style-type: none"> -Significant and moderate increase in adaptive coping strategies ($r = .49$), while avoidant coping strategies ($r = -.33$) and anxiety symptoms ($r = -.37$) significantly and moderately decreased 	NR	NR

NR not reported, RCT Reliable Change Indices

In the two studies with a comparison group [28, 31], Gittins Stone et al. [31] found that videoconferencing-based CBT had significant and comparable outcomes, in terms of reduction in self-reported anxiety and life impairments, when compared to in-person CBT. However, this study used multiple *t*-tests to calculate within- and between-group effects, which might have inflated its type 1 error. When being compared to a passive waitlist group using two-way analysis of variance, videoconferencing-based CBT showed a larger and significant reduction in self-reported anxiety, as well as an increase in parents' sense of competence [28].

Process measure outcomes

Detailed descriptions of process measurements and findings in seven quantitative studies are presented in Table 4. Two out of seven studies [27, 28] reported using quantitative scales for process measures, including homework completeness, client's satisfaction, therapist's fidelity, therapeutic alliance, and usability of technology. On the other hand, one study of Cabrera et al. [32] reported using qualitative questions to collect data about client's engagement, feasibility, and time effectiveness after the videoconferencing-based booster session was completed. None of the studies investigated cost-effectiveness, moderators, and mediators of treatment outcomes. Similarly, none of the studies reported negative effects such as adverse events that occurred during videoconferencing-based interventions.

In the two studies that reported using quantitative process measures [27, 28], the completion rate (i.e., number of participants who completed the intervention) was high (84.6% and 94.1%, pooled average = 89.35%), and the attrition rate (i.e., number of dropouts) was low (15.4% and 5.9%, pooled average = 10.65%). Therapist fidelity rated by external observers was also high (96.7% and 92.1%, pooled average = 94.4%), suggesting that therapists could closely follow the interventions' manuals when delivering CBT via videoconferencing. Only the study of Carpenter et al. [27] measured therapeutic alliance between mother-therapist, which was very high in both mother's and therapist's reports (the lowest mean rating was 237.4 out of 252 in multiple measurements). However, therapeutic alliance between child-therapist was not reported in all studies. On the other hand, only Hepburn et al. [28] reported measures on the usability of technology (i.e., technical issues and how many participants were affected). It was found that 5.8% of participants experienced significant technical interferences. In short, videoconferencing-based CBT for anxious youth seemed to be feasible, satisfying, and had a high completion rate, although technical issues and distractions during videoconferencing calls may sometimes be present. Again, the current quantitative evidence is clearly limited to be conclusive, however.

Qualitative data

The studies of Peros et al. [29] and Ganho-Ávila et al. [33] were extracted for qualitative data (Table 5). Peros et al. [29] discussed the challenges and benefits of videoconferencing, an increasingly common modality to provide

Table 4. Process measures and outcomes, including negative effects reported in quantitative studies

#	Study	Process measures	Process measure findings	Cost evaluation	Negative effects
1	Cabrera et al. (2023) [32]	NR	-All three families actively engaged and reported positive experience with the videoconferencing-based booster session. These data were collected qualitatively	NR	NR
2	Carpenter et al. (2018) [27]	-Barriers to Treatment Participation Scale (BTPS) -Working Alliance Inventory (WAI) -Client Satisfaction Questionnaire (CSQ-8) -Therapist's fidelity checklist: 14.2% of the sessions were randomly selected for double check	- <i>Therapist's fidelity</i> : 96.7% - <i>Satisfaction</i> : high ratings by mothers - <i>Completion</i> : 84.6% - <i>Homework compliance</i> : $M = 67.9\%$ - <i>Therapeutic alliance</i> : high for mother and therapist's reports	NR	NR
3	Ganho-Ávila et al. (2022) [33]	NR	NR	NR	NR
4	Gittins Stone et al. (2023) [31]	NR	NR	NR	NR
5	Hepburn et al. (2016) [28]	-Parent and youth satisfaction (session 4 and 9) -Therapist's fidelity checklist for critical elements (random samples of four sessions from six cohorts, total 24 sessions) -Log of technical difficulties: duration of sessions, number of disconnections or significant interferences, number of participants affected	- <i>Therapist's fidelity</i> : 92.1% - <i>Satisfaction</i> : for youth: $M = 88.8\%$; for parents: $M = 92.9\%$ - <i>Completion</i> : 94.1% (16/17 families in the treatment group completed the treatment course) - <i>Attrition</i> : 5.9% - <i>Usability of technology</i> : 5.8% were affected by significant technical problems	NR	NR
6	McLellan et al. (2017) [24]	NR	NR	NR	NR
7	Uysal et al. (2022) [30]	NR	NR	NR	NR

NR not reported

Table 5. Population, phenomenon of interests, and contexts extracted from qualitative data

#	Study	Population/case	Phenomenon of interests	Context
1	Ganho-Ávila et al. (2022) [33]	A female adolescent (17 years old)	<p>Structure of a videoconferencing-based cognitive therapy:</p> <ul style="list-style-type: none"> -Four key components: How socially anxious mind works (psycho-education), attentional training, behavioral experiments and relapse prevention. The structure of this online program was closely adapted from the in-person program. No deviation from the original version was reported Benefits of delivering a cognitive therapy via videoconferencing: <ul style="list-style-type: none"> -Useful for psychotherapy during global pandemics to avoid contamination, removing barriers to getting help for socially anxious patients (no in-person meetings and traveling), suitable for adolescents who have technology proficiency and are familiar with the virtual environment, possible to develop wealthy therapeutic alliance as in in-person therapies Challenges and recommendations for videoconferencing-based cognitive therapy: <ul style="list-style-type: none"> -Challenges: Limited view to observe bodily avoidance behavior and physiological reactions -Recommendations: Having high-quality, secure Internet connection, headsets, and privacy at home, providing appropriate user training for proficiency using computers (or laptops) where possible for better camera and reading view, taking advantage of the recording function to record parts of the sessions for video feedback tasks, covering or hiding self-camera view for socially anxious patients if needed, and strengthening therapeutic alliance by using communication enhancement strategies (such as encouraging eye contact, therapist's frequent use of body postures and voice tones, frequent enquiry about the meaning of the client's body postures and facial expressions) 	Individual therapy for SOD on Zoom, received from home
2	Peros et al. (2021) [29]	Adolescents and young adults diagnosed with SOD	<p>Benefits of using videoconferencing for group therapies:</p> <ul style="list-style-type: none"> -Time-efficiency: Beneficial for this age group as they often have busy schedules and are dependent on caregivers for transportations to clinics -More ideas for exposure: Sharing/talking about one's personal items or belongings with the others; placing camera closer to face (exposure for appearance-related anxiety); inviting confederates for participants to talk with (exposure for conversation with strangers); use chat messages to send "secret mission" to each participant; use breakout rooms to engage in one-on-one conversations with confederates -Self-view feedback: Participants can get both peer feedback and self-feedback from the self-view on screen Challenges and recommendations for videoconferencing-based group therapy: <ul style="list-style-type: none"> -Fit assessment: Participants with disruptive, oppositional behaviors, and frequent substance use may interfere with group discussion → Screen for these problems using the ADIS-V (Anxiety and Related Disorder Interview Schedule for DSM-V) to decide fitness -Risk assessment: Similarly, use the ADIS-V to rule out impulsivity, severe depression and acute suicidality → Safety planning: protocol for risk assessment, risk exclusion, and risk handling; emergency contact is required; two group leaders will be useful -Therapy rules: Encourage participants to stay on camera (using reinforcement to increase gradually if needed); no private chat to other participants but can chat with the group leaders, use only neutral background for cameras; use headphones/earphones; sit in private space -Maintaining engagement: Use games (e.g., spin the wheel) to break the ice and for exposure tasks; use star stamps on Zoom's whiteboard as rewards to reinforce constructive behavior; have a check-in period (before each session starts) to meet individually (in breakout rooms) and review homework while the other group leader stays in the main room to stimulate conversations for other participants -Consent form: State clearly the risks and benefits of engaging in videoconferencing-based group therapy, online etiquette, prohibition of screen, and audio recording to ensure privacy -Location: Have participants confirm a private space for videoconferencing-based therapy, with help from parents if needed 	Group therapy for SOD on Zoom, received from home

SOD social anxiety disorder

mental healthcare for anxious youth. This article narrowed down the topic to focus only on the exposure practice in group therapy for adolescents and young adults with social anxiety disorder (SOD). The software being discussed was Zoom with functions of breakout rooms, chat messages, whiteboard with drawings and stamps, and screen sharing. While the article did not discuss current research evidence in this topic, it provides practical considerations and specific recommendations to inform the clinical practice of this increasingly common approach to mental healthcare.

As individuals with SOD often find social situations (e.g., talking to strangers, giving a public speech) to be anxiety provoking, videoconferencing offers several benefits to conduct group exposure that may otherwise be difficult to achieve in an in-person modality. Some examples included sharing/talking about one's belongings or items at home with the group (e.g., childhood photos, musical instruments), placing the camera closer to the face (for appearance-related anxiety exposure), or inviting confederates to join the Zoom meeting for an exposure task of talking to strangers. Videoconferencing provided the opportunity for exposure right at the homes of the participants, in which situations were perceived as equally anxiety provoking as in non-virtual social interactions [29]. Using the virtual features of Zoom, group therapists could be creative in assigning exposure tasks, organizing group games, rewarding participants on a whiteboard, or using breakout rooms for individual meetings.

On the other hand, certain challenges in terms of risks, engagement, and technical requirements would always be present that need to be carefully planned for (i.e., safety planning). Several recommendations were given, such as having a second group leader, careful screening to assess risks and fit for virtual group therapy, clearly stating the risks, benefits and online etiquette in the consent form, and having participants confirm a private space to ensure effective engagement with the group via videoconferencing [29].

In the case study of Ganho-Ávila et al. [33], a specific cognitive therapy program called CT@TeenSAD for social anxiety disorder was implemented for a female teenager, with 10 weekly sessions plus two booster sessions, during the outbreaks of COVID-19. Reports on the benefits, challenges, and recommendations when delivering the program online via video calls were extracted for review. In general, barriers and resistance to therapy were successfully overcome by videoconferencing as the client was extremely anxious with in-person social situations, which might have prevented her from getting help with in-person therapies. The authors also suggested that building a positive therapeutic alliance via videoconferencing was possible and important right from the beginning for positive treatment outcomes. Another critical factor for treatment success was technological proficiency, which was demonstrated by the client and was believed to allow smooth engagement and less resistance to online therapies.

In contrast, challenges of this treatment modality included the limited view to observe avoidance behavior (e.g., hiding hands) or physiological reactions. Several recommendations from the study included having high-quality, secure Internet connection, headsets, and privacy at home,

providing appropriate user training for proficiency, using computers (or laptops) where possible for better camera and reading view, taking advantage of the recording function to record parts of the sessions for video feedback tasks, covering or hiding self-camera view for socially anxious patients if needed, and strengthening therapeutic alliance by using communication enhancement strategies (such as encouraging eye contact, therapist's frequent use of body postures and voice tones, frequent enquiry about the meaning of the client's body postures and facial expressions).

Discussion

This paper has provided a systematic review for the current quantitative and qualitative studies in the topic of videoconferencing-based CBT for young clients having anxiety symptoms. Although adolescents (13 to 18 years of age) were initially the primary target population, the limited number of available studies required this paper to broaden its search to include children and young adults from 7 to 20 years old for the sake of review.

In short, the findings of this review suggest that those receiving videoconferencing-based CBT (or a closely related therapy such as cognitive therapy) had statistically significant changes in both primary (i.e., anxiety symptoms and severity) and secondary outcome measures (e.g., global functioning and life interference) at post-treatment. These changes were reported with moderate to large effect sizes. However, it should be noted that due to the lack of comparison groups in a majority of the studies such as in-person CBT or a control group who does not receive any treatment, it was unclear whether therapeutic changes at post-intervention of videoconferencing-based CBT were caused by the intervention's positive effect per se or other unobserved factors. Because none of the studies reported negative effects of videoconferencing-based CBT, albeit which practice is highly recommended by Rozental and colleagues [36], it remains unclear how often and what kind of adverse events may happen with this treatment modality. For now, no adverse events specific to videoconferencing-based CBT have been documented.

To our surprise, the number of published studies on synchronous videoconferencing-based CBT for anxious youth is more limited than asynchronous technology-based CBT (e.g., web based), given that videoconferencing is a commonly available communication tool with affordable costs for users. In the systematic review of asynchronous technology-based CBT for youth anxiety conducted by Vu and colleagues, ten studies were included with a total sample size of 981 youths aged 7 to 18 years [37]. Most of the included studies in their review investigated digital CBT programs with minimal therapist contact, which was mostly via text messaging or telephoning without face viewing. It was found that although asynchronous technology-based CBT for anxiety was well-accepted and satisfying for young clients in general, there is a clear preference for occasional face-to-face meetings with therapists, suggesting that synchronous, real-time interactions with therapists are still important

and favorable. In this case, videoconferencing may be a good alternative. Our review found that client's satisfaction with treatment was high in both client's and caregiver's reports, although only three out of eight studies reported this information. Moreover, therapist's fidelity to the treatment manuals was very high (reported in two studies), suggesting that it is possible to implement CBT via videoconferencing without major technical developments and content deviations from the original, manualized, in-person CBT programs. However, we found that therapeutic alliance is rarely reported. In the only one study that mentioned it [27], therapeutic alliance was high in caregiver's and therapist's reports, whereas youth's report was lacking. This finding aligns with other systematic reviews and meta-analyses in the literature concerning therapeutic alliance in videoconferencing-based therapies across a range of diagnoses for both adults and adolescents, which found that this modality does not impede the bond between client-therapist but may in fact be as strong as in-person therapies [38–40].

Regarding client's completion rate (i.e., the number of participants completing all sessions), our review found that the pooled average percentage reported in the current literature to be around 89.35% [84.6–94.1%] for synchronous videoconferencing-based CBT, which is higher than the completion rate at 72% [40–95.7%] for asynchronous technology-based CBT reported by Vu et al. [37]. On the other hand, attrition rates (i.e., number of dropouts at post-treatment) in videoconferencing-based CBT ranged from 5.9 to 15.4% (reported in two studies), which is comparable to in-person face-to-face CBT [41, 42]. Videoconferencing-based CBT also seemed to have a higher remission rate at 51.95% (i.e., free of any anxiety diagnosis at post-treatment) than asynchronous technology-based CBT (around 30 to 40%) [37], although it was somewhat lower than in-person face-to-face CBT (around 60%) [43]. Again, it should be noted that these findings for the videoconferencing modality from our review are generated from small-scaled, uncontrolled studies.

In terms of technological usability, technical interference was reported in only one study from the client's end [28]. No reports from the therapist's end were documented. All studies included in our review also did not mention whether (and how) therapists and clients were trained to use video calls prior to interventions. To prepare therapists for smooth and interactive sessions with clients, our qualitative extracted data recommended user training. Although most therapists could adapt to videoconferencing therapies quickly without any formal training as reported in the review of Simpson and Reid [40], professional and accredited training to increase therapist's proficiency in videoconferencing-based therapies has been recently available and recommended (e.g., www.telehealth.org), because therapists may face with heightened ethical and legal challenges when working with young or underserved clients via videoconferencing [39, 44]. Whether it is an accredited training or not, it should educate therapists on the current guidelines, law, ethical issues, and best practice of telehealth to prevent complications. At the same time, one study in our review recommended careful fit and risk assessments for anxious youth prior to prescribing videoconferencing-based CBT, especially in a group format [29]. In general, these recommendations align with

the guidelines of the American Telemedicine Association [44]. We suggest that future studies in this topic should pay attention to these recommended practices and report that to ensure transparency and safety for participants while doing research.

Our review also found that the discussion on restricted exposure activities in videoconferencing-based CBT was not frequently discussed. Specifically, to treat problematic anxiety, gradual exposure is a central behavioral component to help clients start approaching the feared situations and become habituated to it and their anxious feelings. Delivering CBT via videoconferencing might limit the types of activities anxious youths can do for gradual exposure. Moreover, therapist's emotional support for a client during exposure might also be limited. Due to the lack of this information in our included studies, it was unknown if the participants did face with these disadvantages during exposure. On the other hand, it is possible that the mobility of videoconferencing-based CBT via smartphones can allow anxious youths to engage in non-virtual, in-person exposure tasks while the therapist is still there (online) to provide emotional support and encouragement. Ganho-Ávila et al. [33] suggested that virtual reality can also be incorporated in videoconferencing-based CBT, although this might be costly in practice and still results in a lack of real-life, in-session exposure tasks. While ideas for online exposure tasks are provided by one of our included papers [29], it is also certainly possible for clients of videoconferencing-based CBT to have in-person exposure tasks if both the therapist and the client are ready. We suggest that future studies in the topic should explore the possibilities and the challenges specific to exposure tasks in videoconferencing-based anxiety interventions as these will have important implications in practice.

To our knowledge, this is the first systematic review in the topic of videoconferencing-based CBT targeting anxiety specifically in youth. In terms of efficacy research, more methodologically rigorous studies are clearly needed to provide better scientific evidence for the outcomes of such treatment modality, which is believed to offer many benefits to anxious youths in the global prospect of digital mental healthcare. In terms of practice, if more evidence can confirm the positive treatment outcomes of videoconferencing-based CBT, it will have important implications for scaling up treatment in remote areas and in low-, middle-income countries such as South East Asians. Highly populated countries with a large proportion of youth and limited mental healthcare workforce are more likely to face with mental health burdens, especially in the effort of tackling highly prevalent internalizing problems such as anxiety. While asynchronous, self-guided web-based CBT requires high reading proficiency to follow web-based written modules and affordability to have a computer or laptop at home, videoconferencing allows clients to be guided in real time by therapists without the needs of a computer or laptop as video calls can work on smartphones. Using smartphones for psychotherapies might be handier because not many families own a laptop, but many may own a smartphone. For example, the latest statistics showed that more than 50% of Vietnamese have access to Internet at home [45], and 94% of Internet users own a smartphone [46]. The smartphone coverage in Vietnamese rural areas is also high at 68% [46]. Oftentimes, those out-of-reach of high-quality care

are those who need interventions the most. Thus, videoconferencing could be a promising modality to close the gap in mental health service. The remaining question is whether it is backed up with enough experimental evidence for its efficacy and effectiveness and how to best deliver it to make it as effective, engaging, and satisfactory as possible. This review has attempted to answer a part of this question and calls for more experimental and qualitative studies to extend the current evidence we now have.

Some limitations of this review need to be considered. Firstly, our review only included English papers and thus might have omitted local studies that were conducted in non-English speaking countries. Secondly, since anxiety is often manifested in some physiological conditions such as oncological and cardiological diseases, the findings of this review might only be generalized to those having psychological problems as the main diagnosis. Finally, the confidence in our findings is evidently limited by the quality and scope of the included papers.

Conclusion

To sum up, current scientific studies on the topic of videoconferencing-based CBT for anxious youth are rather limited as they had small sample sizes, lacked a control group or an in-person, face-to-face CBT comparison group, and lacked data on follow-up and process measures (such as client's satisfaction, treatment completion rate, and usability of videoconferencing technology). Replication studies in low- and middle-income countries are lacking as well. Future studies should also pay attention to examining the negative effects, along with the positive effects of videoconferencing-based CBT interventions for anxiety in youth to provide a thorough understanding of its benefits and risks. To reduce heightened risks and lack of fit for videoconferencing-based CBT, careful screening, safety planning, and user training are recommended prior to the start of intervention. With more evidence drawing from methodologically sound studies, videoconferencing can be potentially supported as an alternative modality to scale up psychological interventions for a highly prevalent problem such as anxiety in youth.

Author Contribution

BPV: conception, independent search, data extraction, analysis, and writing; HMD: independent search, supervision, and revision; PNA: supervision and revision. All authors have read and approved the final manuscript.

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Declarations

Conflict of Interest

The authors declare no competing interests.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

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