The effectiveness of brief CBT in reducing anxiety among US adolescents in school-based mental health programs.

Abstract

Aim: This study aimed to examine how well short-term cognitive behavioral therapy (CBT) works to lessen anxiety symptoms among school-going adolescents enrolled in school-based mental health programs in the US.

Method: A short six-session cognitive behavioral therapy intervention was completed by 42 participants, ages 12 to 16. Using the Generalized Anxiety Disorder 7-item (GAD-7) scale, anxiety levels were measured both before and after the intervention.

Discussion: The findings demonstrated a clinically significant improvement in anxiety symptoms, with mean GAD-7 scores falling from 14.60 to 10.12 ($p < .001$). A significant impact of the intervention over time was suggested by the large effect size ($\eta^2p = .829$) validated by repeated-measures ANOVA.

Conclusion: The study found that CBT is an effective and scalable intervention for anxiety in learning environments. It also showed that school-based mental health programs may help adolescents with moderate to severe anxiety by offering early, easily accessible, and effective therapy. The study recommends the evaluation of the integration of such therapies in schools for more general mental health issues, such as depression and stress-related illnesses, and investigation of long-term effects through randomized controlled trials.

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Introduction

Background

Anxiety is among the most prevalent mental health conditions influencing children and teenagers in the US. Research suggests that close to one-third of US adolescents are likely to be diagnosed with an anxiety disorder, making it one of the most common mental health disorders (as cited in Gregory et al., 2022). The Statistical Manual of Mental Disorders (DSM-5) describes anxiety as the state of expectation of impending danger characterized by tense muscles, increased alertness to potential danger, and persistent or avoidant behavior (De Silva et al., 2024). Individuals with this condition attempt to avoid the stimulus, a tendency acknowledged as a typical adaptive reaction. According to Haugland et al. (2020), a persistent course of anxiety disorders frequently results in severe functional limitations, including decreased academic functioning, peer issues, and further psychopathology. Anxiety disorders are classified according to the situation or object that causes avoidance behavior and feelings of dread, worry, or discomfort (Beesdo, Knappe, & Pine, 2009). People who suffer from any of the anxiety disorders (AD) may have comparable physical, behavioral, and psychological characteristics. Anxiety risk factors include parental anxiety history, trauma, socioeconomic factors and exposure to violence (Kowalchuk, Gonzalez, & Zoorob, 2022). Early screening and intervention are critical in reducing the severity and implications of the condition.

Anxiety Prevalence among Adolescents

According to De Silva et al. (2024), the most prevalent mental health conditions that influence children and teenagers are anxiety. Evidence further suggests that anxiety disorders are the most common mental health issues in adolescents, with a point prevalence of 6.5% and a lifetime prevalence of almost 30% (Haugland et al., 2020The country's economy and children's welfare are both significantly impacted by this high percentage. Statistics estimate that these health conditions are projected to cost $247 billion annually, placing a tremendous burden on the health and well-being of individuals, families, and society (as cited in Xiang et al., 2024). Although prevalence estimates vary significantly, most likely because of methodological discrepancies, the lifetime prevalence of anxiety disorders as evidenced by research involving children or adolescents is roughly 15–20% (De Silva et al., 2024). Evidence suggests that there are several factors specific to teenagers that make them more vulnerable to anxiety (Garcia & O'Neil, 2021). For example, the

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study by Keles, McCrae & Grealish (2019) revealed that social media use and the increase in mental health conditions among adolescents, including anxiety. Overuse of social media has also been cited as a contributing factor, particularly among the adolescent population (McCarthy, 2019). Another example of a common factor that exacerbates anxiety among adolescents is poor sleep (22. National Sleep Foundation., 2019), with only 15% of teenagers reporting getting eight hours or more of sleep on school nights (as cited in Garcia & O'Neil, 2021).

Anxiety Interventions

According to Luxford, Hadwin, and Kovshoff (2016), treatment strategies for young people with ASD have drawn more empirical attention due to the prevalence and effects of anxiety. Although mind-body therapies are becoming more popular for treating anxiety symptoms, their effectiveness in treating anxiety disorders like panic disorder, social anxiety disorder, and generalized anxiety disorder remains unclear (Bandealy et al., 2021). The most common anxiety interventions are Meditation and Mindfulness-Based Interventions (MBIs). According to Bandealy et al. (2021), meditation techniques have gained attention as potential treatments for anxiety and psychological distress. One type of meditation that has been extensively studied in studies employing modified, manualized MBIs to enhance physical wellness and mental resilience is mindfulness meditation, which focuses on mindfulness practice through observing one's thoughts, feelings, and bodily sensations while maintaining a nonjudgmental attitude (Gu et al., 2025). Most studies on anxiety intervention strategies have focused on mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT), both of which comprise 8-week programs that are standardized, manualized, and consist of both personal home practices and group sessions (Bandealy et al., 2021).

According to Bandealy et al. (2021), MBSR was first developed as an intervention for patients with chronic pain, but was later introduced as an intervention for a variety of other mental and physical conditions. The standard MBSR therapy consists of an 8-week group intervention, where participants meet once a week for two to three hours and participate in a 6-hour silent retreat. It is recommended that individuals practice mindfulness for 45 minutes every day to aid in the generalization of skills (Virgili, 2013). Kriakous et al. (2020) claim that MBSR is an effective intervention that can improve psychological health. It includes mindfulness meditation techniques, such as body scanning, mindful movement, and breath awareness. These methods help patients

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recognize incorrect reactions to stress, become more aware of their internal and external stimuli, and easily select an intentional and mindful response (Bandealy et al., 2021). MBSR has been shown to constantly reduce stress, anxiety, and emotional exhaustion while simultaneously increasing positive affect (Kriakous et al., 2020).

Conversely, MBCT aims to educate individuals with a history of depression on how to identify and successfully address early signs of mood deterioration (Elices et al., 2021). According to Bandealy et al. (2021), it incorporates ideas and components from MBSR, as well as concepts from cognitive-behavioral therapy (CBT). Similar to cognitive behavioral therapy, patients are trained to identify habitual thinking patterns and the emotions associated with them without making judgments (Bandealy et al., 2021). Rather than necessarily altering the ideas themselves, the objective is to alter their connection with them. After being conscious of thoughts and feelings, MBCT allows a three-minute breathing space, which helps focus attention on the breath and body (Bandealy et al., 2021).

MBCT is advantageous and adequate for treating mental disorders in patients at different stages. These include those with severe depression symptoms; for people who desire substitutes to antidepressant medications; can be administered in a group environment, potentially reducing costs and the effort of mental health professionals; may address processes associated with a range of psychopathological problems, including rumination, worry, and a decrease in mindfulness (Elices eta al., 2021; Goldberg et al., 2019; Saha et al., 2020). However, while recent research including Goldberg et al. (2019) have explored the effectiveness of MBCT in other psychiatric conditions including anxiety and acute depression demonstrating that its efficacy in these condition is growing, Elices eta al. (2021) observes that there are few research that focus on its effectiveness in real-world samples and its use in diverse healthcare contexts.

Cognitive-Behavioral Therapy

Recent reviews suggest that psychological therapies, such as CBT, are successfully provided in primary care (Cuijpers et al., 2019; Santoft et al., 2019). According to these reviews, these therapies seem to have a preventative impact on those who come with subthreshold depression and to successfully alleviate symptoms in individuals suffering from depression. Likewise, studies show that CBT given in a single day has shown promising benefits in reducing depression and anxiety while improving self-esteem and other outcomes related to mental health

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quickly (Zhang et al., 2025). This type of CBT typically consists of intensive therapy sessions that span 6–8 hours in a single day, conducted in a workshop setting. Potential benefits of one-day CBT over standard CBT include improved patient convenience, cost-effectiveness, and efficiency (Van Lieshout et al., 2021). A randomized control trial conducted by Arch et al. (2013) in which anxious participants underwent either MBSR or CBT revealed modest to significant reductions in their anxiety symptoms when compared to other active treatment options for anxiety. In this study, CBT was demonstrated to be significantly more effective in reducing physical tension and alleviating elevated physiological responses. In contrast, MBSR produced greater reductions in anxiety and co-occurring emotional illnesses, such as depression (Bandealy et al., 2021).

CBT has also been shown to benefit children and teenagers with ASD. It blends cognitive therapy and behavioral therapy, two therapeutic approaches. CBT is a structured, short-term, goal-oriented intervention that focuses on recognizing and changing maladaptive thoughts and behaviors. According to Werner-Seidler et al. (2017), targeted school-based CBT interventions for anxiety aim to increase the accessibility of effective interventions for young people who are experiencing anxiety symptoms or those at risk of developing anxiety disorders. CBT has been shown to successfully reduce anxiety (De Silva et al., 2024). It is regarded as the most effective treatment for anxiety in young people as it has shown great effectiveness in a variety of delivery formats, such as digital, group, and individual interventions. Regarding those suffering from generalized anxiety disorder, a study by Simon et al. (2021) that compared CBT and Kundalini yoga anxiety interventions found that yoga was less effective than CBT when the response rates were compared (Bandealy et al., 2021).

Brief CBT group therapies have been more popular in recent years, although there is variation in their effectiveness in treating anxiety, depression, low self-esteem, and general mental health (Zhou et al., 2025). For instance, Horrell et al. (2014) show that their intervention has been shown in numerous studies to improve not only specific symptoms but also more general mental health issues like depression, anxiety, self-esteem, and general mental well-being in a variety of benefited groups, such as adults. Other studies, including Van Lieshout et al. (2021) adolescents have demonstrated its efficacy in improving mental wellness among adolescents aged 16–18 years old and in mothers suffering from postpartum depression. A recent randomized controlled trial conducted in the UK, involving 900 teenagers, demonstrated that CBT is both commercially

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feasible and clinically effective, and it may be a potential early intervention in schools. (Brown et al., 2024). However, despite this, studies on the efficacy of brief CBT interventions in school settings are still lacking. Given that adolescents spend most of their time at school, empirical evidence of CBT in school settings can provide additional evidence on the context-based variations on the effectiveness of anxiety treatment therapies.

School-Based CBT Interventions

While numerous studies have investigated the efficacy of CBT in various clinical contexts, research on its effectiveness in school settings remains scarce. According to Bella-Awusah et al. (2015), adolescents with depression symptoms have typically responded well to culturally-tailored cognitive behavioral therapy modules. These modified modules incorporate adjustments for accessibility, language, and cultural sensitivity, while preserving the core elements of cognitive behavioral therapy (Saw et al., 2020). Given that many anxious adolescents are school-going, the availability of brief CBT in schools may enhance access to evidence-based therapies (Haugland et al., 2017). Since it is time-saving and requires fewer resources, Haugland et al. (2017) argue that it could be easier to undertake CBT in schools; nevertheless, it must first be proven to be equally effective as the more intensive brief intervention.

According to Colizzi, Lasalvia, and Ruggeri (2020), multidisciplinary and integrated services are necessary to increase the range of effective therapies and reduce the risk of adverse long-term outcomes, potentially lowering the costs of the healthcare system. One strategy that can be used to implement multidisciplinary approaches to addressing the mental health challenge is implementing school-based programs. School-based mental health initiatives are receiving more attention as a frontline strategy for early diagnosis and intervention due to the rising incidence of teenage anxiety in the US. As Lai et al. (2022) note, children and adolescents can easily get mental health support services at school without having to travel to clinics or hospitals through school-based programs. In addition to their families, schools are the second social context in which children and teenagers spend a significant amount of time and where a substantial portion of their learning and development takes place (Lai et al., 2022). Given the aforementioned, schools serve as a location for the timely detection of mental health issues and the provision of intervention (McLaughlin, 2017).

Aim of Research

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The purpose of this research is to assess the efficacy of brief CBT in reducing anxiety symptoms among adolescents participating in school-based mental health programs in the United States. The project aims to produce practice-oriented data that supports the use of short cognitive behavioral therapy (CBT) as a viable and successful intervention for teenage anxiety in actual school settings by concentrating on pre- and post-intervention outcomes.

Measurement Scale

The present investigation employed the GAD-7, a short self-administered screening tool created by Spitzer et al. (2006), to assess generalized anxiety disorder (GAD) in primary care and clinical settings. Spitzer et al. (2006) state that the 7-item anxiety measure has good criterion, concept, factorial, and procedural validity in addition to high reliability. The measure was validated in a sample consisting of more than 3,000 adult patients in the US. Besides the original test that was based on adult subjects, subsequent studies have validated the use of GAD-7 with adolescents. One such study is Mossman et al. (2017)'s meta-analysis, which supported the applicability and reliability of the GAD-7 in adolescent and young adult populations. According to their study that compared the GAD-7 to the Pediatric Anxiety Rating Scale (PARS), the GAD-7 has strong sensitivity and specificity for detecting clinically significant anxiety symptoms. When assessing anxiety symptoms and differentiating between mild and moderate GAD among teenagers, GAD-7 scores may be a more useful tool than the PARS (Mossman et al., 2017). It is a straightforward and trustworthy technique for assessing self-reported anxiety symptoms in an educational environment, as evidenced by its good internal consistency in teenage samples (α = 0.86–0.90), according to Casares et al. (2024).

Methods

Design

The present research employed a quantitative pre- and post-experimental design. An experimental research design was deemed appropriate, as it allowed the researchers to have complete control over all factors that could impact the results of the investigation (Zubair, 2023). Standardized psychometric tools were used logically to evaluate anxiety level changes before and during the intervention. This approach, which represented real-world outcomes in a practice-

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focused educational setting, allowed for the measurement of individual-level development over time.

Participants

Participants consisted of forty-two teenagers, ages twelve to sixteen, who were enrolled in four public schools in the northeastern United States. One of the requirements for eligibility was having clinically severe anxiety symptoms, as defined by a GAD-7 score of greater than 10. Students who were receiving official psychological therapy or who were using anxiety medication were omitted. All participants were required to attend a minimum of five out of six CBT sessions to be included in the final analysis. Informed consent was obtained from both participants and their guardians, and participation was voluntary.

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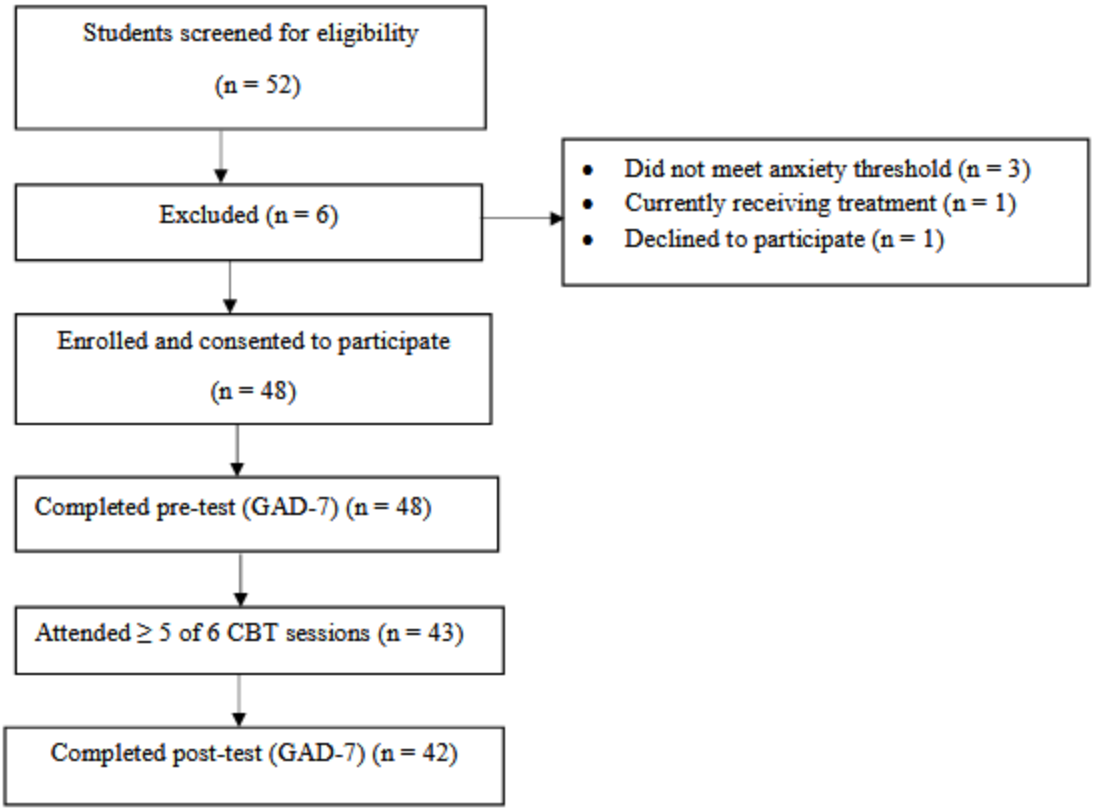
Participant Flow Diagram



Recruitment Procedure

Participants were recruited in collaboration with school counselors and mental health staff. The recruitment process involved distributing parent and student information sheets and consent forms through school communication systems. School staff helped identify students who met the inclusion criteria, after which screening using the GAD-7 was conducted to determine eligibility. Participation was confidential and aligned with institutional ethical standards.

Materials and Measures

Anxiety symptoms were measured using the GAD-7 scale, a 7-item self-report questionnaire assessing the severity of anxiety symptoms over the previous two weeks. Each item is scored on a 4-point Likert scale (0 = not at all, to 3 = nearly every day), with total scores ranging from 0 to 21. The GAD-7 has demonstrated high internal consistency ($\alpha = 0.89$) and is validated for use with adolescent populations. Demographic data, including age, gender, and school grade, were also collected.

Pre- and Post-Intervention Data Collection

Data collection occurred at two points: before the commencement of the CBT intervention and immediately after its conclusion. At baseline, all participants were gathered in a designated private room within their respective schools where they completed a paper-based GAD-7 questionnaire under the supervision of a research assistant and a school counselor. Instructions were read aloud, and participants were encouraged to respond honestly, with clarification provided if needed. Upon completion of the six-session CBT intervention, the same procedure was repeated for the post-test. The same environment and administration format were maintained to ensure consistency. Completed forms were collected securely and anonymized for analysis.

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Data collection instrument

GAD-7 Anxiety

Over the last two weeks, how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3

Column totals _____ + _____ + _____ + _____ =

Total score _____

If you checked any problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?			
Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

Source: Primary Care Evaluation of Mental Disorders Patient Health Questionnaire (PRIME-MD-PHQ).

Scoring GAD-7 Anxiety Severity

This is calculated by assigning scores of 0, 1, 2, and 3 to the response categories, respectively, of "not at all," "several days," "more than half the days," and "nearly every day."

GAD-7 total score for the seven items ranges from 0 to 21.

0–4: minimal anxiety

5–9: mild anxiety

10–14: moderate anxiety

15–21: severe anxiety

Sample Size

This study included forty-two participants who completed the pre- and post-intervention surveys. A power analysis using G*Power indicated that a sample of 34 participants would be sufficient to detect a moderate effect size (Cohen's d = 0.5) using a paired-sample t-test with $\alpha = 0.05$ and power = 0.80. To account for potential attrition, the sample size was increased to 42 participants. This adjustment ensured adequate power to detect statistically meaningful changes in anxiety symptoms following the intervention.

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Data Analysis

The quantitative data collected using the GAD-7 anxiety scale questionnaire were analyzed with SPSS. Descriptive statistics were first computed to summarize demographic variables and baseline anxiety scores. The internal consistency of the GAD-7 scale was assessed using Cronbach's alpha to ensure the reliability of the instrument within the study sample. To evaluate the effectiveness of the brief CBT intervention, a paired-sample t-test was conducted to compare participants' pretest and post-test anxiety scores. Additionally, repeated-measures ANOVA were used to explore within-subject variations if multiple measurement points were included. A simple linear regression was also performed to assess whether baseline characteristics (e.g., age, gender, or initial anxiety severity) predict changes in anxiety outcomes. An alpha level of 0.05 was used to determine statistical significance across all tests. Assumptions for each test (e.g., normality, homogeneity of variance) were checked before analysis to ensure the validity of results.

Results

This study examined the effectiveness of brief cognitive behavioral therapy (CBT) in reducing anxiety symptoms among 42 adolescents aged 12 to 16 years (M = 13.95, SD = 1.50) (M = 13.95, SD = 1.50), with a slight male preponderance (57.1% male, 42.9% female). Participants were recruited from four different schools (A-D), with School D accounting for the largest share (40.5%). At baseline, all individuals had clinically significant anxiety symptoms, with a balanced distribution between moderate (50.0%) and severe (50.0%) categories according to their GAD-7 scores. This section presents the pre-intervention and post-intervention findings based on various statistical tests conducted at the post-intervention.

Before the CBT session, participants' anxiety levels were evaluated using the GAD-7 scale. According to the pre-intervention classification, all 42 adolescents had clinically significant anxiety levels, as shown in Figure 4.1. Half of the individuals (n = 21) were categorized as having moderate anxiety, and the other half (n = 21) as having severe anxiety. The clinical urgency and significance of providing this population with focused mental health care are evident in the equal distribution across the two highest severity categories. Since there were no individuals in the mild or minimum anxiety groups before intervention, the sample was deemed suitable for therapeutic intervention. The categorization also demonstrates that subclinical instances were excluded from

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the research, which supports the validity of the post-treatment results as a measure of improvement in those with well-defined psychological distress. Any observed decreases in post-intervention anxiety levels are clinically significant because this baseline distribution also shows that the individuals experienced a significant symptom load.

Descriptive Statistics

Table 4.1 Variables

Variable Name	Description	Measure Type	Scale
Participant_id	Unique identifier for each participant	Categorical (nominal)	ID code (e.g., P001)
Age	Age of the participant in years	Continuous (ratio)	12–16
Gender	Gender identity of participant	Categorical (nominal)	Male, Female
Grade	School grade corresponding to participant's age (assumed: age - 6)	Discrete (ordinal)	Grades 6–10
School	School attended by the participant	Categorical (nominal)	School_A, B, C, D
pre_gad7	GAD-7 anxiety score before the intervention	Discrete (interval)	10–21
post_gad7	GAD-7 anxiety score after the intervention	Discrete (interval)	0–21
Change_score	Difference between pre- and post-intervention GAD-7 scores	Continuous (interval)	0–21
sessions_attended	Number of CBT sessions attended	Discrete (ratio)	5 or 6
pre_anxiety_category	Categorical severity level of pre-intervention anxiety	Categorical (ordinal)	Moderate, Severe
post_anxiety_category	Categorical severity level of post-intervention anxiety	Categorical (ordinal)	Minimal, Mild, Moderate, Severe

Table 4.2 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
age	42	12.00	16.00	13.95	1.50	.039	.365	-1.436	.717
pre_gad7	42	10.00	21.00	14.60	3.01	.556	.365	-.719	.717
post_gad7	42	3.00	20.00	10.12	3.53	.127	.365	.511	.717
change_score	42	.00	8.00	4.48	2.05	-.205	.365	-.564	.717
sessions_attended	42	5.00	6.00	5.64	.48	-.619	.365	-1.701	.717

As shown in the descriptive statistics in Table 1, the sample of 42 adolescents aged 12-16 years (M = 13.95, SD = 1.50) represents a young adolescent sample with minimal variation, as indicated by the near normality of the distribution (skewness = 0.039, SE = 0.365). Pre-GAD-7 scores before treatment ranged from 10-21 (M = 14.60, SD = 3.01). A slight positive skew (.556) suggests most participants were in the moderate anxiety range and fewer cases of severe anxiety. Post-intervention scores decreased substantially, ranging from 3-20 (M= 10.12, SD= 3.53). The increased standard deviation suggests that there was greater variability in scores post-treatment. Change scores indicated substantively clinically meaningful improvement, with participants averaging a 4.48 point reduction (SD = 2.05) on the GAD-7 scale and a range from no change to an 8-point decrease. Participants were also highly engaged, attending on average 5.64 out of 6 possible treatment sessions (SD = 0.48), with a strong negative skew (-0.619), suggesting that most, if not all, participants attended all six sessions. This indicates constructive intervention adherence and potential feasibility in the school-based intervention.

An analysis of the findings based on demographics was conducted to determine whether the control variables had any significant implications on the intervention outcome. The frequency distribution analysis allowed exploration of some key demographic and clinical characteristics of the sample (see Table 4. 3). For gender, there was a slight male predominance evidenced in the response sample, where 24 males (57.1 %) and 18 females (42.9 %) answered yes to completing the telephone survey. There were notable differences in school contribution, with School D contributing the most significant proportion of participants (n = 17, 40.5 %), followed by School B (n = 10, School A (n = 9, 21.4 %), and School C (n = 6, 14.3 %). Pre-intervention anxiety severity (dependent variable) was evenly split across the moderate and severe severity categories based on participants' Clinical Scale scores, resulting in 21 participants (50.0%) in both the moderate and severe categories. This confirms that all participants were above the clinical threshold for clinically significant anxiety symptoms. In the post-intervention results, participants demonstrated clinically meaningful improvement in symptoms, as evidenced by a movement to lower severity categories, as indicated by GSAS scores. Notably, 16 participants (38.1%) were in the mild category, 20 participants (47.6%) were in the moderate category, whereas only 3 participants (7.1%) remained in the severe category, and 3 participants achieved no anxiety

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(minimal). Therefore, while the vast majority of participants achieved a clinically meaningful change, many participants who achieved only moderate symptoms, rather than no symptoms, are consistent with this distribution pattern.

Table 4.3: Frequency Distribution of Categorical Variables

Variable	Category	Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Gender	Female	18	42.9	42.9	42.9
	Male	24	57.1	57.1	100.0
	Total	**42**	**100.0**	**100.0**	
School	School_A	9	21.4	21.4	21.4
	School_B	10	23.8	23.8	45.2
	School_C	6	14.3	14.3	59.5
	School_D	17	40.5	40.5	100.0
	Total	**42**	**100.0**	**100.0**	
Pre-Anxiety Category	Moderate	21	50.0	50.0	50.0
	Severe	21	50.0	50.0	100.0
	Total	**42**	**100.0**	**100.0**	
Post-Anxiety Category	Minimal	3	7.1	7.1	7.1
	Mild	16	38.1	38.1	45.2
	Moderate	20	47.6	47.6	92.9
	Severe	3	7.1	7.1	100.0
	Total	**42**	**100.0**	**100.0**	

Paired-Sample t-Test

This study conducted a paired-sample t-test to analyze the first research hypothesis that brief CBT would reduce anxiety symptoms among adolescents participating in school-based mental health programs. The paired sample t-test was selected because it is appropriate for the within-subjects pre-post experimental design of the study, in which the same participants were measured on two occasions at two time points (pre- and post-intervention), meaning scores were naturally paired and independent. The paired sample t-test is the appropriate parametric test for comparing means of two related samples to identify a statistically significant change in GAD-7 anxiety scores after the brief CBT intervention, while controlling for individual differences at baseline.

The crucial assumption of normality for the difference scores was thoroughly assessed using a variety of statistical and visual techniques before running the paired-sample t-test. The difference scores (pre_gad7 - post_gad7) were found to be acceptable for normality. The Shapiro-Wilk test was non-significant ($W = .964$, $p = .208$), indicating that the null hypothesis of normality could not be rejected. This was also supported by the Kolmogorov-Smirnov test ($D = .122$, $p = .117$). There were significant results from the paired-sample t-test, indicating that participant GAD-7 scores were statistically significantly higher pre-intervention ($M = 14.60$, $SD = 3.01$) than post-intervention ($M = 10.12$, $SD = 3.53$). There was a strong positive association between pre- and post-intervention scores ($r = 0.815$, $p < 0.001$), indicating that participants' trends in individual responses were correlated. With a mean difference of 4.48 points (95% CI [3.84, 5.12]), the result was statistically significant, $t(41) = 14.144$, $p < .001$, indicating strong evidence that the brief CBT intervention was able to decrease anxiety symptoms in adolescents in a school-based context.

Repeated Measures ANOVA

This study also conducted a repeated measures ANOVA, which offers a more sophisticated analytic method for examining within-subject changes in anxiety symptoms over time, while also controlling for other covariates and exploring interaction effects across our groups in the brief CBT intervention study. This level of intent and analysis goes beyond simple paired t-tests, as it examines how within-subject changes relate to between-subject factors such as gender, school, and age group. This facilitates the understanding of how these demographic factors may result in differential treatment responses. In this analysis, the study employed a mixed-design ANOVA method, utilizing time (pre vs. Post intervention) as a within-subject factor and gender, school, and age group as between-subject factors, with GAD-7-SR scores as the dependent variable. Using this analysis, the main effect of time on anxiety reduction is examined, and interaction effects to examine how treatment response may differ at pre- and post-treatment from the perspective of the two "subgroups" to which they belong are also considered.

The analysis showed a highly significant main effect for Time, $F(1, 40) = 194.51$, $p < .001$, $\eta^2p = .829$, reflecting large decrease from the pre-intervention time point ($M = 14.60$, $SD = 3.01$), to the post-intervention time point ($M = 10.12$, $SD = 3.53$), that represent a meaningful reduction in anxiety symptoms across individuals. The effect size (82.9% of variance) suggests it is a clinically significant reduction of anxiety symptoms. The pairwise comparisons show a significant mean difference of 4.50 points (95% CI [3.85, 5.15]) in support of the intervention's effectiveness.

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The between-subjects analysis indicated a main effect of gender, $F(1, 40) = 5.60$, $p = .023$, $\eta^2p = .123$, males maintained significantly higher GAD-7 scores ($M = 13.29$) than females ($M = 11.11$) across both time points. The Time × gender interaction was not significant, $F(1, 40) = 0.27$, $p = .608$, $\eta^2p = .007$, suggesting improvement of equal magnitude regardless of gender. The females improved by 4.67 points (13.44 to 8.77), while the males improved by 4.33 points (15.46 to 11.13), indicating that the intervention was similarly effective regardless of baseline differences.

In the complete model with school as an additional factor, the main effect for time was still highly significant, $F(1, 34) = 135.43$, $p < .001$, $\eta^2p = .799$, but the effect size was lower than that in the simpler model; the main effect for school was not significant, $F(3, 34) = 0.16$, $p = .923$, $\eta^2p = .014$, nor was the time × school interaction, $F(3, 34) = 0.31$, $p = 816$, $\eta^2p = .027$. The three-way interaction (Time × school × gender) was approaching significance, $F(3, 34) = 2.23$, $p = .103$, $\eta^2p = .164$, and suggests that a few combinations of gender and school may differ in their response to the intervention, and that with larger sample sizes, these possible combinations could and should be explored and investigated.

All the statistical assumptions were satisfied for repeated measures ANOVA. Box's test of equality of covariance matrices was non-significant for both models ($p = 0.261$ and $p = 0.267$), providing support for the assumption of equal covariance across groups. Levene's tests for homogeneity of variance were non-significant for both pre- and post-intervention scores (all $p > .05$), supporting equal variances across groups. Mauchly's test of sphericity was not relevant, as there were only two time point scores ($W = 1.000$). There was consistency across multivariate test statistics (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root), which provided additional confidence in the findings regarding significant time effects and the effectiveness of the intervention in reducing anxiety symptoms.

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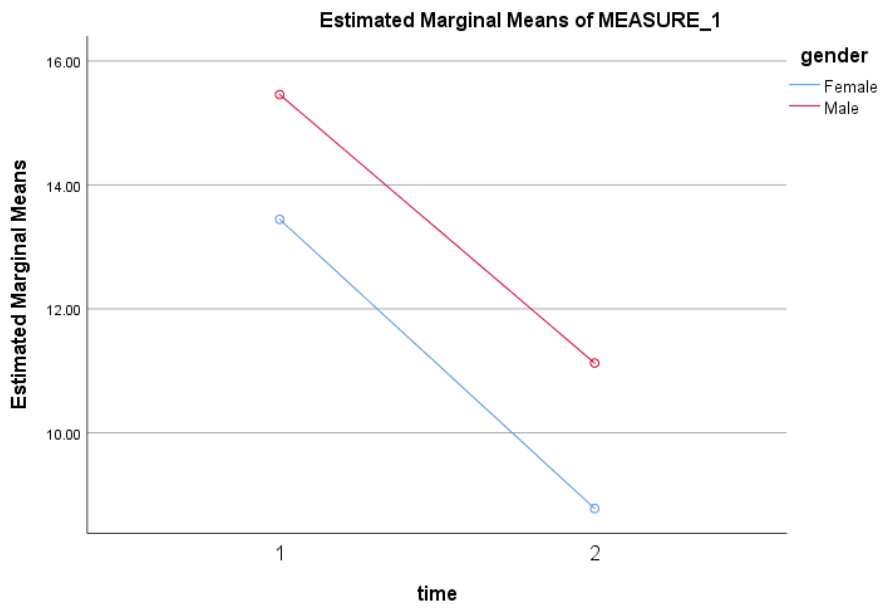

Figure 4.1: Estimated Marginal Means

Linear Regression

The multiple regression analyses conducted to address the baseline clinical variables revealed several important aspects regarding the predictive validity of demographic and clinical variables in reducing measures of anxiety. In examining change scores (i.e., pre-post GAD-7 difference) with prediction variables as predictors, the results revealed that none of the demographic and clinical variables individually contributed to explaining the variance in treatment response. The overall model was not significant, $F(4, 37) = 0.42$, $p = .795$, with an adjusted R^2 of -.060, indicating that the model accounted for less variance than could be expected by chance alone. The individual predictions of age ($\beta = -.084$, $p = .635$), gender ($\beta = .140$, $p = .429$), and pre-intervention GAD-7 scores ($\beta = .087$, $p = .617$), and sessions attended ($\beta = -.125$, $p = .457$) were all non-significant. The adjusted R^2 is also negative, suggesting potential overfitting and weak correlations between demographic and clinical variables and change scores (ranging from -.144 to .081), which do not reasonably predict individual differences in the magnitude of treatment response.

Table 4.4: Regression Models

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Model	Predictor	B	SE	Beta	t	p-value	Sig?
MODEL 1: Change Score	Age	-0.115	0.24	-0.084	-0.479	0.635	No
	Gender (dummy)	0.574	0.717	0.14	0.8	0.429	No
	Pre-GAD7	0.059	0.118	0.087	0.504	0.617	No
	Sessions Attended	-0.527	0.702	-0.125	-0.751	0.457	No
MODEL 2: Post-GAD7 (Enter)	Pre-GAD7	0.948	0.121	0.81	7.807	0	Yes*
	Age	0.183	0.246	0.078	0.744	0.462	No
	Gender (dummy)	-0.618	0.784	-0.088	-0.787	0.436	No
	School B	-0.281	1.022	-0.034	-0.275	0.785	No
	School C	0.254	1.154	0.025	0.22	0.827	No
	School D	-0.499	0.901	-0.07	-0.554	0.583	No
MODEL 3: Post-GAD7 (Step 1)	Pre-GAD7	0.954	0.107	0.815	8.883	0	Yes*
MODEL 4: Post-GAD7 (Step 2)	Pre-GAD7	0.941	0.117	0.803	8.029	0	Yes*
	Age	0.158	0.232	0.067	0.682	0.499	No
MODEL 4: Post-GAD7 (Step 2)	Gender (dummy)	-0.589	0.713	-0.084	-0.826	0.414	No
MODEL 5: Post-GAD7 (Step 3)	Pre-GAD7	0.948	0.121	0.81	7.807	0	Yes*
	Age	0.183	0.246	0.078	0.744	0.462	No
	Gender (dummy)	-0.618	0.784	-0.088	-0.787	0.436	No
	School B	-0.281	1.022	-0.034	-0.275	0.785	No
	School C	0.254	1.154	0.025	0.22	0.827	No

On the other hand, the regression models predicting post-intervention GAD-7 scores demonstrated strong predictive validity. The full model was significant, $F(6, 35) = 12.27$, $p < .001$, and explained an impressive 62.3% of variance (adjusted $R^2 = .623$). Pre-intervention GAD-7 scores were the strongest and only significant predictor ($\beta = .810$, $p < .001$), indicating that participants with higher levels of anxiety previously experienced relatively higher levels of anxiety post-intervention. The remaining predictors - Age ($\beta = .078$, $p = .462$), Gender ($\beta = -.088$, $p = .436$), and school dummy variables (all ps > .05) - were non-significant. The hierarchical regression analysis showed that pre-intervention scores alone explained 66.4% of the variance, followed by a significant, albeit small, amount of variance (0.8%) accounted for by demographic variables (Age and Gender), and a negligible amount of variance (0.6%) accounted for by school variables.

The hierarchical regression analysis established that the severity of anxiety prior to intervention is the strongest predictor of post-treatment outcomes, demonstrating slight incremental validity for demographic or school variables. Model 1, which included only pre-GAD-7, was statistically significant with an acceptable amount of variance explained ($R^2 = .664$, $F(1, 40) = 78.91$, $p < .001$), while the addition of age and gender variables in Model 2 resulted in a negligible amount of variance explained ($R^2 = .008$, $F(2, 38) = 0.47$, $p = .628$). Subsequently, with

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the addition of school variables in Model 3, there was a non-significant increase in variance explained, and the regression model was statistically insignificant ($\Delta R^2 = .006$, $F(3, 35) = 0.22$, $p = .883$). In summary, while baseline anxiety severity is very predictive of post-treatment levels, the individual characteristics of each student in regards to demographics and school did not moderate treatment outcomes.

The regression analyses provide meaningful implications for real-world, clinical CBT treatment planning and outcome predictions. Our pre-intervention transfers yielded a strong predictive relationship between pre- and post-intervention scores ($r = .815$) with no critical predictors for change scores, implying that people with higher levels of anxiety at baseline tend to remain at a relatively high level of anxiety following treatment, even though they are experiencing similar absoluted improvements. Assumption checking confirmed the model was a reasonable fit, with the residuals falling approximately normally distributed and no concerning patterns deviating from homoscedasticity. Collinearity diagnostics confirmed tolerances with acceptable values for every variable (all > 0.57) and all VIF values < 1.75, suggesting that multicollinearity was not an issue. The Durbin-Watson values (1.925 and 2.026) were also a good indicator of the lack of troublesome autocorrelation, confirming the independence assumption. These findings suggest that the CBT intervention appears equally effective (e.g., relative improvements) across demographic groups, and the baseline severity of anxiety can be viewed as the most reliable predictor of the absolute level of anxiety following the treatment.

Discussion

Of the 42 adolescents included in the sample population, half were categorized as having moderate anxiety, while the other half had severe anxiety. The results offer compelling evidence that short CBT is a viable and effective treatment for anxiety in adolescents. Every participant had moderate to severe anxiety at the start of the trial, which is clinically significant. Most participants showed notable improvements after the intervention, and a sizable portion fell into the light or minimal anxiety categories. Both paired-sample t-tests and repeated-measures ANOVA support an average decrease of 4.48 points on the GAD-7 scale, indicating both statistical significance and clinical relevance.

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The pre-intervention scores agree with previous studies that anxiety is a serious challenge among adolescents in the US, suggesting the need for school-based interventions. Previous studies (Haugland et al., 2020; Xiang et al., 2024) have noted with concern that anxiety disorders are the most common mental health issues in adolescents. With this reality, many interventions, including CBT, have been developed and implemented in educational settings. The descriptive statistics, t-test, ANOVA, and regression statistical analyses conducted in this study all revealed a significant positive change in pre- and post-anxiety scores following the CBT intervention.

Furthermore, considering that extreme anxiety in adolescents has been connected to long-term mental health risks, social disengagement, and reduced academic functioning(Garcia & O'Neil, 2021), it is especially concerning since half of the individuals were characterized as having severe anxiety. As such, severe anxiety can also make a person more susceptible to comorbid diseases, including substance use disorders and depression. Therefore, the baseline statistics alone have significant implications: the school-based mental health system must be capable of early identification, prevention, and ongoing monitoring, in addition to providing treatment.

This study's findings also emphasize the strategic importance of providing mental health services in schools. Adolescents often attend schools; therefore, the value of these environments for early detection and intervention is becoming increasingly acknowledged (Lai et al., 2022; McLaughlin, 2017). In this regard, brief CBT sessions can be incorporated into schools to address concerns about stigma, cost, and accessibility, enabling timely support for those who need it. Since the latest results show similar impacts across different schools and demographic profiles, they provide credence to proposals for expanding such programs (Brown et al., 2024; Zhou et al., 2025).

As indicated by participants' GAD-7 scores, there were statistically significant differences between pre-intervention and post-intervention scores, indicating strong evidence that the brief CBT intervention was able to decrease anxiety symptoms in adolescents in a school-based context. The statistical significance (82.9% of variance) effect size in this study suggests a clinically significant reduction of anxiety symptoms after CBT intervention. These findings are consistent with previous research showing that brief CBT is the most effective treatment for anxiety in young people, and are supported by the effectiveness of the brief CBT

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session seen in this investigation. De Silva et al. (2024) and Werner-Seidler et al. (2017) have previously found that CBT has consistently demonstrated effectiveness across various delivery formats.

In line with previous studies that have shown CBT to be an effective intervention in primary care (Cuijpers et al., 2019; Santoft et al., 2019), the current study finds it effective in reducing anxiety among adolescents in school contexts. In agreement with earlier studies such as Bella-Awusah et al. (2015), culturally specific cognitive behavioral therapy modules result in positive results in treating depressive symptoms in adolescents. In this sense, CBT interventions targeting adolescents in their school settings can yield positive results if implemented in various states and counties within the United States. As noted by previous studies, such as Haugland et al. (2017), implementing interventions in schools is simpler since it requires less time and professional resources. Short CBT is therefore appropriate in educational contexts where time and resources are often limited.

This study reveals that changes in anxiety symptoms following brief CBT sessions vary depending on the duration of intervention and severity of pre-intervention symptoms. This finding aligns with research indicating that even brief, one-day CBT sessions can result in a notable reduction in symptoms (Zhang et al., 2025; Van Lieshout et al., 2021). The high adherence rates of this trial, which indicate that most participants attended all six sessions, provide additional evidence of the feasibility and acceptability of brief cognitive behavioral therapy in real-world educational settings. Bella-Awusah et al. (2015) and Haugland et al. (2017) studies align with this study's findings.

Compared to mindfulness-based interventions (MBIs) like MBSR and MBCT, which often require more intensive time commitments and have inconsistent outcomes in adolescent populations, CBT offers a more structured and direct approach to treating maladaptive thoughts and behaviors (Bandealy et al., 2021; Elices et al., 2021). While MBCT and MBSR help enhance general mental wellness, CBT is more action-oriented and may be better suited for adolescents who benefit from concrete coping techniques and cognitive restructuring, as illustrated by this study and previous research (Gu et al., 2025; Kriakous et al., 2020). According to comparative studies, CBT is often more successful than MBIs at reducing anxiety, particularly symptoms like physiological arousal and cognitive rumination (Arch et al., 2013; Bandealy et al., 2021).

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The study also examined whether demographic characteristics, such as age, gender, and educational achievement, had an impact on treatment outcomes. School affiliation did not predict the findings. These findings align with earlier studies (Saw et al., 2020; Colizzi et al., 2020), which demonstrate that CBT can be effectively applied in various contexts when appropriately adapted. The regression analysis showed that while session attendance and demographic factors had minimal effect on post-treatment scores, pre-intervention anxiety levels were the most significant predictor. This suggests that adolescents with higher baseline anxiety may require more intensive or protracted care, even if they show similar relative improvement, a concern also identified by Simon et al. (2021).

The findings of this study also reveal that both genders had an equal level of post-intervention progress. Although males' overall anxiety levels were greater, there was no gender-by-time interaction, suggesting that the intervention's beneficial effects on both sexes were comparable. This implies that CBT interventions are effective across genders and can be adopted in school-based mental interventions to improve the well-being of adolescents suffering from various mental illnesses, including anxiety. However, there were a few combinations of gender and school that differed in their response to the intervention. Thus, with larger sample sizes, these possible combinations should be explored and investigated further to gather additional empirical data. The multiple regression analyses revealed that participants with higher levels of anxiety previously experienced relatively higher levels of anxiety post-intervention.

Another concern raised by this study's findings is the potential ceiling effect of symptom reduction for people with severe anxiety. This study found that after the intervention, individuals who had previously had greater levels of anxiety had comparatively higher levels of anxiety. Thus, while they are witnessing comparable absolute reductions, persons who had greater baseline anxiety levels typically continue to have relatively high anxiety levels after therapy. This suggests that there are variations in the level of effectiveness of CBT depending on the severity of the pre-intervention scores. In this sense, intervention programs should be tailored to meet the pre-intervention anxiety severity. Thus, those individuals with severe anxiety pre-intervention scores (as indicated by GAD-7) should be exposed to more hours of therapy compared to those with moderate to mild symptom scores to achieve high intervention outcomes. This finding is consistent with those of Simon et al. (2021), who discovered that even in cases

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where relative recovery is substantial, post-treatment outcomes are still predicted by the baseline intensity of symptoms. This necessitates a tiered or stepped-care strategy, in which students at the higher end of the clinical spectrum require more intensive or prolonged therapies. In contrast, short cognitive behavioral therapy may be an effective first-line treatment.

Crucially, the equal representation of moderate and severe anxiety provides a special perspective for assessing the adaptability and responsiveness of short-term cognitive behavioral therapy. The argument for widespread use of short cognitive behavioral therapy in schools is strengthened if an intervention can be used throughout such a range and yet provide statistically and clinically meaningful outcomes. However, policy and clinical decision-making about the allocation, monitoring, and follow-up of treatments should be informed if severe patients consistently exhibit greater residual symptoms.

Conclusion

This study shows that adolescents participating in school-based mental health programs have a substantial reduction in anxiety symptoms after a brief cognitive behavioral therapy session. The intervention demonstrated broad applicability across gender and school contexts, with reasonable adherence rates and a strong therapeutic benefit, in addition to producing statistically significant increases in GAD-7 scores. Although demographic characteristics did not affect post-intervention scores, baseline anxiety intensity was a significant predictor, indicating that short cognitive behavioral therapy may be generally helpful across adolescent subgroups. These results support the incorporation of short, structured treatment models into school systems and further CBT as a highly effective, flexible intervention for teenage anxiety. This emphasizes the necessity of adaptable and tier-based school-based care strategies, where short-term cognitive behavioral therapy may be used as a first-line treatment but isn't always a complete solution.

Future studies should focus on randomized controlled trials that target teenage populations in actual school settings to build on these findings. RCTs would provide a more thorough assessment of causation and assist in determining the relative effectiveness of brief CBT compared to other interventions, such as digital tools, mindfulness-based therapies, or psychoeducation. Studies should also examine the long-term results and efficacy of stepped-care models or booster

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sessions for teenagers with more severe or persistent symptoms. Additionally, studies should be expanded to include teenagers who have a greater variety of mental health issues, such as behavioral issues, emotional dysregulation, or co-occurring depression. Treatments that focus only on anxiety may overlook important facets of teenagers' mental health needs because many of them have overlapping symptoms. Therefore, school systems should make investments in multimodal, integrated mental health services that include short-term cognitive behavioral therapy, along with screening, group therapy, peer support, family education, and referral channels for more specialized care.

In summary, brief CBT is a proper and readily available treatment for teenage anxiety, but it should be viewed as a component of a larger mental health framework. To guarantee that treatments are not only evidence-based but also comprehensive, preventative, and responsive to the entire range of adolescent mental health issues, schools, legislators, and mental health professionals must collaborate. While treating anxiety is an essential first step, early identification, specialized treatment, and ongoing support are necessary for enhancing mental well-being among adolescents in school settings.

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