

Efficacy of Cue Centered Therapy in Exposed Adolescents of Interpersonal Violence: A Comprehensive Review of Clinical Interventions

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ABSTRACT

Aim of the Study: Interpersonal violence significantly contributed to traumatic experiences among adolescents, increasing their vulnerability to anxiety, stress, depression and PTSD. This review examined the psychological impact of interpersonal violence on children and adolescents aged 8 and 19 years and the specific objective was to evaluate the efficacy of therapeutic interventions treating PTSD, anxiety, stress and depression in this age group up to 2024, with a focus on Cue-Centered Therapy (CCT). Contemporary evidence highlighted the superior efficacy of CCT compared to interventions like CBT, TF-CBT, CBTIS, EMDR, exposure therapy and others in alleviating PTSD, anxiety, depression, and stress among adolescents.

Methodology: This systematic review was conducted in accordance with the PRISMA guidelines and synthesized data from randomized controlled trials, longitudinal studies, case study and meta-analyses. This review compared CCT to other well-established trauma focused psychotherapies for adolescents in treating PTSD symptoms, anxiety and stress from interpersonal violence.

Findings: Using a trauma-related cue approach, coupled with a life timeline, conditioning processes and exposures, CCT provided a comprehensive treatment model that simultaneously addressed discrete traumatic events and ongoing stressors, yielding more adaptive coping strategies, increased self-efficacy and improved outcomes for both affected adolescents and their caregivers.

Conclusion: In conclusion, interpersonal violence in adolescents led to complex mental health issues like PTSD, depression, anxiety and stress, which hindered development. Early identification prevented long term emotional and physical problems. Psychotherapeutic interventions like CBT, TF-CBT, EMDR and CCT were effective in treating PTSD, with CCT demonstrating high efficacy due to its hybrid model and adaptability for trauma related symptoms.

Keywords: PTSD; Interpersonal Violence; Cue-Centered Therapy; Trauma; Adolescents; Psychotherapy.

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1. INTRODUCTION

Interpersonal violence against adolescents is a pervasive and multifaceted issue, encompassing various forms of abuse such as physical, emotional, and psychological harm. The consequences of such exposure are profound, often leading to severe and lasting post-traumatic stress disorder, anxiety, depression and stress. These adverse effects can extend into adulthood, resulting in long-term impairments in emotional regulation, social functioning, and mental health stability (Mohamad et al., 2022). Given the global prevalence of interpersonal violence, with significant variations across regions, the need for effective therapeutic interventions tailored to the unique challenges faced by this vulnerable population is urgent and critical (Bacchus et al., 2024; Masih et al., 2024).

1.1 Definition and Types of Violence

Interpersonal violence is the intentional use of power and physical force, actual or threatened, against a person, other person, or community and group, that results in maldevelopment, deprivation, psychological harm, injury or death (Organization, 2001). It will comprehensively include all forms of violence, encompassing acts of commission and omission, and addresses outcomes beyond fatalities and physical injuries. Violence is categorized into three primary types: self-inflicted, interpersonal, and collective (Figure 1) (McCord, 1983).

Each category is further divided to encompass specific forms of violence, their settings, and the nature of the violent acts, including sexual, psychological and physical and act of neglect and deprivation. While analyzing specific types of violence is valuable, it is equally important to explore their interconnections (Dodge et al., 2008). For example, those adolescents experience child abuse are statistically more likely to engage in aggressive and violent behavior as adolescents. Similarly, sexual abuse during adolescence is linked with an increased risk of suicidal behavior (Widom, 2006).

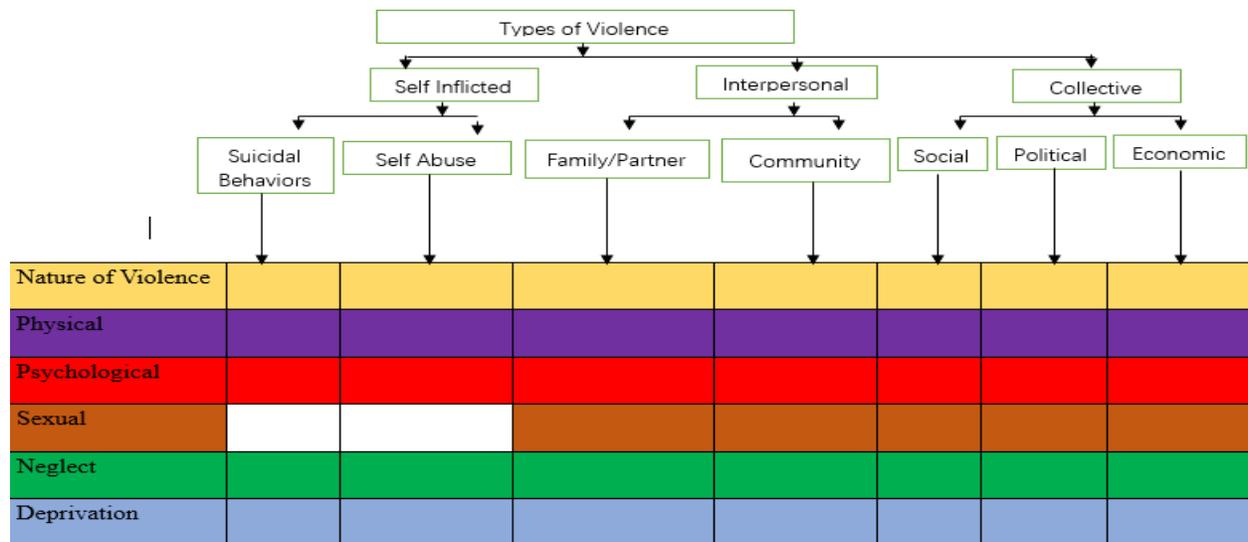


Figure 1: *Types and Nature of Violence.*

Moreover, certain risk factors, such as alcohol misuse, firearm availability, and socioeconomic inequalities, are prevalent across various types of violence. These interconnections highlight the potential to prevent multiple forms of violence by addressing a limited set of critical risk factors. They also underscore the necessity of enhanced collaboration among groups dedicated to preventing different types of violence (Paolucci et al., 2001).

Interpersonal violence encompasses physical, emotional, and psychological abuse that adversely impacts adolescent's well-being and developmental trajectories. Exposure to violence during formative years is linked to significant emotional regulation challenges, increased risks of mental health conditions such as PTSD, anxiety, depression, heightened aggression and behavioral dysregulation (Graham-Bermann et al., 2012; Schechter, 2023). Cumulative exposure exacerbates these effects, contributing to chronic mental health issues and difficulties in forming secure relationships in adulthood, perpetuating cycles of violence (Hamdani et al., 2022). Evidence highlights the alarming prevalence of mental health issues among adolescents exposed to violence, underscoring its role in psychosocial distress and suicidal tendencies (Ghazal, 2022; Khalid et al., 2019)

1.2 Treatment Strategies for Management of Trauma

Cognitive Behavioral Therapy has emerged as one of the most empirically supported psychotherapeutic approaches for treating PTSD in adolescents experiencing interpersonal violence. As highlighted in a recent meta-analysis, CBT, including trauma-focused cognitive behavior therapy, is the most prevalent and effective treatment for post trauma stress disorder among adolescent due to its structured approach that combines cognitive and behavioral way to change behavior and that are dysfunctional due to trauma. The meta-analysis demonstrated that the effectiveness of CBT is relatively consistent across different types of trauma, with no significant gender effects reported in most studies; however, the efficacy tends to increase with age, potentially because of due to the growth of cognitive process in children (Danzi & La Greca, 2021). Moreover, while some studies suggest that factors such as ethnicity, socio-economic status, and caregiver characteristics, including parental involvement and maternal depression, may influence treatment outcomes, these variables have not been extensively researched, necessitating further investigation (Danzi & La Greca, 2021).

Cognitive behavior therapy in group, such as the Cognitive-Behavioral Intervention for Trauma in Schools (CBITS), further extends the application of CBT by integrating peer support and school involvement, aiming to improve performance in school as well as emotional and social well-being in affected children. This program, which consists of structured group and individual sessions along with training for parents and teachers, underscores the importance of a comprehensive support system involving caregivers and educational professionals in the therapeutic process (Syros et al., 2022). The strong evidence base for CBT, coupled with its versatility in various settings, underscores its value as a primary intervention for children and adolescents experiencing PTSD following interpersonal violence, making it a vital component of therapeutic protocols aimed at this vulnerable population. Future research should focus on refining CBT approaches to account for the diverse backgrounds and specific needs of adolescents impacted by interpersonal violence, thereby optimizing results from therapy across different demographic groups (Herrenkohl et al., 2019).

Trauma focused CBT is well researched and most used psychotherapeutic approaches for treating post-traumatic stress disorder, particularly in adolescents who have experienced interpersonal violence. Originally developed for sexual abuse victims, TF-CBT also adapted for other events that are traumatic in nature, demonstrating significant efficacy in reducing PTSD symptoms across various populations (Cohen et al., 2012). Trauma focused cognitive behavior therapy bring shown faster cognitive change compared to methods like exposure therapy alone, possibly due to its comprehensive approach that addresses both trauma-specific symptoms and broader emotional and cognitive dysfunctions (Deblinger et al., 2016). Moreover, TF-CBT's incorporation of parental involvement has been emphasized as crucial for the long-term maintenance of treatment effects, fostering a supportive environment for the child, and promoting adaptive family functioning (Dorsey et al., 2014).

Exposure Therapy, another well-established CBT-based treatment, focuses on reducing PTSD symptoms through systematic exposure to memory and cues related to trauma in a safe therapeutic setting. Prolonged exposure has been extensively researched and is regarded as effective for treating PTSD in adolescents exposed to interpersonal violence (Foa, 2006). The therapy involve exposure on imaginal and

in real to trauma-related stimuli, aiming to diminish avoidance behaviors and foster emotional processing of traumatic memories. However, persistence of post-traumatic stress disorder symptoms post-treatment in some individuals suggests the need for adjunctive therapies or more tailored approaches for those with complex presentations (Galovski et al., 2009).

Relaxation techniques are frequently employed as complementary strategies within these psychotherapeutic frameworks to manage acute anxiety and physiological arousal associated with PTSD. These techniques, such as diaphragmatic breathing, progressive muscle relaxation, and guided visualization, provide immediate tools for adolescents to regulate their physiological responses to trauma reminders, though they are not typically used for post-traumatic stress disorder due to limited proof of their benefit when isolated from broader therapeutic contexts (Kushner & Marnocha, 2008).

Trauma Systems Therapy (TST) represents a comprehensive clinical and organizational way specifically designed multifaceted nature of trauma in adolescents. Rooted in ecological model of Bronfenbrenner, which underscores importance of various ways within which a child grows, TST focuses on both internal factors; ways of coping, regulation of emotions, and conditions from environment and society as external factors that influence an adolescent's perception of threat. This dual approach allows to understand PTSD symptoms, mostly due to misinterpretations of non-threatening stimuli as threats, leading to survival-based behavioral responses. Research indicates that TST is maintaining high treatment retention rates (Brown, 2020). This holistic, systemic approach underscores the importance of addressing both the individual and their environment in treating trauma, aligning with broader ecological perspectives on child development (Brown, 2020).

Play therapy is an empirically supported intervention tailored to help adolescent express complex emotions and thoughts, leveraging expressive media such as art supplies and puppets to facilitate communication in those with limited verbal skills (Landreth, 2001). This therapeutic approach is particularly effective for children who struggle to articulate their experiences verbally, providing a culturally adaptable means of expression that bridges abstract thought and limited language ability. The child-centered play therapy (CCPT) model, an extension of Rogerian client-centered therapy, emphasizes creating a secure environment where children feel empowered to express their emotions freely (Landreth, 2001). Core techniques in CCPT, such as reflective listening and emotional contemplation, are designed to foster a positive therapeutic relationship, crucial for the therapy's success (Baggerly et al., 2010) and promotes emotional regulation by enabling children to process and articulate emotions that they cannot yet verbalize effectively (Geldard et al., 2006). Research indicates that CCPT can significantly reduce symptoms of PTSD in children, especially when involving caregivers, thereby enhancing the therapeutic process and outcomes (Bratton et al., 2005).

Francine Shapiro developed eye movement desensitization and reprocessing (EMDR), is a structured, empirically supported therapy primarily used for disorders related to trauma, including PTSD among adolescents. The therapy's foundation lies in the adaptive information processing model, which suggests that mental health disorders are often the result of improperly processed traumatic memories that disrupt normal cognitive and emotional functioning (Shapiro, 2001). Eye movements through bilateral stimulation, EMDR facilitates reprocessing dysfunctional thoughts, reduce emotional intensity and physiological arousal, ultimately integrating them into the individual's cognitive framework more adaptively (Van der Kolk et al., 2007).

Narrative Exposure Therapy (NET) is a therapy for trauma approach that emphasizes the reconstruction of an individual's trauma narrative to restore coherence and meaning to fragmented memories often seen in PTSD (Schauer et al., 2011). NET considered psychological health is significantly linked to the narratives individuals construct about their lives; disrupted or chaotic narratives are associated with psychopathology, whereas coherent and meaningful narratives promote mental well-being (Schauer et al., 2011). Through guided sessions, individuals recount their entire life stories, focusing on traumatic events to reprocess these memories within a safe therapeutic setting, thereby diminishing their emotional impact

(Robjant & Fazel, 2010). This method, particularly effective for populations exposed to multiple traumatic events such as refugees, helps transform distressing experiences into structured and less distressing narratives by reinforcing a positive self-image and resilience (Gwozdziwycz & Mehl-Madrona, 2013). Unlike therapies focusing solely on the worst trauma, NET involves a comprehensive approach, recognizing that multiple trauma exposures can cumulatively contribute to PTSD, and that addressing these systematically can lead to substantial improvements in symptoms and overall psychological functioning (Schauer et al., 2011).

1.3 Need for Specialized Therapeutic Interventions

Trauma during developmental years affects adolescents' cognition, behavior, emotions and physiology, presents significant diagnostic and therapeutic challenges due to its heterogeneous and multifaceted nature. Treatments for trauma showed promising results, few are explicitly designed to address the cumulative and chronic nature of developmental trauma. This gap highlights need for interventions that enhance adolescent's insight into results trauma that are for long duration, particularly with limited caregiver involvement. Strengths based approaches that emphasize resilience, agency, and empowerment are particularly promising for improving treatment engagement and generalization of skills. More researches are required to identify components of interventions are useful for specific trauma profiles and to determine whether treatments tailored to complex developmental trauma yield superior outcomes compared to those addressing acute, single event trauma.

1.4 Cue Centered Therapy (CCT)

Stanford Cue Centered Therapy (CCT) targeted individual age 8-18 years with trauma, offering a flexible, integrative model that combines element of family therapy, exposure, psychoeducation, narrative components. CCT emphasizes empowerment through psychoeducation, helping children understand how cues for trauma via conditioning process and the way cues influence thoughts, behavior, physiological reactions and emotion. By expanding the traditional cognitive behavioral triangle to include physiological responses, CCT enhances interoception skills, allowing adolescent to develop adaptive reactions to trauma cues while maintain protective reactions during disaster. Unlike interventions anchored to a single traumatic event, CCT accounts for the cumulative impact of trauma across the lifespan (allostatic load) and emphasizes resilience alongside adversity. Its limited caregiver involvement makes it particularly suited for school-based settings, older youth, and families experiencing single trauma, ongoing adversity, ensuring accessibility and effectiveness across diverse contexts (Cai et al., 2019).

1.4.1 CCT Treatment Model and Structure

Stanford Cue Centered Therapy is trauma-focused intervention that include psychoeducation, coping skill development, narrative processing and gradual exposures to trauma cues. CCT enhances insight of adolescent into cognitive, emotional, physiological and behavioral impacts of trauma, applying this understanding through trauma reformulation, narrative reflection and exposure practice. Grounded in classical conditioning principles (Figure 2), CCT targets trauma associated cue responses by helping adolescent develop new adaptive associations, thereby increasing their flexibility and confidence in managing trauma reminders and future stressors. Its unique emphasis on addressing chronic and cumulative trauma positions CCT as a comprehensive approach to treat complex developmental trauma in youth (Kletter et al., 2021).

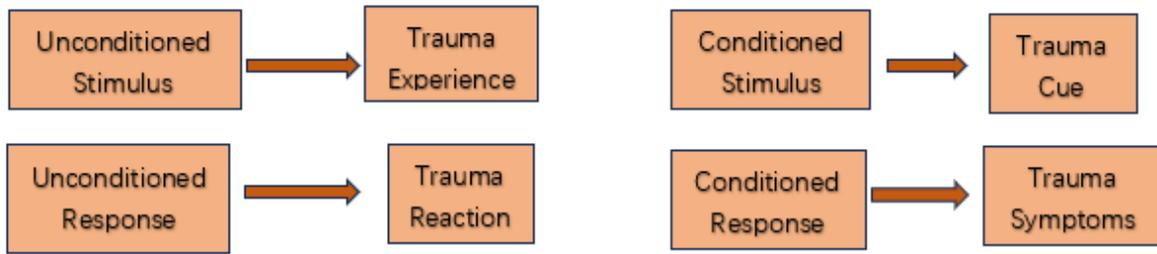


Figure 2. CCT application of classical conditioning of trauma

Through gradual exposures, such as desensitization to trauma cues, CCT helps adolescents develop adaptive response, including relaxation and self-regulation techniques, executive functioning, interpersonal abilities while maintaining flexibility to preserve protective reaction, using a developmental framework to conceptualize trauma’s impact. Delivered over 15 sessions across four phases, CCT is highly collaborative, empowering adolescent as co-investigator in selecting coping strategies, trauma exposures and sharing treatment progress. This approach builds self-efficacy while equipping adolescents with the skill to adaptively respond to trauma cues and stressors in varying contexts (Kletter et al., 2021).

CCT is a structured intervention delivered in four phases, begins with assessment of trauma, psychoeducation on trauma responses, and coping skill development. In phase two, adolescent then create a life timeline and process trauma narrative to understand cue related reactions. In phase three, gradual exposure to trauma cues, fostering adaptive responses across emotional, cognitive, physiological and behavioral domains. The final phase, integrates treatment gains, reinforces skills and prepare adolescent for future adversities (Figure 3). CCT promotes trauma insight, coping flexibility, and resilience, effectively reducing post-traumatic stress and improving overall functioning in adolescent (Kletter et al., 2021).

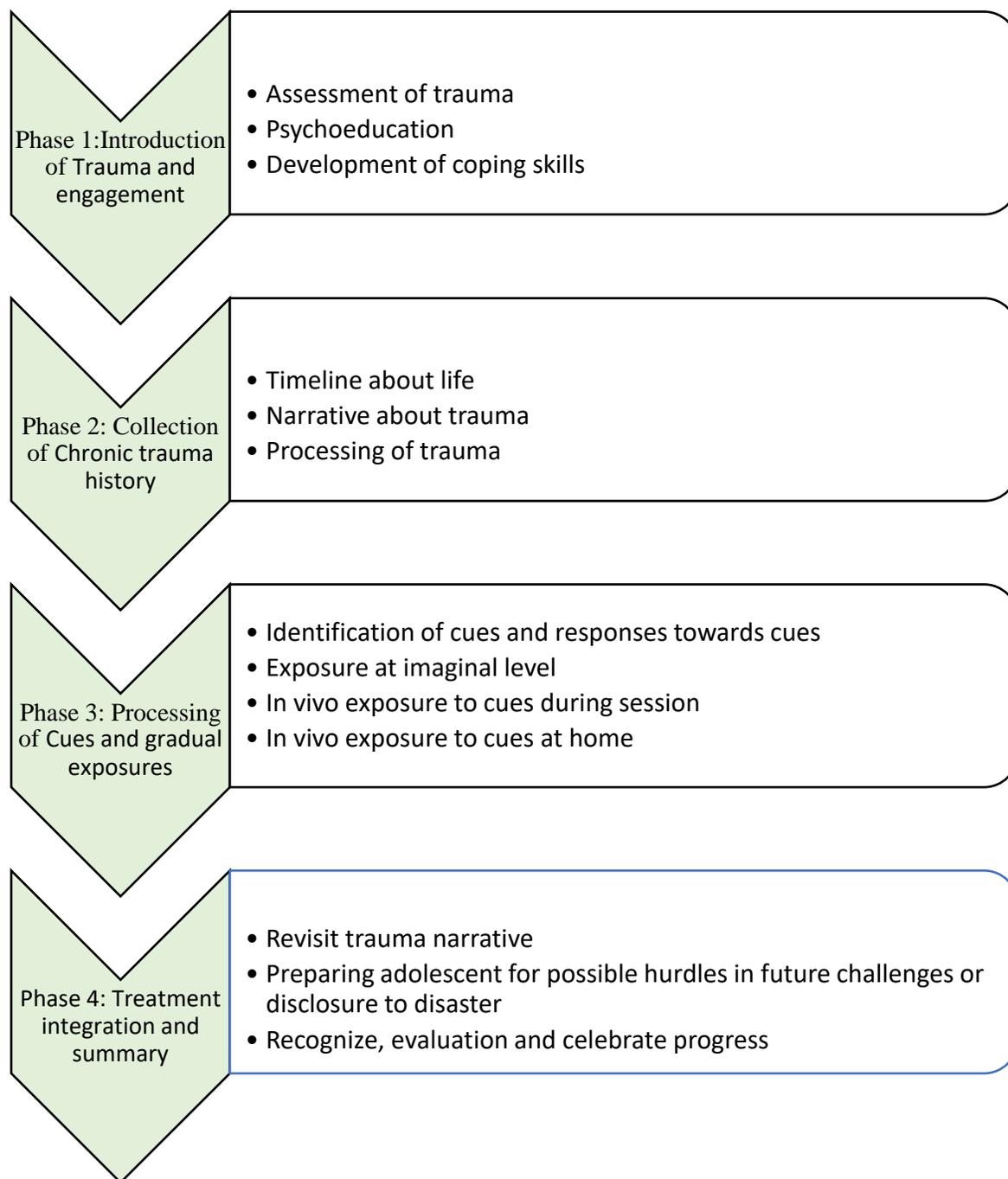


Figure 3: A flowchart indicating the CCT main phases and component (Kletter et al., 2021).

1.4.2 CCT Training Model and Dissemination

The Stanford Cue Centered Therapy (CCT) training and dissemination model emphasizes best practice for implementing evidence-based intervention in clinical and school settings. The training incorporated a comprehensive manual for treatment, workshops, and clinical supervision for case consultation. The manual provides a theoretical framework, session guidelines and practical tools, including visuals and worksheets, available in English, Spanish and Urdu. In person workshops, led by CCT master trainers,

balance didactic teaching with active learning methods such as role play, behavioral modeling, and clinical skills practice to enhance provider competence and treatment utilization (Kletter et al., 2021).

To date, 231 local clinicians and 2347 therapist have been trained through workshops in California, Puerto Rico, and international settings, integrating CCT with preventive interventions like mindfulness and yoga. Training has been delivered across universities, community clinics, disaster response programs, and international trauma conferences. Clinical supervision, the final training component, involve case consultations for a minimum of two CCT cases, adhering to best practices such as feedback, fidelity monitoring, and problem solving. However, efforts are underway to expand CCT dissemination globally through the development of a formalized training plan the trainer, aiming for more trained CCT providers and ensure broader implementation across diverse settings (Kletter et al., 2021).

1.4.3 Training Innovations

To enhance the accessibility and effectiveness of CCT training, innovative efforts have focused on integrating online learning into the training process. In 2018, the CCT team, in collaboration with Stanford School of Medicine's Educational Technology (EdTech), developed a sequential web-based training program consisting of eight interactive, self-paced modules. Designed using the ADDIE instructional model, the modules present clinically oriented content through multimedia formats, offering flexibility for learners to review material at their pace. This approach aligns with broader trend in empirically supported interventions, such as, TF-CBT and DBT, that have successfully incorporated web-based instruction to improve training outcome. By addressing learner needs through focus groups and interviews, these innovations aim to improve global accessibility, cost effectiveness, and learner engagement in CCT training (Kletter et al., 2021).

Evaluation of CCT training have consistently incorporated feedback from trainee to refine in person and online instruction, resulting in improved satisfaction and engagement over time. Need assessments highlighted enthusiasm for interactive online modules featuring clinical vignettes. The COVID-19 pandemic necessitated remote production and testing of the first module with 44 clinicians, with frequent improvements planned. More work is needed evaluate trainings' impact on provider knowledge, behavioral change and implementation barriers to ensure its clinical effectiveness (Kletter et al., 2021).

2. METHOD

This review article assesses the efficacy of Cue Centered Therapy (CCT) for adolescents exposed to interpersonal violence, with a comparative analysis against other psychotherapeutic approaches. The scope of the review includes research paper, meta-analyses, randomized control trails, case study and review papers published between 2000-2024. Review paper include researches both quantitative and qualitative that evaluates therapeutic interventions for juvenile PTSD, with more attention on RCT and empirical due to rigorous methodology and statistical validity.

A comprehensive exploration across multiple databases; PsycINFO, Scopus, PubMed, and Elsevier. Search terms included "interpersonal violence," "Cue Centered Therapy," "psychotherapy," "PTSD in adolescents," and specific psychotherapy; "cognitive-behavioral therapy," EMDR, Exposure therapy and "TF-CBT". The intervention must specifically target interpersonal violence, depression, post-traumatic stress symptoms, anxiety and stress in children, adolescents, with a clear focus on reducing these symptoms (figure 4). Boolean operators were utilized to refine search results and ensure relevance. The initial search yielded 475 bibliographic sources. To narrow the selection, studies were filtered. Only studies published from 2000 onward were considered to ensure relevance and currency. Studies involving participants aged 8 to 19 years were included. A permissible age range deviation of up to two years was allowed. Only English research studies were included and other non-English languages studies were excluded. Spanish studies were included only when no suitable English study was available. Preference was given to quantitative studies, including RCTs and meta-analyses, due to their robust evidence base. Qualitative studies were included only when no suitable quantitative studies were available. Only studies

published in reputable journals or by reputable authors were considered. Those studies were excluded which were based on involving adult populations were excluded. Non-empirical studies, such as opinion pieces or theoretical articles without empirical data, were excluded. Articles not published in English and Spanish were excluded.

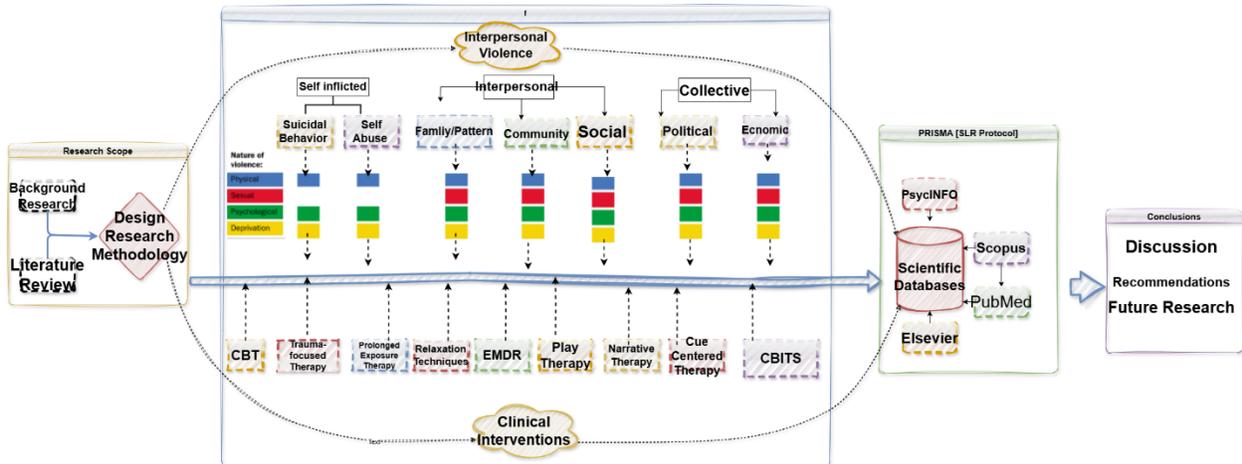


Figure 4. Flowchart of Proposed Research Design

Following the initial search and filtering process, from 475 bibliographic sources that were initially identified, only 12 research papers were considered for this review paper (Figure 5). Data were extracted on study design, sample characteristics, intervention types, and efficacy outcomes. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were employed to ensure a rigorous and systematic review process. Analysis involved qualitative and quantitative assessments of the interventions' efficacy. Included studies were evaluated based on DSM-5 criteria for diagnosing PTSD, stress, anxiety and depression with an emphasis on empirical measures such as interviews or questionnaires administered to participants or their caregivers. The effectiveness of CCT and other intervention was analyzed to determine relative efficacy. Methodological rigor, sample size, and relevance to the research question is the criteria to assess the quality of study. Very small number of high-quality studies available and the potential for publication bias, which may influence the interpretation of findings is the limitation of this review paper.

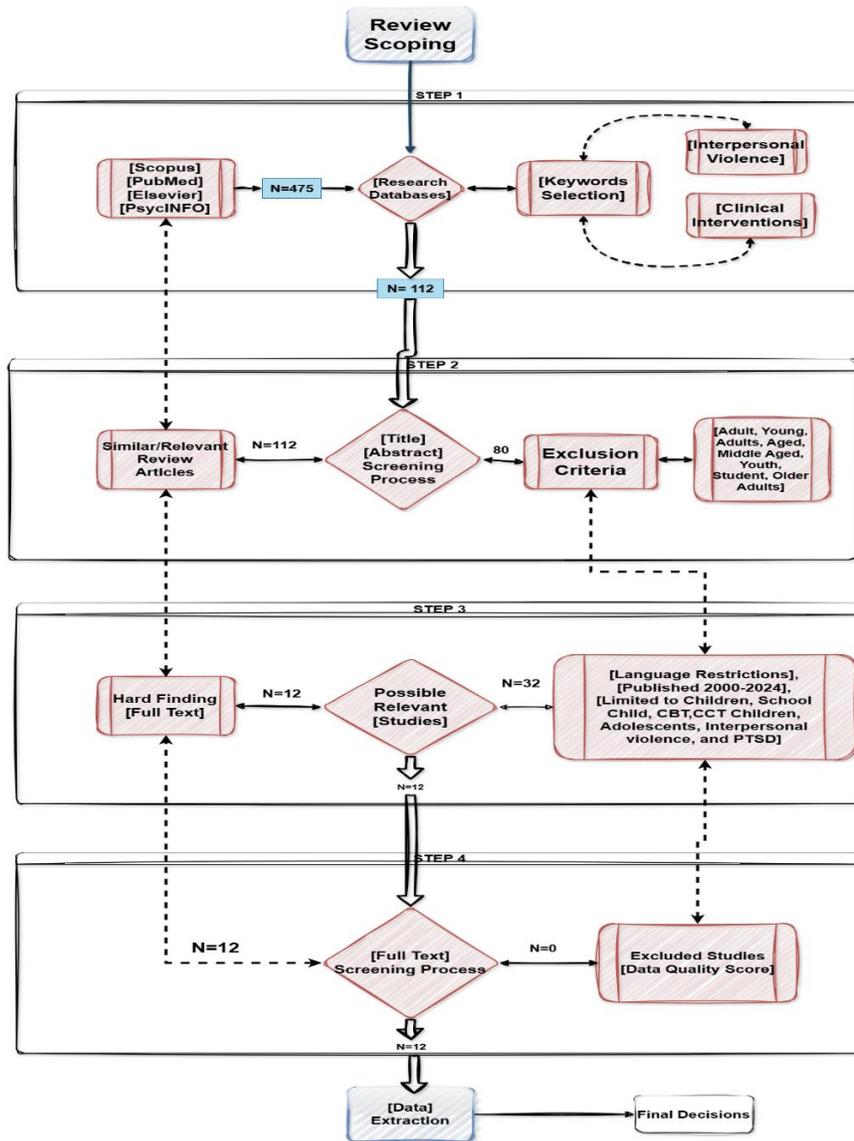


Figure 5. Flowchart of PRISMA methodology

This review aims to provide a comprehensive evaluation of CCT compared to other psychotherapeutic interventions for adolescents affected by interpersonal violence, highlighting strengths and identifying gaps in the current literature.

3. RESULTS

The evaluation of Cue-Centered Therapy (CCT) in comparison with various established psychotherapeutic interventions underscores its notable efficacy, particularly in addressing trauma-specific symptoms adolescents. CCT was found to provide a more targeted reduction in trauma cue reactivity and advantage in treating patients with distinct trauma triggers (Smith, 2022).

Cruylles, Kletter & Carrion (2022) in a hybrid format focuses on a case study conducted in person and online involving a child post traumatic symptom. The CCT helps children recognize their patterns, process emotions and strengthen relationship. In this case, the combined format proved effective in

adapting to logistic challenges while maintain therapeutic benefits. Key results highlighted improvements in emotional regulation and reduction in trauma related symptoms (Cruylles et al., 2022).

Up till now, CCT is well researched with two RCTs. In First RCT, sixty-five youth age 8-17 years were included in the study. Result showed youth experienced at least two traumas and average traumas are five. Youth reported separation (75%), witnessing violence (61.5%), homicide (51.9%), bullying (25%) and physical abuse (25%). Youth were randomly assigned to CCT and control group. Child were assessed using UCLA PTSD RI, CDI and CGAS and parents were assessed using PTSD-RI, BAI and BDI. Result found CCT reduces PTSD symptoms, depression, stress and anxiety and improvement in functioning in adolescents and caregiver overall. These gains were also sustained at 3 month follow up (Carrion et al., 2013).

The second RCT include 73 youths age between 7-17. Research Participants were assigned randomly to CCT, TF-CBT or a treatment as usual (TAU). Assessment included UCL PTSD RI, MASC, BRIEF, BIS and fNRIS. Result showed TF-CBT and CCT were effective in treating PTSD. Post hoc tests for follow up revealed lower post treatment score on the PTSD-RI for CCT significantly ($M=23.4$, $SD= 18.6$, $d=1.39$) and TF-CBT ($M=18.5$, $SD= 16.5$, $d=1.08$) (Carrion, 2020).

In a three-day work group of eight authors with expert on treatment adolescents exposed to war and violence. In meeting personal experiences and previous research were discussed to develop a wide range of intervention approaches. CCT, was considered as a hybrid intervention that emphasizes education on classical conditioning and trauma related reminders (cues), focusing on how these are linked to current behaviors, emotions, thoughts, and physiological process for youth exposed to war and violence (Kletter et al., 2013).

Kletter et al. (2021) in his review paper indicated promising outcome of CCT in improving adolescents' and caregiver functioning and reducing PTSD symptoms. He mentioned RCTs of CCT and stated that CCT is for developmental trauma, helpful in developing youth insight in to the trauma, narrative processing and through exposures and its effect on emotions, cognition, physiology and psychology and helpful in developing more adaptive response for current situation (Kletter et al., 2021).

Espil et al. (2021) conducted a transdisciplinary feasibility study evaluating effectiveness of school-based yoga and mindfulness curriculum, with a particular focus on underserved communities. Using a Fidelity Observation Form (FOF) developed and refined in two phases he collected data from one sixty-five adolescents, and the findings were refined by taking 91 additional observations in study 2. The current research assessed the alignment between intervention components and curriculum goals, as well as instructor adherence. Key findings reveled that instructor demonstrated compassion, maintained order, and provided clear instruction; however, fidelity was in consistent across certain content areas. The study underscored the feasibility of implementing structured mindfulness interventions in school, highlighting the necessity of systematic training and monitoring to ensure consistent delivery. These insights are critical for clinical interventions, emphasizing the role of structured evaluation tools and trainings to enhanced the efficacy and replicability of therapeutic approaches for adolescents, which rely on consistent and measurable outcome (Espil et al., 2021).

Balters et al. (2021) utilized fNRIS for explore brain activation patterns in youth exposed to trauma related stress and exhibiting post traumatic stress symptoms. Using portable fNRIS system, the study examined cortical hemodynamic responses in 57 participants aged 7-17 during a facial expression task involving fearful and neutral stimuli. The results showed increased dorsolateral prefrontal cortex (DLPFC) activation in response to emotional stimuli, with stronger activation to neutral faces compared to fearful ones, suggesting cognitive efforts to regulate emotion generators. A predictive model integrating cortical activation, age and sex effectively forecasted post traumatic stress symptoms severity ($r=0.65$). These findings highlighted fNRIS for identifying brain biomarkers of post-traumatic stress symptoms, and providing objective neurobiological correlates to inform clinical interventions and enhancing the precision of targeting emotional regulation circuits for trauma affected youth (Balters et al., 2021).

Cai et al. (2019) conducted a comprehensive investigation into neural mechanisms by using functional MRI during a Stop- Signal Task (SST). The study examined 9-12 years old adolescents, is important for the maturation of inhibitory control and utilized a Neural Maturity Index (NMI) to assess the similarity of brain activation patterns among adolescents. The findings revealed that adolescents with higher NMI scores demonstrated better inhibitory control, as measured by spot signal reaction times (SSRTs). Moreover, the study highlighted the critical role of hyper direct cortical basal ganlia pathway. These insights offer valuable implications for clinical interventions by identifying neural makers of self-regulation and inhibitory control processes that can guide targeted therapeutic strategies for developmental disorders in trauma affected youth (Cai et al., 2019).

Warren et al. (2020) used functional MRI and computational drift diffusion modeling (DDM), the study assessed latent cognitive effective processes during emotional regulation tasks, especially reappraisal in 10-11 years old adolescents. Significant findings revealed that reactivity due to stress and anxiety hindered regulation in emotions through increased bottom-up causal influences from the amygdala to the DLPFC, while also hindering behavioral dynamics such as decision bias and evidence accumulation. These insights emphasize the amygdala- DLPFC pathway's role as a critical transdiagnostic circuit in childhood anxiety, suggesting its potential as a target for early intervention (Warren et al., 2020).

Espil et al. (2022) in an experimental study to examine role of cortical activation in predicting posttraumatic symptom in youth undergoing TF-CBT or Stanford Cue Centered Therapy (CCT). The study included 73 youths and utilized the UCLA PTSD RI and fNIRS to assess posttraumatic stress symptoms and cortical activation. Overall, post stress symptoms reduced through follow-up across conditions, with some evidence of relative benefit of TF-CBT and CCT, with findings suggesting the cortical activation patterns were predictive of symptom improvement. This highlights the potential of using neural biomarkers to better understand emotional dysregulation in clinical population. The study underscores the relevance of neural mechanism in tailoring therapeutic approaches and refining interventions for trauma affected youth (Espil et al., 2022).

Chbeir and Carrion (2023) presented a review exploring the role of nature, nurture, environment, and the microbiome contribute to mitigating stress and allostatic load, with a focus on Stanford CCT. The paper emphasized CCT's unique approach to promote adaptive and resilient responses by incorporating life timeline as a central the therapeutic component for processing events in adolescent's lives. The review highlighted the efficacy of CCT in improving PTSD symptoms, which has been supported by findings linking therapeutic progress to cortical activation pattern. This underscores the interventions' neurobiological foundation and its potential to target emotional dysregulation through structured and adaptive therapeutic techniques (Chbeir & Carrión, 2023).

McCurdy et al. (2024) in nonrandomized comparison evaluate mental health curriculum in school incorporating yoga and mindfulness, involving 881 participants. Using the RQ, WRAT-R an BASC-2, the study demonstrated the mindfulness-based interventions significantly improved children's coping skills, emotional regulation and academic outcomes. Th findings underscore the efficacy of integrating mindfulness techniques in school settings, these approaches are a promising avenue for addressing emotional dysregulation and stress related challenges in youth (McCurdy et al., 2024).

In summary, the evidence from the studies reviewed consistently supports the effectiveness of CCT in managing trauma-specific symptoms, highlighting its advantages over various other psychotherapeutic modalities.

Table 1. Main Results and study characteristics

Author (Year)	Type of Study	Sample Size	Instruments	Conclusion-Guide for Clinical Interventions	Full Article Title	Journal Name (Volume)	References
(Cruylles et al., 2022)	Case Study	1 youth	Child and Adolescent Trauma Screen (CATS), Self-Report Measures for PTSD, Anxiety, Depression	CCT reduce post traumatic symptoms not meeting clinical criteria. CCT is suggested treatment option for chronic posttraumatic stress disorder in children.	Combined Online and In-person Cue Centered Therapy: A case Study	<i>Revista de Psiquiatría Infanto-Juvenil</i> , (39(4) , 33-41).	Cruylles, S., Kletter, H., & Carrión, V. G. (2022). Terapia de claves traumáticas en formato combinado, presencial-telemático: a propósito de un caso. <i>Revista de Psiquiatría Infanto-Juvenil</i> , 39(4), 33-41.
(Carrion et al., 2013)	Randomized Controlled Trial (RCT)	65	PTSD Checklist, Child and Adolescent Trauma Screen (CATS), Self-Report Measures for PTSD, Anxiety, Depression	Cue-Centered Treatment (CCT) significantly reduced PTSD symptoms, anxiety, and depression in youth exposed to interpersonal violence.	Cue-Centered Treatment for Youth Exposed to Interpersonal Violence: A Randomized Controlled Trial	Journal of Traumatic Stress (26, 654-662)	Carrion, V. G., Kletter, H., Weems, C. F., Berry, R. R., & Rettger, J. P. (2013). Cue-Centered Treatment for Youth Exposed to Interpersonal Violence: A Randomized Controlled Trial. <i>Journal of Traumatic Stress</i> , 26(6), 654-662. https://doi.org/10.1002/jts.21870
(Kletter et al., 2013)	Workgroup Study with Expert Insight	N/A	Expert Discussion and Review of literature	Developed a nine- phase intervention model addressing cultural and ecological challenges, emphasizing partnerships with school/organization, focusing on resilience building, and highlighting cultural adaptations for children exposed to war and violence.	Helping Children Exposed to War and Violence: Perspectives from an International Work Group on Interventions for Youth and Families	<i>Child and Youth Care Forum</i> (42:371–388)	Kletter, H., Rialon, R. A., Laor, N., Brom, D., Pat-Horenczyk, R., Shaheen, M., Hamiel, D., Chemtob, C., Weems, C. F., Feinstein, C., Lieberman, A., Reicherter, D., Song, S., & Carrion, V. G. (2013). Helping children exposed to war and violence: Perspectives from an international work group on interventions for youth and families. <i>Child & Youth Care Forum</i> , (42: 371–388). https://doi.org/10.1007/s10566-013-9203-4

(Carrion, 2020)	Randomized controlled trial	73 children	PTSD R index, BRIEF, MASC, CDI and fNIRS	Both CCT and TF-CBT significantly improved post traumatic and anxiety symptoms in children exposed to chronic interpersonal violence. fNIRS data will further clarify executive function outcome.	Cue Centered Therapy in Community settings	Journal of the American Academy of Child & Adolescent Psychiatry, 59(10S), S323	Carrion, V. G. (2020). Cue-centered therapy in community settings. In <i>2020 Virtual Meeting</i> . AACAP. 59(10S), S323. https://doi.org/10.1016/j.jaac.2020.07.768
(Kletter et al., 2021)	Literature Review and RCT summary	RCT1: 65 youth RCT2: 73 Youth	UCLA PTSD R index, RCMAS, CDI, CGAS, BIS, MASC, fNIRS	CCT reduces PTSD symptoms, anxiety and depression in children. It provides a structured, integrative treatment frame work targeting trauma responses (emotions, cognitions, physiology, behaviors) using psychoeducation, narrative processing and gradual exposure. CCT foster resilience, adaptability, and empowerment, especially in contexts of complex developmental trauma and limited caregiver availability.	Cue centered therapy for youth experiencing posttraumatic symptoms	Current treatment options in psychiatry	Kletter, H., Matlow, R., Tanovic, S., & Carrion, V. (2021). Cue-Centered Therapy for youth experiencing posttraumatic symptoms. <i>Current Treatment Options in Psychiatry</i> , 8(3), 125–140. https://doi.org/10.1007/s40501-021-00241-3
(Espil et al., 2021)	Feasibility study on fidelity of yoga and mindfulness implementation in school.	Study 1: 165 observations Study 2: 91 observations		Fidelity Observation Form (FOF), Student engagement measures, Structured observation, principal components analysis.	Measuring the Fidelity of a School Based Yoga and Mindfulness Curriculum for Youth: A Transdisciplinary Feasibility Study.	Child & Youth Care Forum (50:57-75)	Espil, F. M., Rettger, J. P., Weems, C. F., Neill, E. L., & Carrion, V. G. (2021). Measuring the fidelity of a school-based yoga and mindfulness curriculum for youth: A transdisciplinary feasibility study. <i>Child & Youth Care Forum</i> , 50(1), 57–75. https://doi.org/10.1007/s10566-020-09558-1

(Balters et al., 2021)	Experimental study using fNRIS to predict PTSD symptom severity	57 youths	UCLA PTSD R index, fNRIS system, facial expression task.	Portable fNIRS is effective in identifying cortical biomarkers for PTSD in youth, highlighting its potential as a diagnostic and treatment monitoring tool. Cues in environment showed activation of patterns in the dorsolateral prefrontal cortex correlated strongly with the symptom severity, enabling targeted interventions.	Functional near infrared spectroscopy brain imaging predicts symptoms severity in youth exposed to traumatic stress.	Journal of Psychiatric Research (144: 494-502)	Balters, S., Li, R., Espil, F. M., Piccirilli, A., Liu, N., Gundran, A., Carrion, V. G., Weems, C. F., Cohen, J. A., & Reiss, A. L. (2021). Functional near-infrared spectroscopy brain imaging predicts symptom severity in youth exposed to traumatic stress. <i>Journal of Psychiatric Research</i> , 144, 494–502. https://doi.org/10.1016/j.jpsychires.2021.11.003
(Cai et al., 2019)	Cross sectional study	Child	fMRI, Behavioral task	The maturity of the hyper direct insula-basal ganglia pathway and global brain response patterns predict inhibitory control development. Clinician/s should focus on interventions targeting self-regulation skills to strengthen inhibitory pathways in children.	Hyper direct insula-basal-ganglia pathway and adult like maturity of global brain responses predict inhibitory control in children.	Nature Communication (10, 1-13)	Cai, W., Duberg, K., Padmanabhan, A. <i>et al.</i> Hyperdirect insula-basal-ganglia pathway and adult-like maturity of global brain responses predict inhibitory control in children. <i>Nat Commun</i> 10, 4798 (2019). https://doi.org/10.1038/s41467-019-12756-8
(Warren et al., 2020)	Experimental fMRI study	N=120 (Children)	fMRI (functional MRI), Behavioral Assessment	Anxiety and stress disrupt the amygdala-DLPFC interaction in children, impairing emotional regulation and decision making. Interventions should target this brain circuitry to enhance cognitive control and emotional regulation.	Anxiety and Stress Alter Decision Making Dynamics and Causal Amygdala-DLPFC circuits During Emotional Regulation in Children	Biological Psychiatry (88,576-586)	Warren, S. L., Zhang, Y., Duberg, K., Mistry, P., Cai, W., Qin, S., Bostan, S-N., Padmanabhan, A., Carrion, V. G., & Meno, V. M. (2024). Anxiety and Stress Alter Decision-Making Dynamics and Causal Amygdala-Dorsolateral Prefrontal Cortex Circuits During Emotion Regulation in Children. <i>Biological Psychiatry</i> , (88, 576-586). https://doi.org/10.1016/j.biopsy

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(Espil et al., 2022)	Experimental Study	N=73 youth	UCLA PTSD R index, fNRIS	Overall, TF-CBT and CCT benefits PTSD symptoms. Association between functional activation and youths' PTSD symptoms improvement may be a promising avenue for understanding emotional dysregulation in clinical population.	Cortical activation predicts posttraumatic improvement in youth treated with TF-CBT or CCT.	<i>Journal of Psychiatric Research</i> , 156(25-35).	Espil, F.M., Balters, S., Li, R., McCurdy, B.H., Kletter, H., Piccirilli, A., Cohen, J.A., Weems, C.F., Reiss, A.L. and Carrion, V.G., 2022. Cortical activation predicts posttraumatic improvement in youth treated with TF-CBT or CCT. <i>Journal of Psychiatric Research</i> , 156(25-35). https://doi.org/10.1016/j.jpsychires.2022.10.002
(Chbeir & Carrión, 2023)	Review Paper	N/A	N/A	CCT emphasizes resiliency and positive adaptation factors by using the life timeline as a core component for both positive and negative events in youths life. CCT have demonstrated PTSD symptoms improvement as measured by cortical activation patterns.	Resilience by design: How nature, nurture, environment, microbiome, mitigate stress and allostatic load.	<i>World Journal of Psychiatry</i> , (13(5), 144-159).	Chbeir, S., & Carrión, V. (2023). Resilience by design: How nature, nurture, environment, and microbiome mitigate stress and allostatic load. <i>World Journal of Psychiatry</i> , 13(5), 144-159. doi: 10.5498/wjp.v13.i5.144
(McCurdy et al., 2024)	Non-Randomized Comparison Design	881, 461 participants in intervention group, 420 comparison group, Children	RSQ, WRAT-R, BASC-2	Mindfulness based intervention show promise for improving coping skill, emotions regulation and academic outcome.	Program evaluation of a school-based mental health and wellness curriculum featuring yoga and mindfulness	<i>Plos one</i> , 19(4),	McCurdy, B. H., Bradley, T., Matlow, R., Rettger, J. P., Espil, F. M., Weems, C. F., & Carrion, V. G. (2024). Program evaluation of a school-based mental health and wellness curriculum featuring yoga and mindfulness. <i>Plos one</i> , 19(4), e0301028. https://doi.org/10.1371/journal.pone.0301028

4. DISCUSSION

CCT is a promising comprehensive integrative approach to treat trauma related symptoms in adolescents. CCT offers distinct benefits as a psychotherapeutic modality for alleviating posttraumatic stress symptoms, improving emotional regulation, and facilitating resilience, specifically incorporating insights from classical and developmental aspects of trauma.

Two high quality RCTs provide robust support for the efficacy of CCT. In a study, significant reductions in PTSD, anxiety and depression were observed among youth undergoing CCT, with sustained improvements in functioning reported by both adolescents and caregivers at follow-up (Carrion et al., 2013). A later RCT conducted by Carrion (2020) produced similar findings, showing that CCT resulted in significant decreased post treatment PTSD symptoms comparable to TF-CBT (Carrion, 2020). These findings underscore the neurobiological underpinnings of CCT, as evidenced by decreased reactivity to trauma cues and enhanced neural patterns associated with executive functions (Chbeir & Carrión, 2023; Espil et al., 2022).

CCT's versatility in addressing logistic hurdles without sacrificing therapeutic outcomes has been demonstrated in case studies and hybrid delivery models. Studies showed that integrating online and in person formats produced promising results, including improved emotional regulation and reduction in trauma related symptoms (Cruylles et al., 2022). Kletter and his colleagues emphasized CCT's effectiveness in addressing complex developmental trauma by incorporating neuroscience, and classical conditioning into its design (Kletter et al., 2021).

Beyond direct comparisons, studies on mindfulness-based interventions, align with CCT's emphasis on emotional regulation and coping strategies. These studies highlight shared therapeutic mechanisms, including enhanced resilience and adaptive responses (McCurdy et al., 2024), while neuroimaging researches has further solidified the scientific framework supporting CCT. Neuro-imaging techniques like fNIRS and fMRI studies have identified key neural circuits implicated in trauma and emotional regulation, including the dorsolateral prefrontal cortex, anterior insula and subthalamic nucleus (Balters et al., 2021; Cai et al., 2019; Warren et al., 2020). These findings validate CCT's ability to target emotional dysregulation at a neurobiological level and provide biomarkers for the treatment outcomes.

In summary, CCT represents an innovative and adaptable framework for trauma treatment, integrating psychoeducation, narrative and trauma processing, coping skills, cognitive restructuring, conditioning process and exposure-based practices. It provides a foundation for addressing the chronic trauma in developmental phase of adolescents.

4.1 *Limitations in Existing Research*

Despite the promising outcomes associated with Cue-Centered Therapy (CCT), there are significant limitations within the existing body of research. A notable gap is examined about efficacy of CCT across diverse populations. Most research has been conducted on relatively homogenous groups within specific cultural or socioeconomic contexts, raising concerns about the generalizability of these findings to broader and more varied populations. The underrepresentation of ethnic minorities, economically disadvantaged groups, and individuals from different cultural backgrounds limits our understanding of how these populations might respond to CCT, potentially leading to disparities in treatment outcomes.

Moreover, current literature lacks long-term follow-up research. Most studies focus on short-term outcomes, measuring improvements in symptoms immediately following the conclusion of therapy. However, the lack of longitudinal studies tracking adolescents over extended period leaves a question about the durability of CCT's therapeutic effects unanswered. Without long-term data, it remains unclear whether the benefits of CCT are sustained over time or if adolescents are at risk of relapse.

Additionally, several methodological issues in existing research like sample size, no longitudinal studies and few randomized trials further complicate the assessment of CCT's effectiveness. Furthermore, the

flexible and individualized nature of CCT leads to variations in how the therapy is implemented across studies, making it difficult to standardize and compare results. Addressing these methodological challenges is essential for validating the efficacy of CCT and ensuring its reliable application across diverse clinical settings.

4.2 Future Directions

To enhance the effectiveness and reach of CCT, several key recommendations emerge. First, there is a need for larger, more diverse studies to validate CCT's efficacy across different cultural and socioeconomic contexts. Expanding the evidence base with research that includes underrepresented populations helps to tailor CCT according to the specific needs of diverse groups. Future studies should prioritize cross-cultural research that examines how CCT can be adapted to meet the specific needs of youth and their caregivers from various cultural backgrounds.

Furthermore, integrating CCT with other community-based interventions or school-based programs presents an opportunity for creating collaborative care models that more effectively support adolescents exposed to interpersonal violence. Combining CCT digital health tools could enhance its accessibility and impact, particularly in underserved areas. The potential for using technology, such as teletherapy platforms or virtual reality, to deliver CCT remotely offers an innovative avenue for expanding its reach, making the therapy more accessible to adolescents who might otherwise be unable to receive care. Future research should focus on identifying core CCT components, optimizing its use based on adolescent's characteristics, and developing care algorithms. Efforts are underway to refine CCT training standards, implement a train-the-trainer model, and evaluate delivery modalities to enhance accessibility and reduce barriers to clinician engagement.

5. CONCLUSION

In conclusion, interpersonal violence causes complex mental issues like PTSD, aggression, depression, anxiety and stress in adolescents, which may hinder development. Identification in start will prevent the adolescent from mental, emotional, physical problems in the long term. The effectiveness of psychotherapeutic interventions like CBT, TF-CBT, EMDR are very helpful in treating PTSD. While CCT has shown substantial promise in addressing trauma-related symptoms in adolescent exposed to interpersonal violence, ongoing research and strategic adaptations are necessary to maximize its impact. Stanford Cue Centered Therapy (CCT) is a trauma focused intervention that incorporates evidence-based component such as psychoeducation, coping skill development, cognitive restructuring, narrative and trauma processing and gradual exposure to trauma cues. It aims to enhance adolescent's insight into the multifaceted impact of trauma; cognitive, emotional, physiological and behavioral while fostering adaptive responses to trauma reminders, CCT promotes resilience and flexibility in managing both past and future stressors and adversities. By addressing current limitations and exploring new avenues for integration and delivery, CCT can become an even more powerful tool for fostering psychological recovery and resilience in this vulnerable population.

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Conflict of Interest

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