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CLINICAL RESEARCH ARTICLE



PTSD symptom changes during Trauma-Focused Cognitive Behavioural Therapy (TF-CBT) in children and adolescents: a Single-Case Experimental Design study

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ABSTRACT

Introduction: Trauma-Focused Cognitive Behavioural Therapy (TF-CBT) is an evidence-based therapy for posttraumatic stress symptoms (PTSS) in children and adolescents. Nevertheless, drop-outs and limited effectiveness in individual and more complex cases remain a challenge. Detailed insight into individual symptom changes during therapy is missing. A Single-Case Experimental Design (SCED) is used to evaluate the changes and impact of the different modules of TF-CBT.

Methods: A SCED study with repetitive baseline was conducted. The most prominent symptoms for each participant were assessed weekly throughout therapy. Standardized self-report questionnaires measured trauma, anxiety, depression, trauma-related cognitions, and parent-child interaction at six key points. Pre- and post-assessments were based on the clinician administrated interview. Session reports were used to evaluate the therapy's progress.

Results and Discussion: Eight participants (ages 14–21) were included in the study. Graphical visualizations are presented of each individual symptom during the baseline and full course of the therapy (range = 20–70 weeks), alongside the corresponding standardized self-report. Most changes are seen during the narrative module, especially combined with the cognitive reprocessing and sharing module. A more severe or complex PTSD profile, needed more integration of coping skills and more sessions. For negative cognitions such as self-blame, cognitive reprocessing is necessary during the narrative. This SCED study provides a detailed insight in the therapeutic process of TF-CBT in a complex and heterogenous population.

Cambios en los síntomas del TEPT durante la terapia cognitivo-conductual centrada en el trauma (TF-CBT) en niños y adolescentes: un estudio de diseño experimental de caso único

Introducción: La Terapia Cognitivo Conductual Centrada en el Trauma (TF-CBT, por sus siglas en inglés) es una terapia basada en la evidencia para los síntomas de estrés postraumático (PTSS, según sus siglas en inglés) en niños y adolescentes. No obstante, las tasas de abandono y la efectividad limitada en casos individuales o más complejos siguen siendo un desafío. Falta una comprensión detallada de los cambios en los síntomas individuales durante la terapia. Se utiliza un estudio de Diseño Experimental de Caso Único (SCED, según sus siglas en inglés) para evaluar los cambios y el impacto de los diferentes módulos de la TF-CBT.

Métodos: Se realizó un estudio SCED con una línea base repetitiva. Los síntomas más relevantes de cada participante fueron evaluados semanalmente a lo largo de la terapia. Se utilizaron cuestionarios estandarizados de autoinforme para medir trauma, ansiedad, depresión, cogniciones relacionadas con el trauma e interacción padre e hijo en seis puntos clave. Las evaluaciones pre y post tratamiento se basaron en una entrevista administrada por el clínico. Los informes de sesión se utilizaron para evaluar el progreso terapéutico.

Resultados y Discusión: Ocho participantes (entre 14 y 21 años) fueron incluidos en el estudio. Se presentan visualizaciones gráficas de cada síntoma individual durante el inicio y curso completo de la terapia (rango = 20–70 semanas), junto con el correspondiente autoinforme estandarizado. La mayoría de los cambios se observan durante el módulo narrativo, especialmente combinado con el módulo de reprocesamiento cognitivo y de compartir la experiencia. Un perfil de TEPT más severo o complejo requirió una mayor integración de habilidades de afrontamiento y un mayor número de sesiones. Para las cogniciones negativas, como la autoinculpa, el reprocesamiento cognitivo es necesario durante la narrativa. Este estudio SCED proporciona una visión detallada del proceso terapéutico de la TF-CBT en una población compleja y heterogénea.

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Child and adolescent psychotherapy; trauma; PTSD; SCED; personalized psychotherapy

PALABRAS CLAVE

Psicoterapia en niños y adolescentes; trauma; TEPT; SCED; psicoterapia personalizada

HIGHLIGHTS

- TF-CBT is effective in reducing trauma and comorbid symptoms, as observed in both individual and group changes. However, symptoms do not decrease in a clear line, and individual symptom fluctuations are common.
- The trauma narrative, combined with reprocessing and sharing modules, induces the most significant symptom changes.
- Individualized therapy adaptations, such as integrating coping skills and adopting a more flexible approach to cognitive restructuring, are necessary especially regarding children with a more complex trauma history or severity of symptoms.
- By focusing on in-therapy changes, we take a step towards personalized psychotherapy, supporting clinicians in making therapeutic adjustments and refining interventions.

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1. Introduction

Post-Traumatic Stress Disorder (PTSD) in children can be developed after exposure to traumatic events, such as abuse, violence, accidents, or natural disasters (American Psychological Association, 2013). Going through potentially traumatic events can impede a child's ability to process and make sense of these experiences, affecting their emotional, cognitive, neurobiological and physical well-being. Their developmental stage makes children especially vulnerable to lasting negative effects (Connor et al., 2015; Silva et al., 2000). Symptoms such as avoidance, hypervigilance, and re-experiencing the traumatic event through nightmares or flashbacks, can disrupt a child's safety and trust, impacting relationships, learning, and functioning. Therefore, early intervention and treatment targeting trauma symptoms are crucial in helping children recover from PTSD (Bastien et al., 2020).

1.1. Trauma-Focused Cognitive Behavioural Therapy (TF-CBT)

An international evidence-based therapy for post-traumatic stress symptoms (PTSS) in children and adolescents, is Trauma-Focused Cognitive Behavioural Therapy (TF-CBT). This therapy incorporates cognitive-behavioural principles and exposure techniques to address PTSS, as well as co-occurring symptoms such as depression, behavioural problems, and parent-child interaction challenges. Initially developed for PTSS from sexual abuse, TF-CBT now addresses various traumatic experiences, including abuse, violence, and disasters. According to the protocol, TF-CBT is conducted in 12–16 sessions and include key components such as psychoeducation, coping skills, gradual exposure, cognitive processing of trauma-related thoughts and beliefs, and caregiver involvement (Cohen et al., 2016). The therapy is trauma-focused from the outset, but exposure to the traumatic memories is gradual and structured in modules. These modules are built by the elements: psychoeducation, relaxation, affect modulation, cognitive coping, trauma narrative, in-vivo exposure, conjoint session and enhancing safety, described as the acronym PRACTICE (Cohen et al., 2016). The first module (acronym PRAC) focuses on building skills to manage intrusive thoughts, overwhelming emotions, and to understand behaviour. The second module, known as the trauma narration and reprocessing (acronym T), involves gradually processing the traumatic memory through narrative work, followed by cognitive restructuring. The final module (acronym ICE) reinforces learned skills and prepares the child and their caregiver for future challenges. While the TF-CBT modules in the protocol are evenly divided in time and exist in a logical sequence, therapists may revisit earlier steps during

later stages if necessary, such as relaxation techniques from the first module into the narrative module. Alongside the individual child sessions, caregivers sessions are provided to support their child through the process. Figure 1 gives an overview of the steps and modules of TF-CBT.

1.2. Individually tailored trajectories

Over the past few decades, numerous Randomized Controlled Trials (RCTs) have demonstrated the effectiveness of TF-CBT, with a recent meta-analysis reporting a large effect size (Hedges' $g = 1.14$, 95% CI: 0.97–1.30) indicating a large reduction in posttraumatic stress symptoms (PTSS) compared to control conditions, (Thielemann et al., 2022). The success of TF-CBT has led to its widespread dissemination and implementation across the US, Europe, and Africa (Forbes et al., 2020; Murray et al., 2013). Despite strong evidence for its efficacy, dropout and persistent PTSD symptoms continue to affect a substantial group of severely traumatized children (Mitchell et al., 2023; Swift, 2024). RCTs are crucial for the evaluation of effectiveness, typically adhering closely to standardized protocols and assess outcomes at set intervals (e.g. pre-treatment, post-treatment, and follow-up), providing insight into average treatment effects. Their emphasis on group level outcomes limits the ability to capture individual responses and may overlook clinically meaningful variability at the individual level. Furthermore, it is difficult to generalize outcomes of a controlled research setting to clinical practice, as protocols in clinical contexts are often tailored to the child's needs, whereas in research the protocols are followed as closely as possible to maintain standardization. This distinction is particularly relevant for TF-CBT, where adaptability and flexibility are considered crucial to the intervention's success (Cohen et al., 2016). For instance, the PRAC module provides children with a toolbox of coping skills and symptom awareness. Some children may already possess strong coping skills and can move more quickly to the narrative module, where others may need a longer time. Although developers and international trainers emphasize the importance of all TF-CBT elements, experienced therapists often rely on their judgment and intuition to make adjustments during treatment. As highlighted in a recent meta-analysis (de Haan et al., 2024), there is a growing need for more nuanced, person-centred approaches that go beyond group-level analysis to gain insight in the individual variability of the therapy response. Within our knowledge of the effectiveness and the benefits of TF-CBT, we know that both individual and treatment-related factors can significantly influence outcomes, either amplifying or diminishing the effects of TF-CBT (de Haan et al., 2024). In addition, identifying the mechanisms through

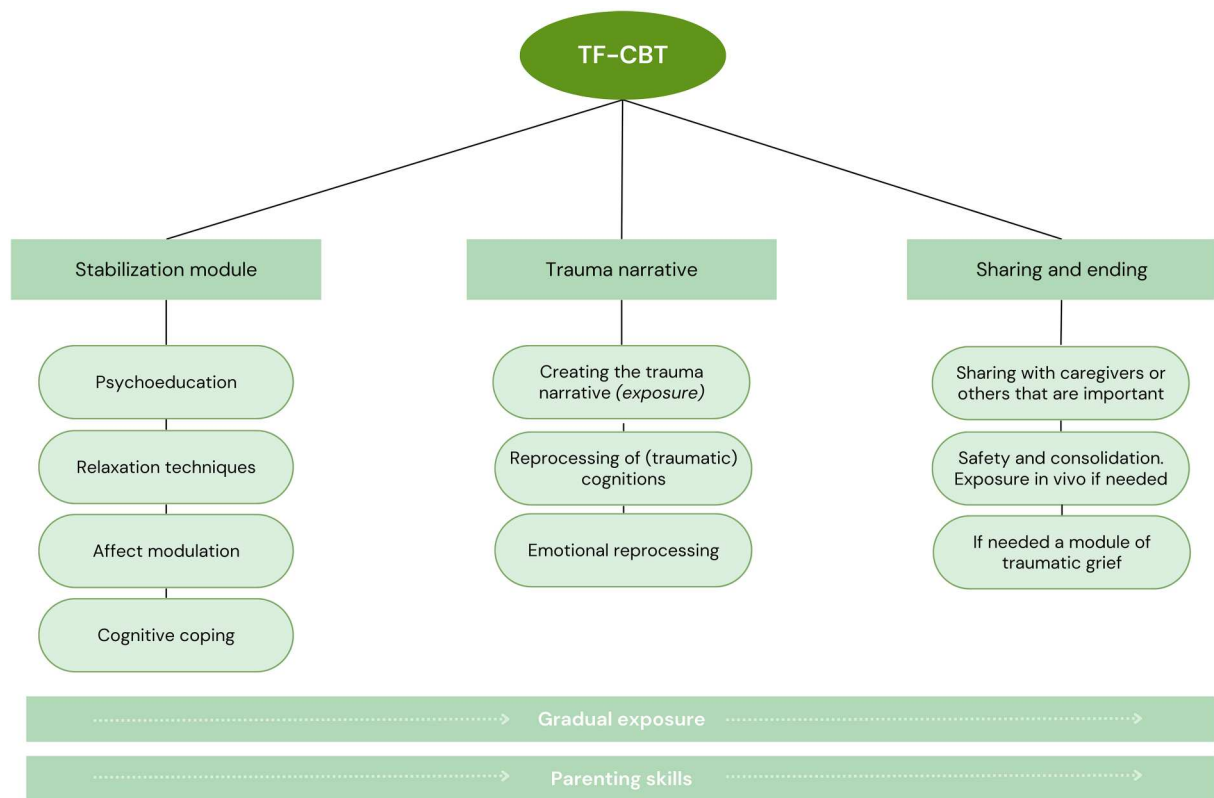


Figure 1. Overview of the TF-CBT modules.

which TF-CBT leads to symptom change is a critical next step. Mechanisms such as exposure, emotional processing, cognitive restructuring, and caregiver support seem to contribute differently to symptom changes and need further exploration in clinical practice (Kangaslampi & Peltonen, 2022).

Building on its well-established efficacy, TF-CBT is a suitable trauma therapy for exploring the symptom changes using an individualized approach. Since symptom improvements are associated with TF-CBT, we can reasonably argue that observed changes are because of specific therapeutic components rather than to random effects. This makes it possible to investigate symptom changes throughout therapy within individuals – an aspect that is often missed in group-level analyses. This study aims to present real-time symptom changes throughout each module of TF-CBT, as provided in routine clinical practice. By doing so, we provide a more detailed understanding of what occurs throughout the various modules of TF-CBT, specifically in terms of trauma symptoms and comorbidity, such as anxiety and depressive symptoms. To achieve this, we use a Single-Case Experimental Design (SCED) approach (Monahan, Kratochwill, & Lipscomb, 2011). This intensive measuring method allows for tailoring interventions to the specific needs of individual participants, making it especially suitable for research in clinical settings. We will use this method to bridge the gap between controlled trials, often with various exclusion criteria and fixed protocols, and practical, individualized

care for small and heterogenous populations. A SCED begins with a baseline phase, during which the dependent variables are consistently measured in absence of an intervention followed by the intervention phase with intensive repeated measurements to evaluate the impact of the intervention. By visualizing symptom changes throughout therapy, we hope to gain a clearer understanding of how and when specific modules lead to improvements. This leads to a better support of adjustments throughout TF-CBT.

2. Methods

2.1. Single-Case Experimental Design (SCED)

This study utilized a SCED with a Repetitive Baseline (RB) of a minimum five-week baseline period in order to get a representative estimate of the dependent variable. Participants completed repeated weekly measurements during both the baseline- and intervention phase. Secondary measures were administrated at six key points: At the start of the study (T0), after baseline (T1), after PRAC module (T2), after trauma narrative module (T3), after cognitive reprocessing module (T4), and after sharing module (T5). We decided to divide the trauma narrative and processing into separate modules for this study, to clearly distinguish symptom change between the narrative and reprocessing elements. Pre- and post-measurements were based on the clinician-administered interview (CAPS-CA) conducted by a trained clinician, who was not the therapist, in order to avoid potential

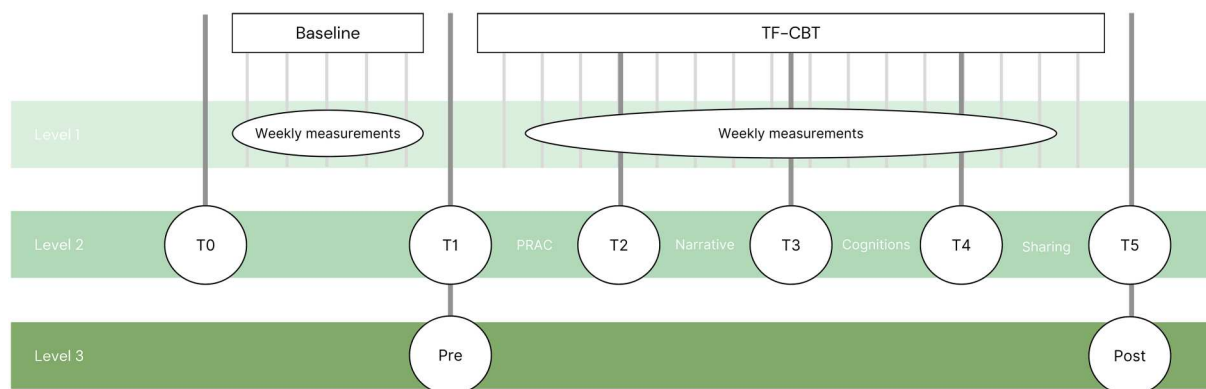


Figure 2. Overview of the three levels of the SCED design.

bias. Weekly measurements were questions derived from the questionnaires measured at T0. A visual representation of the design is given in Figure 2. The study has been approved by the ethical commission of the Amsterdam UMC (W22_156).

2.2. Therapists

A group of seven therapists participated. Therapists were employed at Levvel, child and adolescent psychiatry Amsterdam, and were certified TF-CBT therapists. Group supervision by a certified TF-CBT supervisor occurred every five weeks, as is usual routine in the clinical practice of Levvel. During TF-CBT, the therapists had access to the outcomes of the standardized questionnaires (at level 2 and 3) of their client, as these assessments are standard protocol during TF-CBT. The weekly measurements (level 1) were not shared with the therapist until the therapy was completed.

2.3. Participants

The number of participants was based on guidelines from the What Works Clearinghouse (WWC) (Hitchcock et al., 2015) and previous TF-CBT research. WWC standards specify that a minimum of three participants is required for a SCED (Maggin et al., 2013) and American Psychological Association (APA) recommends nine replicated single-case studies, to prove efficacy. Given the dropout rates of 30% in children and adolescents (Diehle et al., 2014) – we concluded that 12 participants were required. Patients were included if (1) they were 12 years and older, (2) TF-CBT was indicated for treating PTSS and (3) they had sufficient knowledge of the Dutch language. Participants were excluded if severe co-morbid psychiatric problems (such as active suicidal ideation or psychosis) were present, or if there was an inability to fill out online questionnaires due to a lack of technology or sufficient language skills.

Participants were recruited through the regular routes for referral of Levvel. When eligible for the

study, they were assigned to one of the study therapists, and written informed consent was obtained from the participants and their caregiver. We included 12 participants, of whom seven completed TF-CBT. Participants dropped out, due to several reasons as described in Figure 3. In this study a total of 8 participants were included for analyses. An overview of the participants is displayed in Figure 3, and details for each participant are described in the Results section in Table 1.

2.4. Measurements

2.4.1. Instruments

Questionnaires were sent out to the participants through CASTORedc, a data management system where data is directly stored safely and anonymously (Castor, 2019).

2.4.2. Child and Adolescent Trauma Screener version 2 (CATS-2)

The Dutch version of the CATS-2 (*Kind en Jeugd Trauma Screener, KJTS*) is a DSM-5 based checklist that includes the 20 posttraumatic stress symptoms (PTSS) and 5 impairment items. A higher symptom score represents more presence of PTSS, with a clinical cut-off score of 21. It has established good psychometric properties internationally (Sachser et al., 2022) as well as in a Dutch sample (Kooij et al., 2025). Current CATS-2 selfreports showed good to excellent internal consistency (Cronbach's Alpha T0 = .87, T1 = .93, T2 = .93, T3 = .96, T4 = .95, T5 = .92).

2.4.3. Patient Reported Outcomes Measurement Information System (PROMIS) anxiety and depression

These short forms exist of 8 items each, assessing anxiety and depressive symptoms. Reference scores are used and a score of 50 is seen as an average score for the referenced population. Higher scores equals more severity of the symptoms, and both show a sufficient reliability and construct validity in a Dutch sample (Klaufus et al., 2021). The PROMIS

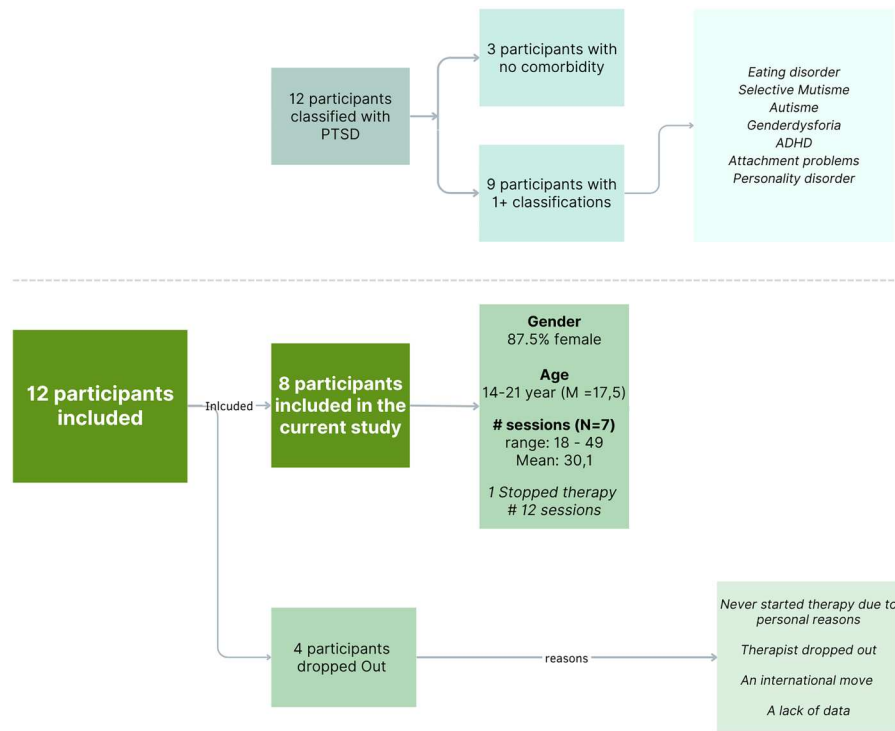


Figure 3. Participant overview.

Table 1. Overview of the included participants.

PP	Age	CAPS-CA		Comorbidity	NEQ**		Missing data	Reason missing data
		PTEs	Pre Post		Frequency neg. eff.	Due to treatment		
1	14	12	47 -	Attachment problems	-	-	T5: cPTCI, NEQ Post CAPS-CA	Not motivated anymore for ending the questionnaires
2	18	13	38 27	ADHD, attachment problems	5	2	-	Cognitions were assessed throughout Narrative
3	20	12	50 29	Selective Mutism	5	2	T4	
4	21	9	23 11	Genderdysphoria and Autism	1	1	-	Measurements were not send out, due to a miscommunication with the therapist Never filled out the questionnaires.
5	16	14	42 13	Eating disorder, ADHD	14	14	T3 & T4	
6	15	2	32 17	Eating disorder	13	7	T1	Did not want to continue therapy. Decreased feeling of symptoms. Dropped out during Narrative, end measurement T5 done
7	17	11	34 12	No	2	1	-	
8	17	13	24 -	No	16	4	T3 & T4 Post CAPS-CA	

Notes: PP = participant; PTEs = Potential Traumatic events; CAPS-CA = Clinician Administrated PTSD Scale – Children and Adolescents; ADHD = Attention Deficit Hyperactivity Disorder; PACHIQ-r = Parent Child Interaction Questionnaire – revised; NEQ = Negative Effect Questionnaire; cPTCI = child Post Traumatic Cognitions Inventory.

**All participants reported resurfaces of traumatic and negative memories due to the therapy;

anxiety in this study showed acceptable to excellent internal consistency (Cronbach's Alpha T0 = .95, T1 = .93, T2 = .88, T3 = .94, T4 = .98, T5 = .77) and the PROMIS depression showed good to excellent internal consistency (Cronbach's Alpha T0 = .85, T1 = .96, T2 = .95, T3 = .96, T4 = .98, T5 = .92),

2.4.4. Child version – Post-Traumatic Cognitions Inventory, short version (cPTCI-S)

The cPTCI-S is a self-report questionnaire consisting of 10 items that is designed to assess dysfunctional trauma-related cognitions in children and adolescents. A higher score representing more presence of

traumatic cognitions. A score ranging from 16 to 18 is seen as the most fitted cutoff point. The reliability and the validity were reported to be adequate in a Dutch sample (Diehle et al., 2015). Current cPTCI showed good to excellent internal consistency (Cronbach's Alpha T0 = .91, T1 = .94, T2 = .90, T3 = .93, T4 = .93, T5 = .89),

2.4.5. Parent Child Interaction Questionnaire – Revised (PACHIQ-R)

The PACHIQ-R (in Dutch *Ouder Kind Interactie Vragenlijst, OKIV-R*) consists of 25 items and is meant to obtain an overall measure of parent-child relationship

quality (Lange et al., 2002). Higher scores indicate a more positive relationship. Psychometric evaluation of the PACHIQ-R in a Dutch sample has revealed good reliability and validity (Lange et al., 2002). The child to mother questionnaire in this study showed excellent internal consistency (Cronbach's Alpha $T_0 = .97$, $T_1 = .98$, $T_2 = .97$, $T_3 = .98$, $T_4 = .99$, $T = .94$) and the child to father questionnaire showed good to excellent internal consistency (Cronbach's Alpha $T_0 = .91$, $T_1 = .94$, $T_2 = .92$, $T_3 = .96$, $T_4 = .80$, $T_5 = .86$),

2.4.6. The Dutch version of the Clinician-Administered PTSD Scale for DSM-5 – Child and Adolescent (CAPS-CA-5)

The CAPS-CA-5 is a semi structured interview based upon the DSM-5 criteria for PTSD. The CAPS-CA-5 includes a life event checklist of 26 potentially traumatic events (PTEs), and continues with the 20 DSM-5 PTSD symptoms. The range of the total score is 0–80, with a higher score representing a higher severity of PTSS. There are no standard cut-off scores available. Instead, it's scored to match DSM-5 diagnostic criteria. The CAPS-CA is administered by trained psychologists with sufficient knowledge of PTSD in children and adolescents (Pynoos et al., 2015). The CAPS-CA in the current study showed good internal consistency in the pre- and post-test (Cronbach's Alpha pre-test = .81 and post-test = .84).

2.4.7. The Negative Effects Questionnaire (NEQ)

The NEQ has the intention to examining potentially adverse and unwanted events in psychological treatments. The questionnaire is used at the end of the treatment and exists of 32 items. Questions address both negative effects that are attributed to treatment, as negative effects that are possibly caused by other circumstances. The NEQ exhibits fairness across socio-demographic variables, including age and gender, in Swedish adult populations. This suggests potential applicability across diverse patient groups. However, psychometric validation in a Dutch, and in a youth sample is still lacking, and results should be interpreted with caution (Rozental et al., 2019). The NEQ in the current study ($N = 6$) showed good internal consistency with a Cronbach's Alpha = .87.

2.4.8. Session report for therapists

An overview of the elements that belong to each session is given to the therapist, and the therapist administrated after every session which element they addressed. They recorded this information in a session report, which was also added to the electronic patient file.

2.4.9. Weekly measurements

For the weekly questions, we assessed only the most prominent symptoms for each individual child, since

the weekly burden of completing the full set of questionnaires is too comprehensive, and while all children are classified with PTSD, they may experience a different set of symptoms.

The items were established with the individual child and researcher at T_0 . We used the following criteria as a minimum to provide generalization of the symptoms across participants. Whenever a child made clear that more symptoms were burdening them, we added an extra symptom.

- From the CATS-2 at least one item from criteria B and C, and two items from criteria D and E was exited.
- From the PROMIS anxiety and PROMIS depression questionnaire at least one item was exited.
- From the CPTCI at least one item was chosen.
- From the PACHIQ-R at least one item was chosen.

The answer to these questions was changed into how much this symptoms is a burden to them that week on a 0–100 VAS (Visual Analogue Scale). Participants received these set of questions on a weekly recurring time, through CASTORDedc and filled them out within 2–3 min. These weekly questions were send out with a gap of 3–4 days to the therapy session.

2.5. Data analyses

Analyses were done with nonparametric tests, as the asymptotical assumptions of parametric statistical tests are most likely violated (Bulté & Onghena, 2008; Heyvaert & Onghena, 2014). Statistics were conducted in IBM SPSS statistics 28 (Bennett et al., 2022) and Rstudio 4.3.2 (R Core Team, 2023)

2.5.1. Primary measures – weekly measurements

Visual data inspection was used to explore the symptom changes over the course of the therapy. Changes were visualized in a graph, alongside their corresponding secondary measurement (the standardized questionnaire) that was done at the six key time-points. For statistical inference between the weekly measures in the modules, we conducted the permutation distance test (PDT) for each participant (Vroeindewij et al., 2023). The PDT corrects for autocorrelation due to repeated measurements within each participants, and has more power than the often used permutation test of Koehler and Levin (Koehler & Levin, 1998). In order to calculate the statistical effect for the group, the property of p -values being uniformly distributed between 0 and 1 was used. In a SCED study the participant acts as their own control, so therefore it is important to assess the difference between the baseline and the intervention on an individual level. We calculated the difference in means between the baseline and intervention (T_0 -

T1 versus T1-T5). Furthermore we assessed the mean differences between the baseline and PRAC module (T0-T1 versus T1-T2) and the baseline and intervention without PRAC module (T0-T1 versus T2-T5). The randomization tests could not be conducted for the isolated cognition and sharing modules, due to an insufficient number of observations in these phases for most participants. Lastly we looked at the difference between the PRAC module and the narrative (T1-T2 versus T2-T3), because we expect that the narrative module will influence symptom change more than the PRAC module, due to the exposure component (Huang et al., 2022; McLean et al., 2022).

2.5.2. Secondary measures

For the standardized questionnaires the reliable change index (RCI) was calculated for every participant, where a negative number represented a decrease of symptoms. Furthermore we conducted some group analyses. A Friedmans ANOVA was used to assess for group differences over the course of the therapy. For the pre- and posttest of the CAPS-CA, the Wilcoxon Rank test was done to check for significant changes. Lastly the PRACTICE checklist was coded to assess which the elements are used over the course of TF-CBT.

3. Results

3.1. Study progress

Sixteen months into the study, two therapists dropped out. For participant 1, this resulted in a therapy break while waiting to transition to another study therapist. Two participants withdrew fully, as one switched to another therapist outside the study, and the other participant didn't start therapy. Additionally, participant 8 stopped attending therapy during the narrative module. Other priorities, such as school, friends, and work, became more prominent. The last measurements were completed and therefore we included participant 8 in the study. While participants were motivated to complete the questionnaires, many forgot to do so after a few weeks. School or holiday travels were often mentioned as reasons for forgetting, leading to some missing data in the weekly measurements. Some standardized measurements are missing due to several reasons. These reasons, and participants characteristic, are described in Table 1.

3.1.1. Primary idiosyncratic measures at level 1

3.1.1.1. Visual data inspection weekly measurements. Weekly measurements (level 1, (*idiosyncratic measurement*)) are presented alongside standardized level 2 data. Modules are distinguished by colour, and missing weekly data are omitted. Appendix A contains

all participant data. Two participants are highlighted in this manuscript as examples of the complex group. These two participants were selected because they had sufficient data available and, more importantly, represent two distinct clinical profiles – one a more complex presentation of PTSD and longer trajectory with less clear symptom changes, whereas the other reflecting a single, chronic PTE, and a more typical TF-CBT trajectory.

Participant 2 (pp2, Figure 4) experienced multiple interpersonal traumatic events, including various foster care and child welfare home placements. Despite numerous psychological interventions, this is the first trauma-focused therapy aimed at addressing the most prominent traumatic events. Main symptoms included bad dreams (B), avoidance of feelings (C), self-blame, loneliness (D), hypervigilance, and sleep issues (E). Additional concerns included worry (PROMIS D), distrust, worthlessness (cPTCI), and difficulty seeking caregiver support (PACHIQ-R). Between weeks 59–68, most symptoms increased due to the work on self-blame cognitions and shame. Furthermore, the preparation of the sharing module was severely distressing for this participant, due to self-blame and believing the caregiver felt the same way. In the sharing the caregiver was able to address and reframe these thoughts. Symptoms such as bad dreams and worry increased before sharing but significantly decreased afterwards.

Participant 6 (pp6, Figure 5) experienced a single but chronic traumatic event, and a comorbid eating disorder (ED), for which treatment was finished before starting TF-CBT. Main symptoms were intrusive thoughts and memories (B), avoidance of feelings (C), negative feelings and self-perception (D), exaggerated startle response, and sleep issues (E), along with nervousness (PROMIS A), sadness (PROMIS D), and caregiver frustration (PACHIQ-R). Graphs show that an increase in intrusive symptoms was followed by an increase in negative alterations in cognition and mood (NACM) and hyperarousal symptoms. From week 32 of therapy, a resurgence of eating disorder symptoms and arguing with the parents increased, which seemed to contribute to an increase in comorbid symptoms such as depressive feelings and negative emotions. However, trauma symptoms related to Criterion B and C remained unaffected.

3.1.1.2. The permutation distance test (PDT). Table 2 displays the mean differences of the weekly measurements of participant 2, participant 6 and the group effect. The intervention is effective for lowering all symptoms compared to the baseline, even when the PRAC module was removed. Zooming in on the two exhibited participants, we see that both participants experience a higher level of intrusive symptoms

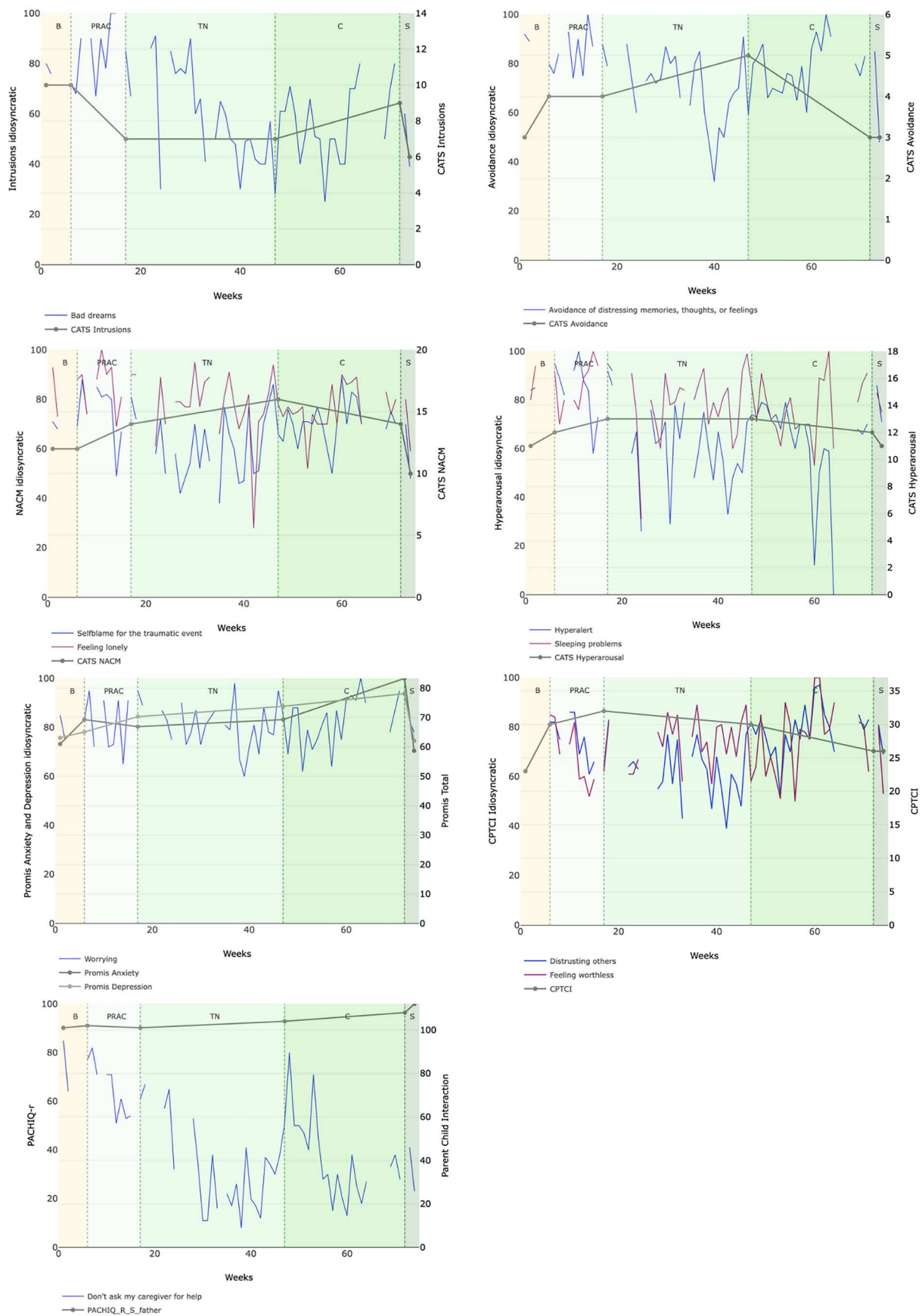


Figure 4. Symptom changes during TF-CBT of Participant 2.

Note: CATS-2 = Child and Adolescent Trauma Screen-2; PROMIS A = short form questionnaire for anxiety; PROMIS D = short form questionnaire for depression; CPTCI = child Post Traumatic Cognitions Inventory; PACHIQ-r = Parent Child Interaction Questionnaire-revised.

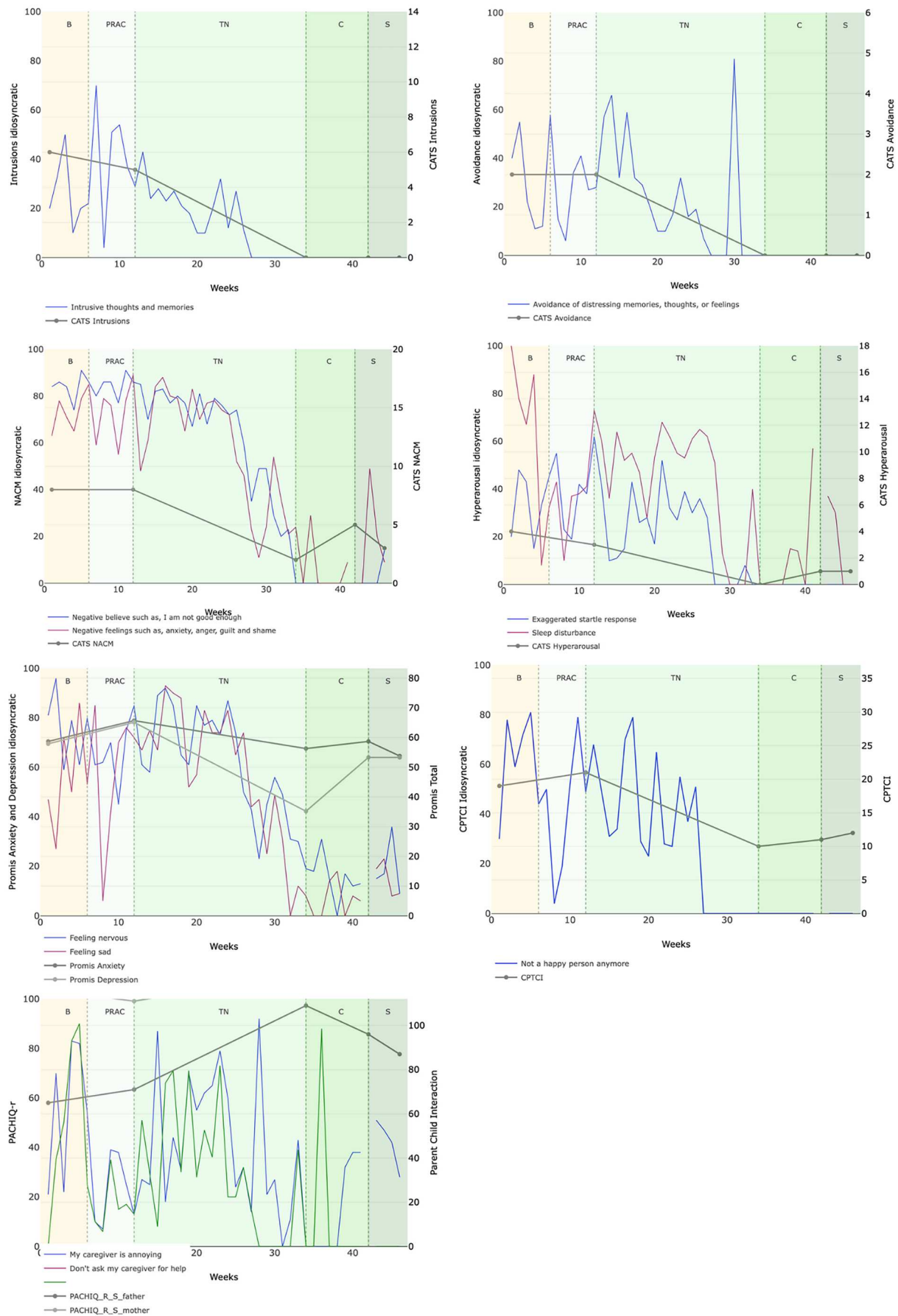


Figure 5. Symptom changes during TF-CBT of Participant 6.

Note: CATS-2 = Child and Adolescent Trauma Screen-2; PROMIS A = short form questionnaire for anxiety; PROMIS D = short form questionnaire for depression; cPTCI = child Post Traumatic Cognitions Inventory; PACHIQ-r = Parent Child Interaction Questionnaire-revised.

Table 2. Mean differences of the permutation distance test for pp02, pp06 and the group.

	Baseline (T0–T1) vs. Intervention (T1–T5)			Baseline (T0–T1) vs. PRAC (T1–T2)			Baseline (T0–T1) vs. Narrative, Cognitions & Sharing (T2–T5)			PRAC (T1–T2) vs. Narrative (T2–T3)		
	pp02	pp06	group	pp02	pp06	group	pp02	pp06	group	pp02	pp06	group
CATS-2 Intrusions	16.72	12.28	17.14*	–5.22	–13.07	0.75	20.75	16.75	22.10*	23.27	24.44	18.07*
CATS-2 Avoidance	11.20	10.60	9.77*	2.33	–2.17	0.38	12.83	12.85	13.96*	13.03	6.76	9.86*
CATS-2 NACM	1.48	29.54	16.78*	–6.44	–0.67	2.53	2.94	34.87	21.30*	10.79*	15.99	14.25*
CATS-2 Hyperarousal	13.65	24.01	13.09*	1.28	14.75*	4.42*	15.92*	25.65	16.80*	14.41*	1.09	10.84*
PROMIS Anxiety	4.12	25.38	10.35*	4.56	9.70	–1.05	4.04	28.14	14.43*	–0.09	1.96	12.12*
PROMIS Depression	–	12.23	16.54*	–	1.07	4.33	–	14.19	19.68*	–	–4.76	10.35
cPTCI Traumatic cognitions	1.92	40.40	13.57*	1.69	22.67	6.18	1.96	43.53	17.13*	3.90	9.70	8.08*
PACHIQ-r Parent Child interaction	30.28	26.16	12.37*	5.00	30.18*	8.05*	35.02	25.45	14.02*	30.87	–11.81	4.55

Notes: CATS-2 = Child and Adolescent Trauma Screen-2; NACM = Negative Alterations in Cognitions and Mood; PROMIS A = short form questionnaire for anxiety; PROMIS D = short form questionnaire for depression; cPTCI = s = child Post Traumatic Cognitions Inventory – short form; PACHIQ-r = Parent Child Interaction Questionnaire – revised.

* $p < .05$ significance.

(CATS B) and NACM (CATS D), during the PRAC compared to the baseline, although pp6 experiences a decrease in hyperarousal symptoms (CATS E) during the PRAC module compared to the baseline. A slightly higher depressive symptoms during the narrative compared to the PRAC are reported by pp2 and this is seen for anxiety symptoms in pp6. Appendix B contains data of all participants.

3.1.2. Secondary outcomes: standardized measurements

3.1.2.1. Individual outcomes of the standardized questionnaires. A complete table of RCIs can be found in the Appendix C. As expected TF-CBT is effective as an intervention for trauma symptoms (RCI ranges from -2.27 – -3.83), except for participant 2 (RCI = 1.05). For anxiety symptoms there was a significant change during the intervention (RCI ranges from -2.02 – -5.56), except for participant 4 (RCI = 0) and participant 8 (RCI = .32), for depressive symptoms there was a significant change (RCI ranges from -2.45 – -6.32), except for participant 2 (RCI = $-.82$), participant 7 (RCI = 1.61) and participant 8 (RCI = -1.39). On the cPTCI we see a significant decrease during the intervention (RCI ranges from -10.55 – -3.24), except for participant 4 (RCI = 1.62), participant 7 (RCI = -1.62) and participant 8 (RCI = .81). Participant 1 didn't complete the

cPTCI during T5, but shows a significant change looking at T1 – T4 (RCI = -12.06). We didn't find any significant changes on the PACHIQ-R.

In Table 3 important timepoints are shown for every participant. It is clear that the isolated PRAC module barely induced significant change, where the isolated narrative module was mostly effective, especially when combined with the reprocessing and sharing. We zoom into the important changes of the example participants, pp2 and pp6.

Participant 2. The standardized measurements show some changes throughout TF-CBT, but they were not statistically significant. Notably the traumatic cognitions decreased when narrative was combined with the reprocessing and sharing. The negative cognitions were linked to the caregiver, and the sharing was an important step for changes in these cognitions.

Participant 6. To have an idea of the symptom changes during the PRAC we see that there are no significant symptom changes during the baseline and PRAC (T0–T2) with RCI ranges from $-.36$ – -1.53 . The participant had a low mood and depressive thoughts, mostly related to the eating disorder symptoms, and the anxiety and depression symptoms show less change compared to the trauma related symptoms (CATS-2 and cPTCI). It was seen during therapy that these symptoms might need more attention after trauma therapy.

Table 3. Reliable change index for all participants on trauma symptoms, anxiety, depression and traumatic cognitions.

	CATS-2 Trauma symptoms			PROMIS Anxiety			PROMIS Depression			cPTCI Traumatic cognitions		
	T1–T2	T2–T3	T2–T5	T1–T2	T2–T3	T2–T5	T1–T2	T2–T3	T2–T5	T1–T2	T2–T3	T2–T5
PP1	–1.07	–2.17*	–3.09*	.25	–3.51*	–2.52*	–2.08*	–.66	–4.34*	–1.67	–4.06*	–
PP2	.00	.72	–1.65	–.49	.51	–1.24	1.64	.13	–2.15	1.67	–1.62	–4.38*
PP3	–1.07	–2.41*	–2.89*	–.51	–1.98*	–2.76*	–1.86	–.68	–4.32*	–2.51*	–4.06*	–4.38*
PP4	–1.28	–.24	–.82	1.45	.00	–1.07	–6.07*	.51	2.70*	.84	3.24*	.73
PP5	–1.92	–	–1.86	.25	–	–3.43*	.00	–	–3.66*	.00	–	–9.49*
PP6	–	–3.85*	–2.89*	–	–1.98*	–1.80	–	–1.09	–3.09*	–	–8.92*	–6.57*
PP7	–1.92	–1.69	–2.06*	–1.39	–.34	.63	–.53	–.07	–1.10	–.84	–.81	–.73
PP8	1.28	–	–.41	2.70	–	–1.34	.00	–	–1.33	–1.67	–	2.19*

Notes: CATS-2 = Child and Adolescent Trauma Screen-2; PROMIS A = short form questionnaire for anxiety; PROMIS D = short form questionnaire for depression; cPTCI = child Post Traumatic Cognitions Inventory; PACHIQ-r = Parent Child Interaction Questionnaire – revised.

*Significance (RCI > 1.95 or RCI < -1.95); negative numbers stand for a decrease of the symptom, positive for an increase.

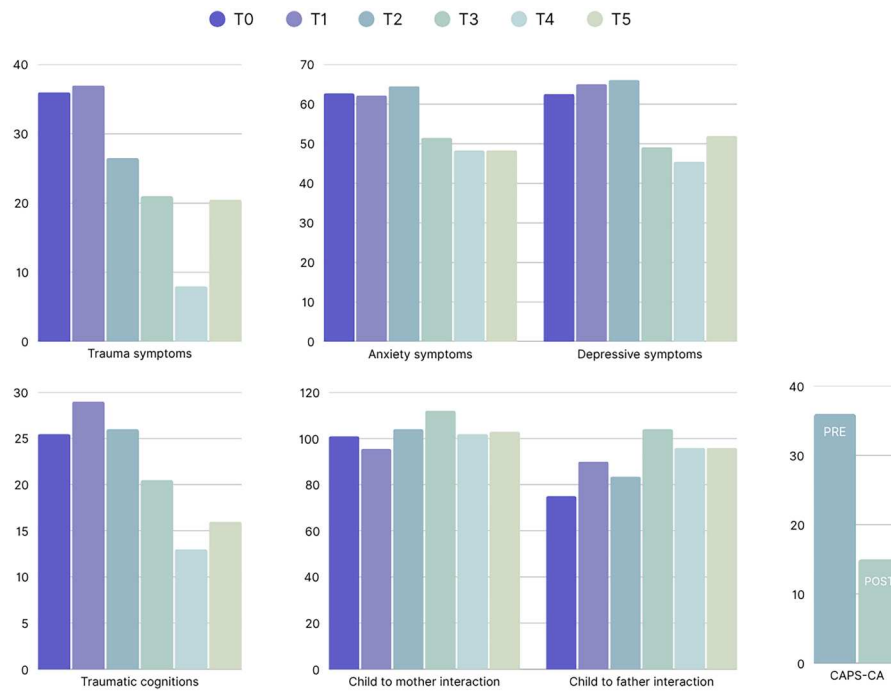


Figure 6. Median scores of the group from T0–T5.

Notes: CATS, PROMIS A & D: T0 $N=8$, T1 $N=7$, T2, $N=8$, T3, $N=6$, T4 $N=5$, T5 $N=8$, cPTCI T0 $N=8$, T1 $N=7$, T2, $N=8$, T3, $N=6$, T4 $N=5$, T5 $N=7$, PACHIQ-R mother. T0 $N=7$, T1 $N=6$, T2, $N=7$, T3, $N=5$, T4 $N=4$, T5 $N=6$, PACHIQ-R father. T0 $N=4$, T1 $N=3$, T2, $N=4$, T3, $N=3$, T4 $N=3$, T5 $N=3$.

3.1.2.2. Group level analyses. In Figure 6 a visualization of the group medians on the trauma (related) symptoms is shown. It shows that trauma symptoms decrease directly when TF-CBT starts, whereas depressive and anxiety symptoms increase first. Furthermore a Friedman's ANOVA is done with the timepoints T0, T2 and T5, as these timepoints contain complete data ($N=8$). This analysis show significant changes in trauma symptoms Chi square(2) = 14.25, $p < .001$ ($N=8$), anxiety symptoms Chi square(2) = 5.87, $p = .05$ ($N=8$) and depressive symptoms Chi square(2) = 8.47, $p = .02$ ($N=8$). A decrease of symptoms, but not significantly, is seen in traumatic

cognitions Chi square(2) = 2.00, $p = .37$ ($N=7$) and an (non-significantly) increase of positive interaction is seen in the PACHIQ-R child to mother Chi square(2) = 1.83, $p = .40$ ($N=6$) and PACHIQ-R child to father Chi square(2) = 5.64, $p = .06$ ($N=3$). A pre and post-test through the Wilcoxon rank test show a significant change of the total score of the CAPS-CA ($Z = -2.20$, $p = .03$, $N=6$).

Follow up on the significant differences of the Friedmans test, the Wilcoxon rank test is done (Table 4). Notably all changes are significantly during the intervention, and none during the baseline, similar as in the weekly measurements. The group outcome

Table 4. Wilcoxon Rank tests for every TF-CBT phase, CATS-2, PROMIS A and PROMIS D.

	<i>N</i>	CATS-2 Trauma symptoms		PROMIS Anxiety		PROMIS Depression		TF CBT module
		<i>Z</i>	<i>p</i>	<i>Z</i>	<i>p</i>	<i>Z</i>	<i>p</i>	
T0–T1	7	–1.36	.173	–1.37	.172	–.105	.916	Baseline
T0–T2	8	–2.32	.020*	.00	1.00	–.676	.499	
T0–T3	6	–1.99	.046*	–1.15	.249	–1.78	.075	
T0–T4	5	–1.75	.080	.00	1.00	–.94	.345	
T0–T5	8	–2.53	.012*	–2.20	.028*	–2.37	.018*	
T1–T2	7	–1.48	.139	–.34	.735	–1.48	.138	PRAC
T1–T3	5	–1.75	.080	–1.46	.144	–1.21	.225	
T1–T4	4	–1.60	.109	–.37	.715	–.73	.465	
T1–T5	7	–2.20	.028*	–1.78	.075	–2.37	.018*	Intervention Narrative
T2–T3	6	–1.78	.075	–1.49	.136	–1.15	.249	
T2–T4	5	–1.83	.068	.00	1.00	–.67	.500	
T2–T5	8	–2.53	.012*	–2.38	.017*	–1.96	.049*	Cognitions
T3–T4	5	–1.21	.225	–2.03	.042	–.14	.892	
T3–T5	6	–2.00	.046*	–1.48	.138	–.31	.753	
T4–T5	5	–.14	.893	–1.48	.138	.00	1.00	Sharing

Notes: TF-CBT: Trauma Focused Cognitive Behaviour Therapy; PRAC = first module of TF-CBT for coping skills; CATS-2 = Child and Adolescent Trauma Screen-2; PROMIS A = short form questionnaire for anxiety; PROMIS D = short form questionnaire for depression; cPTCI – s = child Post Traumatic Cognitions Inventory – short form; PACHIQ-r = Parent Child Interaction Questionnaire–revised.

*Significance $p < .05$.

Table 5. Overview of the number of sessions per participant.

PP	# Sessions	Module 1	Module 2		Module 3
		# PRAC (%)	# Narrative (%)	# Cognitions (%)	# Sharing (%)
1	41	12 (29%)	19 (47%)	7 (17%)	3 (7%)
2	49	7 (14%)	20 (41%)	13 (27%)	9 (18%)
3	24	4 (17%)	17 (71%)	1 (4%)	2 (8%)
4	22	6 (27%)	11 (50%)	2 (9%)	3 (14%)
5	28	8 (29%)	15 (54%)	3 (10%)	2 (6%)
6	29	4 (14%)	17 (59%)	5 (17%)	3 (10%)
7	18	5 (28%)	7 (39%)	2 (11%)	4 (22%)
8	11	6 (55%)	6 (45%)	–	–

Notes: PP = participant number; PRAC = first module of TF-CBT for coping skills.

show that the most changes are induced when narrative, cognitions and sharing module are combined (T2–T5).

3.1.3. Therapist reports

3.1.3.1. TF-CBT modules. Therapists were asked to conduct their therapy as they would do in their routine care. By their session reports we were able to create an individual overview for each therapy as displayed in Table 5 and Figure 7. These results show the individual choices therapists made to extend certain modules or to incorporate elements. We found an average of 30 sessions (range 18–49 sessions) to complete TF-CBT. Table 5 provides an overview of the number of sessions and their percentage of the total intervention for each participant.

Furthermore, the session elements were colour-coded and displayed in a heatmap. This map provides a visual summary of the elements used throughout therapy (Figure 7).

As an example we are looking more closely to pp06. It is observed that during the narrative module in three sessions, the therapist reported using PRAC elements, besides the narrative elements. Similarly, during the narrative module, two times a cognitive reprocessing element was recorded. This shows that the therapist choose to use some restructuring techniques while writing the narrative in these sessions.

4. Discussion

This SCED study is used to evaluate symptom changes and the impact of the different TF-CBT modules in individual trajectories. Due to the large number of measurements at three levels, we are able to zoom in on the individual process. Similar to previous RCTs, we found that trauma and comorbid symptoms significantly decrease over the full course of therapy (Bastien et al., 2020; Uppendahl et al., 2020), but not merely decrease in a clear line. Large weekly fluctuations are common in all 8 participants, and individuals with severe trauma related symptoms and interpersonal traumatic events show more persistence of symptoms. Traumatized children have particularly sensitive stress systems, making them more receptive

to daily stressors such as school, loss, or exams (Glaser et al., 2006; Silva et al., 2000). As a result, their symptoms often fluctuated in response to seemingly minor daily events. Symptom variability may also reflect a natural and expected part of TF-CBT, given the heightened emotional sensitivity and stress due to exposure to traumatic memories and feelings. In our study, therapists did not have access to the weekly symptom fluctuations, and therefore we cannot draw conclusions about how real-time feedback would have influenced therapeutic decisions. However, our findings show the importance of monitoring symptom changes to determine whether they are actual fluctuations rather than a lasting increase of symptoms. If so, these fluctuations can be normalized, helping clients and caregivers understand that temporary increases in symptoms, such as anxiety or distress, are common, especially during emotionally intense phases such as the narrative or sharing modules. Notably, our individual and group findings suggest that the PRAC module alone may not directly decrease trauma (related) symptoms. However, for participants with interpersonal trauma, attachment problems or more complex trauma symptoms, elements of the PRAC module are often repeated to reinforce coping skills. Given that caregivers play a crucial role in the symptom reduction and the emotion regulation of traumatized children (Brown et al., 2020; Yasinski et al., 2016), we argue that an increased focus on developing and strengthening these coping skills during therapy may be especially necessary for children who experience limited support or inconsistent parenting from their caregivers.

A critical decrease of symptoms has been observed in the narrative module combined with the cognitions and sharing module. The creation of the narrative primarily focuses on (gradual) exposure to traumatic memories, which aligns with prior research on exposure therapy's efficacy (Huang et al., 2022; McLean et al., 2022). In addition, intensified and in-vivo exposure show their effectiveness, particularly for patients with comorbidity or therapy resistance (Craske et al., 2014; Salloum et al., 2025). According to the TF-CBT protocol, in-vivo exposure should be introduced when avoidance behaviours persist after the trauma narrative. However, in-vivo exposure is not frequently used in our sample as some participants may not have needed it after the narrative and cognitions modules. In our study these two modules extended beyond the specified narrative time in the protocol, raising the question if earlier introduction of in-vivo exposure might have facilitated a faster or more effective decrease of symptoms giving the positive effect on therapy resistance and more complex cases (Salloum et al., 2025). This leads to the hypothesis that when symptoms, especially avoidance, persist during the narrative module, introducing in-vivo

Color legenda: PRAC Narrative Cognitions Sharing

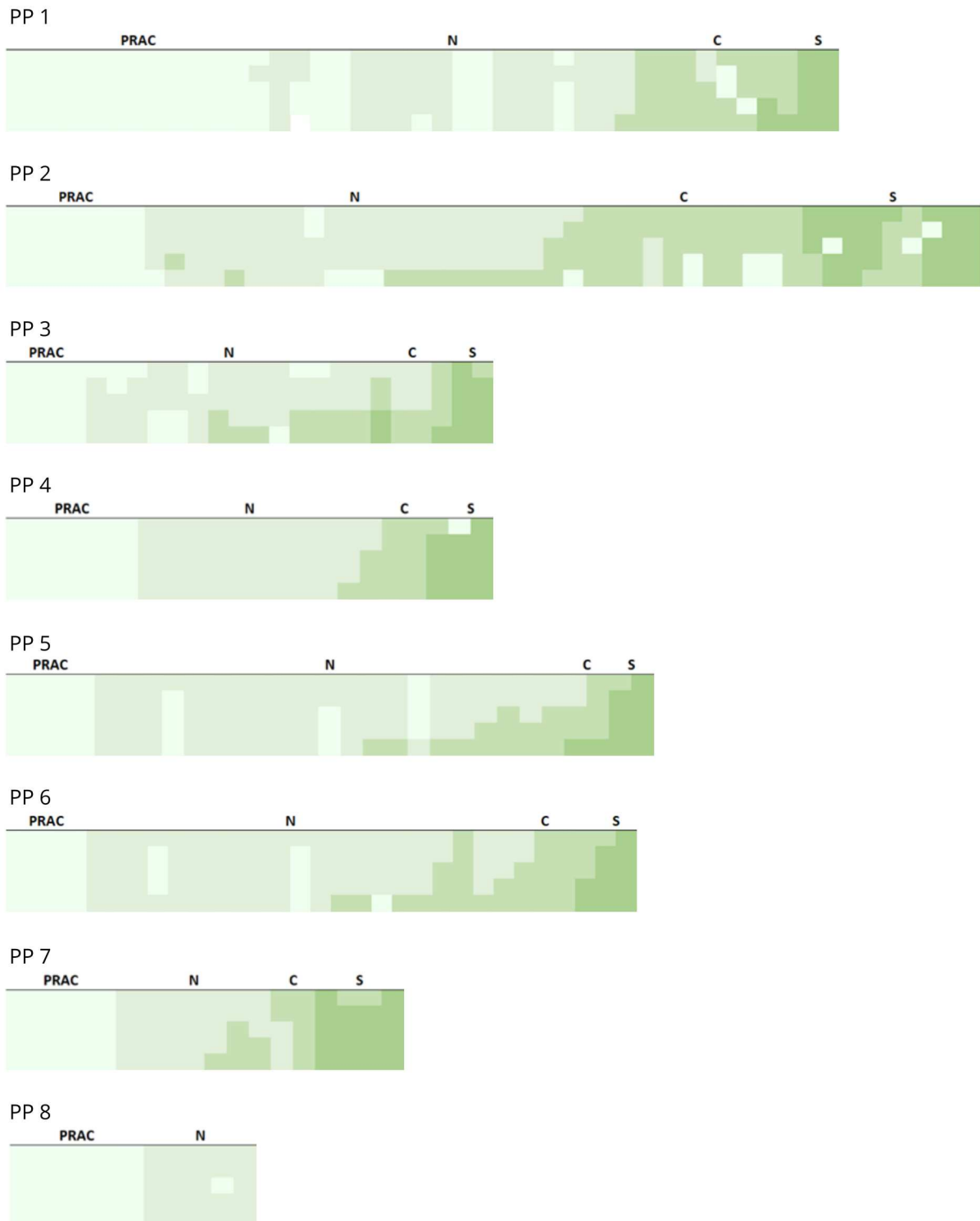


Figure 7. PRACTICE elements overview per participant as reported by the therapist.

Abbreviations: PP = participant; PRAC = Psycho-education Relaxation, Affect modulation, Cognitive coping; N = Narrative; C = Cognitive reprocessing; S = Sharing.

exposure earlier in therapy may enhance outcomes. This is consistent with our findings regarding the integration of cognitive reprocessing elements during the narrative module, which appeared beneficial in more complex cases. Future (SCED) studies should consider systematically incorporating and tracking in-vivo exposure, especially when avoidance symptoms persist

or generalization is limited. While exposure alone can be effective, integrating reprocessing and caregiver involvement appears more beneficial for all participants. In cases where self-blame was prominent (e.g. participants 2 and 3), it was necessary to prioritize cognitive restructuring before progressing through the next narrative component of therapy. This aligns with research

emphasizing reprocessing of negative cognitions, such as self-blame, to effectively reduce trauma symptoms (Holliday et al., 2018; Sharma-Patel & Brown, 2016). Furthermore our findings underlie the importance of the sharing and caregiver involvement, to strengthen therapeutic techniques and coping strategies of the child (Brown et al., 2020; Szota et al., 2023). Most therapy time was spent in the narrative and cognition modules, and we cannot exclude the contribution of time to symptom reduction. However, considering the timing of symptom improvements and the fact that TF-CBT is an evidence-based intervention with established efficacy (de Haan et al., 2024), it can be argued that the observed improvements are likely therapy related.

The average number of sessions was higher in our population than the TF-CBT protocol describes, with more sessions needed for children with severe symptoms or comorbidities. A more clear progress is seen in children with PTSD as their sole classification, as demonstrated by participant 7. In such a case, TF-CBT was delivered in closer line with the standard protocol, requiring 18 sessions with modules more evenly divided. Previous studies found contradicting evidence for an extended period of therapy. Some found that with more complex PTSD, prolonging therapy is necessary (Eilers et al., 2021; Ross et al., 2021; Sachser et al., 2017), whereas others did not support this finding (Hébert & Amédée, 2020; Jensen et al., 2022). We see that participants with prolonged childhood trauma and attachment issues require longer therapy and especially a more flexible approach, such as repeated PRAC modules or flexible cognitive restructuring elements. A clear case conceptualization seems necessary to create personalized adaptations for this heterogeneous and complex population.

Notably, participant 5 and 6 both had a comorbid ED and both noted limited positive changes and frequent negative effects due to the therapy in the NEQ scale. However, the idiosyncratic weekly measurements, standardized self-reports and the clinician-administered scale, indicated a substantial symptom decrease. This ambivalence is more often reflected in participants with ED. While wanting to recover, giving up the perceived 'benefits' of control makes it challenging (Pettersen et al., 2008). For the often co-occurring ED and PTSD there is no integrated treatment yet (K. S. Mitchell et al., 2021) and consistent measurement seems particularly important for these children, as their progress may not be immediately noticeable, but can be observed through careful monitoring.

4.1. Strengths and limitations

A crucial strength lies in the use of idiosyncratic weekly measurements, providing valuable insights into the child's experiences during therapy. These regular assessments created a dynamic view of

symptom changes and impact on daily life, while allowing therapeutic adjustments. This enhances our understanding of the mechanisms and challenges throughout trauma therapy, and work towards a personalized intervention. Furthermore, this SCED minimizes selection bias, as it includes TF-CBT eligible participants who might be excluded from larger RCTs due to strict criteria (Garcia-Argibay et al., 2025; Hitchcock et al., 2015). Therefore we can extend our research knowledge further in this changing and complex group of children in specialized psychiatry. Additionally, in this design we successfully created a relevant symptom tracking for each individual, while maintaining comparability across participants. This offers both individualized insights and more generalizable findings (Lane & Gast, 2014).

Several limitations must be acknowledged. Our study did not include follow-up data, making it unclear how symptoms fluctuate over time after receiving TF-CBT. Given that trauma-related cognitions and possibly also family relationships may take longer to improve or stabilize (Kline et al., 2018), future SCED studies including follow-up measurements would be advisable. Furthermore, there is a potential bias introduced by the weekly measurements additional to routine care therapy. Consistent symptom tracking may influence both the child's perception of symptoms as the therapist's approach in the session. Although therapists did not have access to the weekly data during therapy, they did receive the feedback from the standardized assessments. This systematic assessment should be routine, but this level of frequent monitoring most likely doesn't occur in daily practice. Having frequently outcomes on the standardized questionnaire, will influence their therapy process as they readjust perspectives for themselves and their patient (Yager et al., 2021). Lastly, a limitation is that the weekly measurements were tailored to each participant's most prominent symptoms. This approach limits comparability at an individual item level across our sample. To mitigate this, symptom selection followed structured criteria to ensure inclusion of the core DSM-5 PTSD symptom clusters, while enhancing clinical relevance and reducing the participants burden.

4.2. Clinical implications

Several clinical implication rise from this study. A particularly important aspect of TF-CBT is the cognitive processing of trauma-related beliefs, such as self-blame. Sufficient time should be dedicated to challenging these maladaptive thoughts, as reframing them is crucial for long-term therapeutic success (Holliday et al., 2018; Schumm et al., 2015). In some cases, it may be necessary to focus on cognitive restructuring

before progressing with new parts of the narrative. It is also important to note that anxiety, depressive symptoms and intrusive memories often increase in frequency and intensity during therapy. This potential increase and fluctuation should be explained to both the child and caregivers from the start, and reinforced throughout treatment. Preparing families for symptom fluctuations can help them support the child, and children should be reassured that they can manage daily stressors and symptom increases are temporary. Finally, the combined modules of narrative, cognitive processing and sharing impose the most decrease of symptoms, but some children and their caregivers need more support in their coping skills throughout the therapy. Although the isolated PRAC module does not appear effective on its own, it may be more effective integrated throughout therapy, especially regarding children with a more complex trauma history, such as children in foster care and interpersonal traumatic events. A flexible approach with necessary individual adaptations is needed to reach the wanted effect.

5. Conclusion

This research used a SCED design to systematically explore symptom changes occurring during TF-CBT, offering a more detailed understanding of the therapeutic process. By focusing on these in-therapy changes, we make a step towards personalized psychotherapy, and support clinicians in therapeutic adjustments in therapy and refining therapeutic interventions.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

Data that support the findings of this study are available from the corresponding author, LHK, upon reasonable request.

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