RESEARCH ARTICLE

The Added Value of Targeting Specific Risk Factors for Child Maltreatment in an Evidence-Based Home Visitation Program: a Repeated Single-Case Time Series Study

Trudy van der Stouwe[1] · Patty Leijten[1] · Bonne J. H. Zijlstra[1] ·
Jessica J. Asscher[2] · Maja Deković[2] · Claudia E. van der Put[1]

Abstract

The effects of home visiting programs to reduce child maltreatment are generally limited and warrant improvement. The present study, therefore, examined whether the effectiveness of a home visitation program in the Netherlands can be improved by adding specific intervention components targeting important risk factors for child maltreatment, namely parental stress, parental anger, and PTSD symptoms. Using a single-case experimental design, nine mothers were assessed weekly during 36 weeks of the Dutch home visiting program VoorZorg, comparing baseline, treatment (i.e., phase with added intervention components), and follow-up. Outcome effects were examined using statistical analyses on a group level and combining statistical and visual analyses on a case level for primary outcomes: perceived stress, parental anger, and PTSD symptoms, and secondary outcomes: risk of child maltreatment and parental sense of competence. As a group, mothers showed a reduction of anger in response to the additional components. No group effects were found for other outcomes. At an individual level, three mothers showed only positive effects, four mothers showed no intervention effects, and two mothers showed mixed effects (i.e., positive on some outcomes and negative on other). Consequently, the component targeting parental anger seems promising, because it can easily be implemented, but it is important to prevent any possible detrimental effects. Effects of the component targeting stress depended on the use of relaxation exercises, and therefore this component should be expanded in such a way that it is more feasible for mothers to implement it.

Keywords Home visitation program · Child maltreatment prevention · Increased effect · Single case

✉ Trudy van der Stouwe
  t.vanderstouwe@uva.nl

Extended author information available on the last page of the article

🖄 Springer

Introduction

Child maltreatment is a global phenomenon affecting as many as one-third of all children worldwide (Moody et al., 2018), with grave and long-lasting economical, societal, and developmental consequences (Peterson et al., 2018). Because perpetrators are most often the child's parents (Gilbert et al., 2009), interventions to reduce the risk of child maltreatment typically target parents. These programs aim to support parents in their parental role such that they are less likely to resort to harmful parenting. However, these programs generally show small and inconsistent effects (Euser et al., 2015).

One of the most frequently used and researched formats for child maltreatment intervention is home visitation (see, e.g., Van der Put et al., 2018). These interventions generally consist of (para)professionals visiting parents at home, providing parenting information and support for at-risk families. Although the exact contents and the degree of structure across programs vary, most have a structured protocol for targeting parenting skills on the one hand and making better use of community services on the other hand. Delivering the program in the participants' home is thought to overcome barriers that usually interfere with treatment adherence and outcomes with harder-to-reach populations, such as limitations in transportation or childcare options (Avellar & Supplee, 2013; Casillas et al., 2016). Although home visitation programs are considered modestly effective, intervention effects vary largely across programs, target populations, outcomes, and research settings, and the effects on child maltreatment have so far been limited, warranting improvement (Euser et al., 2015; Van der Put et al., 2018). One way to do so is to improve our understanding of the content that most effectively reduces the risk for child maltreatment. To this end, we examined the effects of added intervention components targeting three key specific risk factors for child maltreatment (i.e., parental stress, parental anger, and posttraumatic stress symptoms) in a nationwide disseminated evidence-based program to prevent child maltreatment in at-risk families in the Netherlands.

The program examined in this study is the Dutch nurse home visitation program VoorZorg (Mejdoubi, 2014). This intervention finds its origins in the Nurse-Family Partnership program (NFP, see, e.g., Olds, 2012) but has been culturally adapted and further developed after implementation in The Netherlands in such a way that it is now regarded as a stand-alone intervention program. In addition to its primary goal of preventing child maltreatment, it aims to enhance the mother and the child's health and development (Mejdoubi, 2014). The intervention targets young first-time mothers with a low educational level (i.e., dropped out of school or maximum pre-vocational secondary education) who are at risk for child maltreatment. VoorZorg has shown to be effective in reducing smoking during pregnancy and after birth, increasing the prevalence of breastfeeding 6 months after birth, decreasing intimate partner violence victimization and perpetration, decreasing child-protecting services reports, improving the quality of the home environment, and decreasing child internalizing behaviors (Mejdoubi, 2014).

In line with the theoretical underpinnings from NFP (Olds, 2012), as well as increasing evidence supporting the positive effects of father involvement (see,

e.g., Barker et al., 2017; Choi & Pyun, 2014), increasing father involvement is an important target of the VoorZorg intervention. However, given the fact that the target population mostly consists of single mothers (Mejdoubi et al., 2015), the presence and involvement of fathers could not be guaranteed. (Although, in hindsight, our sample data suggests that fathers were involved more often than anticipated, see Appendix B.) Moreover, the evidence base for the targeted risk factors has underrepresented fathers on the one hand or has or has found differences in the influence of risk factors between mothers and fathers on the other hand. This may limit the generalizability of the targeted risk factors across mothers and fathers and the treatment components used to target these factors in the present study. Consequently, the additional intervention components were hypothesized to be applied mainly with mothers. Therefore, the present study has focused on outcomes for mothers specifically.

The first component that we added aimed to reduce parents' stress levels, because parents with high stress levels are more likely to engage in harsh parenting (Beckerman et al., 2018), which increases the risk of child abuse (Rodriguez & Richardson, 2007). Furthermore, stress has shown to mediate the relation between harsh parenting and multiple risk factors, such as negative affectivity, and difficult child temperament (Le et al., 2017; Martorell & Bugental, 2006). Arguably, parents who experience a lot of stress lack the resiliency to show positive parenting practices amid negative parenting circumstances, which may be because they experience a lack of control (Martorell & Bugental, 2006). Therefore, increasing parents' skills to cope with stress, thereby reducing the level of perceived stress and increasing their levels of control, might help to increase positive parenting practices and reduce the risk of child maltreatment. Moreover, meta-analysis has shown that child maltreatment prevention programs that specifically target personal skills, including stress management skills, are the most effective (Van der Put et al., 2018). For this component, parental stress was targeted using a guided imagery exercise on audio, following a script that has shown to be effective in reducing stress in previous studies (Bigham et al., 2014; Darthmouth Student Wellness Center n.d.; Naparstek, 1994). Motivating for and support with daily use of this exercise was hypothesized to reduce parental stress.

The second component that we added aimed to improve parental anger management skills, because the ability to cope with feeling angry seems to differentiate non-maltreating parents from maltreating parents, particularly in the case of psychological abuse (Lavi et al., 2019). Perhaps, when parents lack skills to deal with negative emotions, they are more inclined to express those emotions in harmful ways (Rodriguez, 2010). In addition, they may justify and intensify their negative feelings and behaviors through dysfunctional attributions about their children's behavior (Pidgeon & Sanders, 2009). Therefore, targeting negative attributions may help parents reduce feelings of anger and increase appropriate coping skills, thereby reducing the risk of child maltreatment. This approach has already proved effective in a parent group training setting (Sanders et al., 2004) and may generalize to home visiting programs as well. We, therefore, designed this component to alter negative attributions that mothers might have about their children's behavior and provide alternative strategies to respond to behavior that triggers anger using a cognitive-behavioral

approach. First, anger was discussed and normalized, and, second, ways to calm down were discussed. Finally, using a set of cards based on the work of Kock et al. (2003), anger triggers and negative attributions were turned around into more realistic attributions and adequate behavioral alternatives.

The third component that we added aimed to reduce posttraumatic stress symptoms. Histories of trauma are prevalent in parents at risk for child maltreatment (Van Ee et al., 2016). Furthermore, parents with symptoms of posttraumatic stress disorder (PTSD) generally experience a poorer, less affectionate relationship with their children and may be less sensitive and responsive compared to parents without those symptoms (Van Ee et al., 2016). This may be because PTSD leads to deficits in maternal emotion regulation, which makes it difficult for mothers to parent assertively and adequately (Kumar et al., 2020). Consequently, adequate recognition and (referral to) treatment of PTSD symptoms may enhance the effects of programs to prevent child maltreatment (Ammerman et al., 2012). For this component, we aimed to improve recognition to treatment using a standardized screening instrument for PTSD (i.e., abbreviated PCL-C; Lang & Stein, 2005), including referral to (EMDR) treatment when mothers scored above the symptomatic threshold.

Various experimental designs allow for testing the added effects of discrete intervention components, such as additive trials where participants are randomly allocated to either the traditional or enhanced intervention or factorial experiments where participants are randomly allocated to any combination of intervention components (Leijten et al., 2021). Most designs are between-subject designs, requiring extensive sample sizes to yield sufficient statistical power to detect small or medium effects. They also come with the ethical concerns (e.g., withholding potentially effective treatment content to participants allocated to control conditions) and implementation difficulties (e.g., avoiding contamination between conditions). In the present study, we therefore opted for a repeated single-case experimental study. This design has gained popularity in the last decade, in part, because technology makes frequent assessment easier and is particularly appropriate for difficult-to-research and small populations such as the VoorZorg target population, because a relatively small research sample may be sufficient to demonstrate an effect (Kazdin, 2021; Vlaeyen et al., 2020). The design makes it possible to examine (mechanisms of) change in individual mothers—as opposed to a group of mothers *on average*—and to gain insight into the changes that occur during different phases of treatment. Furthermore, by means of meta-analysis of multiple mothers, it is also possible to test treatment effects on an aggregated level. Notably, according to the American Psychological Association (APA), several well-conducted single-case studies may provide a viable alternative to a randomized controlled trial in effectiveness studies (Byiers et al., 2012; Kratochwill et al., 2013).

Over the past decade, there has been a shift in guidelines and common practice for single-case research analysis (see, e.g., Kazdin, 2021; Tanious & Onghena, 2021). Whereas previously visual analysis was the most common approach to analyze outcome data, more and more emphasis is now being placed on statistical analysis. This is due to increasing evidence of the subjective (i.e., unreliable) nature of visual analysis on the one hand and expanding knowledge about and possibilities with statistical analyses on the other hand. There are, however, many ways to

statistically analyze single-case experiments, each with their own benefits and limitations, and there is little consensus about the most suitable method. In the present study, we, therefore, used visual analysis as well as statistical analysis. To increase reliability of the visual analyses, we used a scoring protocol (by Wolfe et al., 2019) to assess intervention effects, and all outcome graphs were scored by three researchers. Next, we used these outcomes to appreciate the outcomes of our statistical analyses: only if the visual analyses determined that there was phase stability (i.e., a reasonably consistent pattern per phase), the statistical analyses were deemed appropriate to determine (indices of) an intervention effect. We have thus tried to make optimal use of the advantages of both analytical methods, while compensating for their limitations.

In the present study, weekly measurements were taken during regular postnatal VoorZorg home visits for a baseline, treatment (i.e., during the implementation of the intervention components), and follow-up phase for the targeted risk factors specifically (i.e., parental stress, parental anger, and PTSD symptoms), as well as the risk of child abuse and parental sense of competence. The aim was to examine the effectiveness of the added intervention components. If these components are, indeed, effective in targeting the specific risk factors, we would expect improvements in the primary outcomes (parental stress, parental anger, and PTSD symptoms) between baseline and follow-up. Furthermore, we would expect a decrease in our secondary outcome measures: the risk of child abuse and parental sense of competence. In addition, we examined the moderating effects of child temperament, important life events, and the quality of the home environment to examine how these factors influence amenability to the added intervention components.

Methods

Data were collected between April 2019 and February 2021 and consisted of pre- and post-tests with 36 weekly assessment points for mothers and a (bi)weekly checklist for their nurses. Qualified VoorZorgYouth Health Care nurses were trained in the additional intervention components, and the trained nurses invited mothers in their caseload to participate. If a mother agreed to participate, she was randomly assigned to receive the intervention components after 10 (group I), 12 (group II), or 14 (group III) weeks. However, in practice, the intervention components were not always timed in line with the assigned baseline group, and we, therefore, analyzed the mothers not how they were assigned to receive the components (i.e., "intent to treat" as a multiple baseline study), but "as treated," i.e., as a repeated single-case time series study. We preregistered the analytic plan for this study after data collection had finished but before the start of the analyses (see Van der Stouwe et al., 2021).

Procedure

This time series was divided into three phases during regular VoorZorg intervention: baseline (i.e., before the intervention components were applied: "B"), treatment (i.e., when the added intervention components were applied: "T"), and follow-up (i.e., after the intervention components were applied: "F"). Participating mothers answered weekly short online questionnaires, assessing three primary outcomes: perceived stress, parental anger, PTSD symptoms, and two secondary outcomes: risk of child maltreatment and parental sense of competence. The nurses registered the occurrence and contents of every home visit during the study in biweekly assessments.

Additionally, a pre- and post-test home visit was conducted by one of the researchers in which demographics were assessed, such as age, birth country, the mothers' maternal and paternal birth countries, and levels of education. Furthermore, full-scale assessments were conducted for the primary and secondary outcomes. Putative moderators were child temperament and important life events that happened in the last 6 months (e.g., got divorced/separated, got fired). In addition, the quality of the home environment was assessed through standardized observation only at the pre-test home visit.

Thirteen nurses were trained to deliver the additional intervention components. The mothers were eligible for participation if they had at least 36 weeks of VoorZorg intervention left (i.e., child aged 0–15 months) and sufficient understanding of the Dutch language to participate. There were 23 mothers registered for participation in the study. A researcher then contacted the mothers to discuss informed consent and to explain the rewards for participating, which consisted of a present for the mother and the child at both pre- and post-tests, and a €2 gift voucher per weekly assessment, with a €28 reward if the mother completed all assessment points (maximum total: €100). The nurses could receive a €10 gift voucher for implementing the intervention components and a €10 gift voucher if the mother completed the majority of her assessments.

A flowchart of the study participants can be found in Fig. 1. A total of $N=23$ mothers registered for the participation in the study, but $n=5$ of them did not complete the pre-test assessment because they would not receive VoorZorg after all ($n=3$), because they could not be reached ($n=1$), or because they did not agree with the participation after explaining the study's requirements ($n=1$). Another $n=2$ mothers dropped out shortly after the start of the study, because they did not like the weekly questionnaires. Finally, $n=16$ mothers participated in the study up to the post-test assessment point, but only $n=9$ of them were used in the analyses, because the other mothers had incomplete datasets due to insufficient weekly assessments ($n=2$) or insufficient application of the additional treatment components ($n=5$). The available assessment points, the actual implementation of the intervention components, and the corresponding treatment phase are summarized in Table 1.
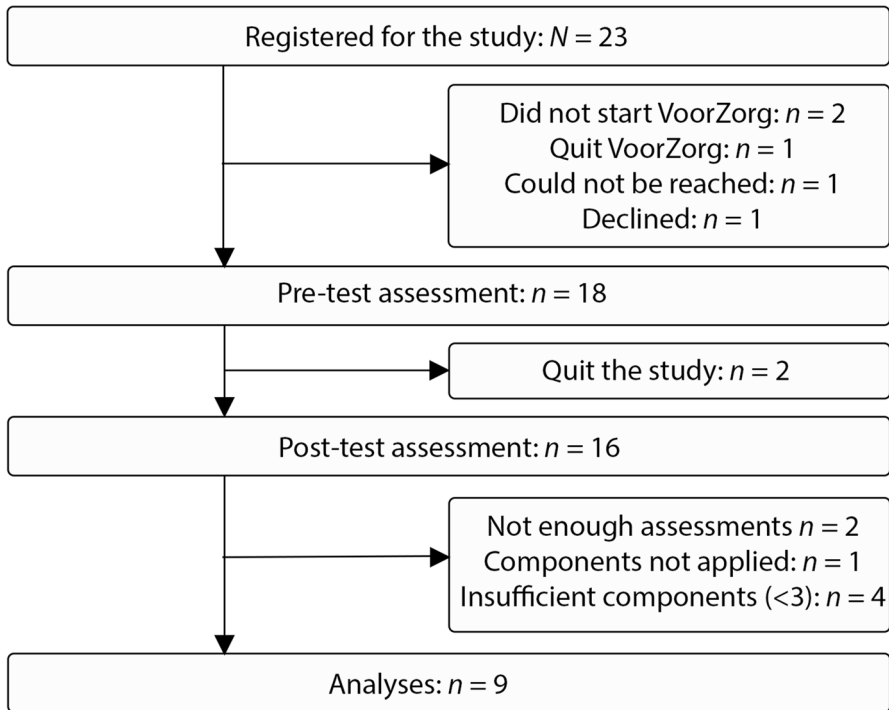
Fig. 1 A participant flowchart of the study

Intervention Components

All the participants received regular (mostly biweekly) VoorZorg home visiting intervention for the full 36-week period. The mothers are eligible for VoorZorg when they are younger than 26 years, have a low educational level (i.e., dropped

Table 1 Available assessment points and applied intervention components per participant

M		Study weeks												%ass
G	1 . . . . 6 . . . . . . 12		18		. . . .	24	.	. . . . 30		. 36				
M01 III		SA	SA		S S	SA	S	SA		S				100
M02 I S	S A A S	S	ST	S										94
M03 III	A	A	A	SA										94
M04 I		SA	A	SAT	SA					ST	ST			94
M05 II		S					AT A		A		A			97
M06 I	A	S	A		SA									81
M07 I	S	SA		SA	SAT									100
M08 II			S		A A	A				AT				100
M09 III		S		SA	SA	SAT	SAT	S	A					100

Note. M = mother; G = original baseline assignment group: treatment starts after 10 weeks (I), 12 weeks (II), or 14 weeks (III); % ass = proportion available assessments; S = stress component was applied; A = anger component was applied; T = trauma component was applied; gray = treatment phase

out of school or maximum pre-vocational secondary education), are pregnant with their first child, and have at least sufficient understanding of the Dutch language to be able to participate in the program. The mothers are referred to VoorZorg based on these inclusion criteria by a health care professional involved with the family. Then, to determine eligibility for VoorZorg, the presence of one or more of the following additional risk factors is assessed by a VoorZorg Youth Health Care nurse in an intake home visit: a lack of social support, history of violence or abuse, domestic violence or neglect, psychological problems, financial problems, unemployment, housing problems, substance (ab)use or using alcohol or smoking during pregnancy or having unrealistic expectations of motherhood. The home visits conducted by the trained VoorZorg Youth Health Care nurses started weekly during pregnancy and continued biweekly up from the seventh week after birth into the second life year of the child.

During the treatment phase of this study, the additional intervention components were to be integrated into six consecutive home visits. Assuming biweekly frequency, the treatment phase would then have a duration of 12 weeks. We used the structured intervention components targeting perceived stress, parental anger, and PTSD symptoms developed by De Wit et al. (2020). In short, the stress component consisted of a relaxation exercise audio clip for daily use, starting the first treatment home visit. Then, starting the second treatment phase home visit, anger triggers and attributions and ways to calm down were discussed and normalized. Finally, the severity of PTSD symptoms was assessed in the fourth treatment phase home visit, and direct referral to (online) eye movement desensitization and reprocessing therapy (EMDR; see, e.g., Shapiro, 1989a, 1989b) was offered. A more elaborate description of the intervention components can be found in Appendix A.

The actual implementation of the intervention components has been examined using the nurses' weekly checklists, see Table 1 (i.e., excluding 5 mothers that were excluded from the analyses due to insufficient component application, see Fig. 1). First, the relaxation exercise was discussed with every mother in an average of 4 occasions (range, 1–8). Second, the anger component was discussed with every mother in an average of 4 occasions (range, 2–6). Third, the trauma component was discussed with 6 out of 9 mothers (67%) in an average of 2 occasions (range, 1–3). None of these mothers actually registered for EMDR treatment. During the study, there was one mother that registered for EMDR treatment, but she was excluded from the present analyses due to insufficient assessment points. Eventually, the mother was referred to different treatment, because, at intake, her issues were deemed to be too complex for the relatively unimodal treatment approach that was offered.

Consequently, the execution of the intervention component may have been fully successful for only the anger component, given the fact that all the mothers received it, and this was (on average) in the prescribed amount (i.e., 4 home visits). For the stress component, we prescribed implementation in 6 home visits, while the trauma component was to be implemented with all the mothers in 2 home visits, indicating implementation was suboptimal. In addition, Table 1 shows that some of the components were applied outside the assigned treatment phase, and that the home visitation frequency, as well as the order in which the intervention components applied,

was not always as prescribed, although mothers M02, M04, M07, and M09 seem to show the most adequate patterns.

Outcomes and Measures

Our main outcomes, perceived stress, parental anger, and PTSD symptoms, as well as our secondary outcomes, risk of child maltreatment, and parental sense of competence, were assessed with full-scale measures at pre- and post-tests and abbreviated measures at the weekly assessment points. For the weekly assessments, the questioning was adapted to ask about experiences during the last week, and the item scales were transformed from a Likert-scale to a sliding, a 0–100 scale, using the same answer categories. We transformed these scores back into the original scoring scale without rounding to retain the outcome variance and used a mean item score for all weekly outcome measures unless otherwise specified.

Perceived Stress

Perceived stress was measured using the Perceived Stress Scale (PSS; Cohen, 1988; Cohen et al., 1983). The mothers answered items, such as "In the last month, how often were you unable to cope with all the things that you had to do?" on a 5-point scale, ranging from 1 (*never*) to 5 (*very often*), with higher scores representing a higher stress level in mothers. At pre- and post-tests, the 10-item version was used, while we used the 4-item version of the PSS for the weekly assessment (PSS-4; Cohen, 1988).

Parental Anger

Parental anger was measured using the "expression"-subscale of the Parental Anger Scale (PAS; Gavita et al., 2011). This measure consisted of items such as "I get so angry with my child that I scream or yell at my child" on a 7-point scale, ranging from 0 (*never*) to 6 (*several times a day*). At pre- and post-tests, we used the full 11-item subscale, with higher scores corresponding to more frequent anger. For the weekly assessment, we selected six items that had the highest factor loadings on the "expression" factor (see Del Vecchio et al., 2017, p. 3018, Table 1).

PTSD Symptoms

Posttraumatic stress symptoms were measured using the abbreviated PTSD Checklist—Civilian (PCL-C; Lang & Stein, 2005). These items measured how often symptoms such as "repeated, disturbing memories, thoughts, or images of the stressful experience" occurred on a 5-point scale, ranging from 0 (*not at all*)

to 4 (*extremely*). We used the 6-item version for the pre- and post-tests and a two-item version for the weekly assessment (Lang & Stein, 2005).

Risk of Child Maltreatment

The risk for child maltreatment was measured at the pre- and post-tests using the Instrument for early Identification for Parents at Risk for Child Abuse and Neglect (IPARAN; Horrevorts et al., 2017; Van der Put et al., 2017). This instrument consists of 16 questions on the presence of the most important risk factors for child abuse. The answer options have been scored between 0 and 2 in line with their weight in predicting the risk of child maltreatment. The total risk of child maltreatment was a sum score of all 16 items, with a maximum score of 17.5 and higher scores representing a higher risk of child maltreatment. For the weekly assessments, we selected four items that referred to dynamic (i.e., changeable) risk factors and averaged item scores from 0 to 100 into a mean item score with a maximum of 100.

Parental Sense of Competence

Parental sense of competence was measured using the shortened Sense of Competence subscale of the PSI (Abidin, 1983; De Brock et al., 1992). This subscale consists of nine items, such as "I feel that I am not very good at being a parent" on a 6-point scale, ranging from 1 (*I totally agree*) to 6 (*I totally disa*gree), with higher scores representing higher levels of competence. For the weekly assessments, we used two items of the shortened PSI (Abidin, 1983; De Brock et al., 1992).

Analytic Strategy

We examined the effects for all the mothers as a group, and all the individual mothers comparing (1) B versus T, (2) B versus T + F, and (3) T versus F. We tested for level change and slope change between phases as advised by Huitema and McKean (2000). That is, if the intervention component was effective in, for instance, perceived stress, we would expect significantly lower stress levels at T (+ F) compared to B and significantly lower stress during F compared to T. Alternatively, an effect could also be shown when an increase of stress during B would turn smaller or into a decrease during T (+ F), when a stable level of stress turned into a decrease, or when an increase got larger in magnitude and the same would be expected for T versus F.

In addition, we examined individual differences by combining statistical and visual analysis of individual mother graphs. Analyses were conducted for our primary outcomes: perceived stress, parental anger, and PTSD symptoms, and our secondary outcomes: risk of child maltreatment and parental sense of competence. We only included data from the mothers who provided at least 5

measurement points per phase and received the intervention components in at least 3 occasions ($n = 9$ participants).

Group-Based Analyses

The effects for all the mothers together were examined using a linear mixed model that has been fit using restricted maximum likelihood (REML) with the "nlme" package in R (Pinheiro et al., 2021; R Core Team, 2020). In line with the model suggested by Huitema and McKean (2000), the following variables (with associated coefficients) have been included as predictors: an intercept (i.e., β_0, reflecting the level at the first measurement), a variable for week (i.e., β_1, to estimate the slope over time in the first phase), a binary variable for the phase of interest (β_2, to estimate the level change), and a variable for weeks since the start of the phase of interest (β_3, to estimate the slope change and $\beta_1 + \beta_3$ estimates of the second-phase slope). We only considered the level change (i.e., β_2) to be adequate when there was no significant slope change (i.e., β_3) between phases. Random intercepts have been estimated using a case as a grouping factor, and all models have been estimated assuming a first-order autocorrelational covariance structure for the residuals. Before conducting the analyses, we have first tested whether including random slopes for the previously mentioned predictors resulted in a statistically significant better model fit, using a deviance test. If so, the model including random slopes has been used, and the variance for the random slopes has been included in the outcome table. If not, the model without random slopes has been used.

In addition, we have examined whether there were differences in line with the specified hypotheses between the pre- and post-test assessments, using a paired, one-sided Wilcoxon test in R (R Core Team, 2020). We have analyzed these differences for the (full-scale) measures that were assessed at pre- and post-tests: perceived stress, parental anger, PTSD symptoms, risk of child abuse, and parental sense of competence.

Case-Based Analyses

For the statistical analyses per mother, we have used a generalized least squares fitted linear model that has been fitted using REML, using the "nlme" package in R (Pinheiro et al., 2021; R Core Team, 2020). Estimated models were similar to the group-based analyses, except for the absence of random effects at the subject level.

For the visual analyses, three researchers (i.e., the first, the second, and the sixth authors) visually analyzed all the participants, using a subset of the ABAB-scoring protocol by Wolfe et al. (2019). Because our study consists of three phases (i.e., B, T, and F), we only used protocol items 1–10, consistent with an ABA comparison, and considered a score of 2 and higher as indicative of an effect.

With this protocol, the coder first determines whether there is phase stability (i.e., items 1, 2, and 6 for B, T, and F, respectively). Points for signs of a treatment effect are only assigned when there is phase stability for both concerned phases based on contrast between the phases (i.e., items 3 and 7; 1 point), immediacy of the contrast (i.e., items 4 and 8; 0.25 point), less than 30% overlap between

phases (i.e., items 5 and 9; 0.25 point), and consistency between F and B (i.e., item 10; 0.25 point). In the original scoring scheme, later questions are blocked if the rater determines there is no phase stability, but we did not use the blocking to increase possibilities to determine interrater reliability. Interrater agreement between three coders was 70% (per participant: 56–94%; per item: 38–100%; per outcome: 54–85%).

For the visual analyses, the individual graphs were provided using the scan package in R (R Core Team, 2020; Wilbert & Lueke, 2019). The maximum for the *y*-axis (i.e., outcome) has been determined by using the maximum score over all the participants per outcome to obtain consistent scaling and outlook of the graphs. In addition, (dotted) lines have been added to mark a mean and trend line for every phase to increase reliability in scoring the protocol on related items. Finally, overlap scores have been calculated and provided for the scoring of protocol items 5 and 9 (whether there is less than 30% overlap with the previous phase). The graphs can be found in Figs. 2, 3, and 4. Separate images of the graphs per participant per outcome at a higher resolution can be found at https:// osf.io/96k3y/.

Deviation from Preregistration

For this study, all analyses described in the preregistration have been conducted (see Van der Stouwe et al., 2021). However, the analyses on our secondary outcomes, as well as the case-based analyses, were described as exploratory, while, in fact, they are all part of our main study analyses, and we have described them
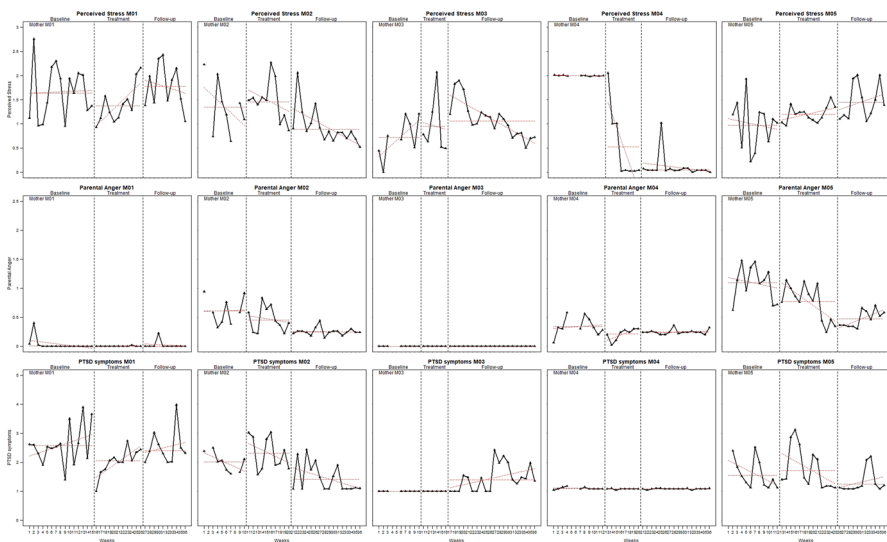

Fig. 2 Outcome graphs of perceived stress, parental anger, and PTSD symptoms for participants M01–M05. *Note*. Every column represents outcome graphs for one mother. Larger images can be viewed at https://osf.io/96k3y/
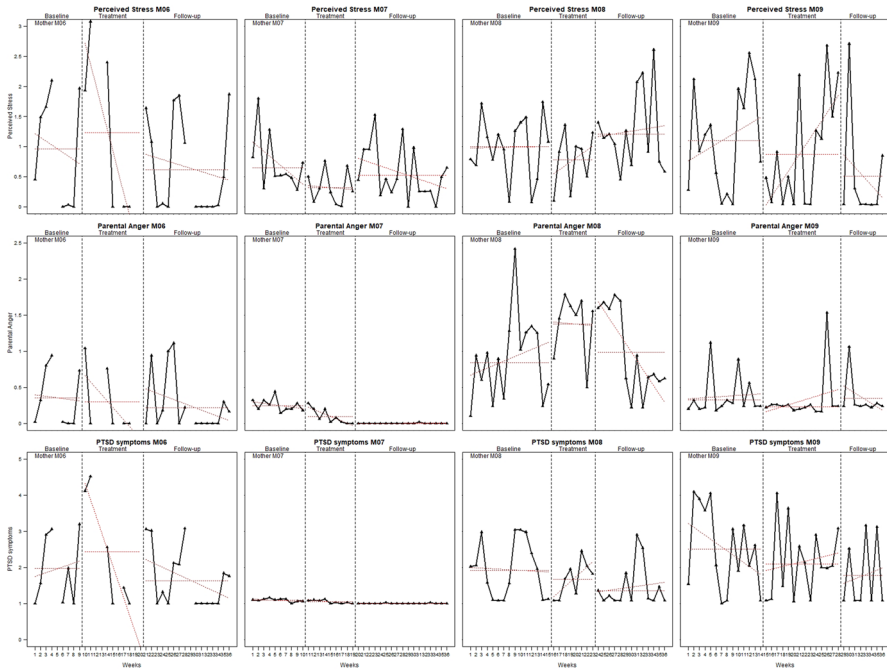
Fig. 3 Outcome graphs of perceived stress, parental anger, and PTSD symptoms for participants M06–M09. *Note*. Every column represents outcome graphs for one mother. Larger images can be viewed at https://osf.io/96k3y/

as such here. In addition, we chose not to describe all results here due to word/page limitations. First, we omitted anger frequency as an outcome to retain only one outcome per intervention target and because this outcome was based on one questionnaire item only. Second, we omitted visual analyses for the 4 mothers that received the components at less than 3 occasions, because this would be inconsistent with the number of the mothers examined in the statistical analyses (i.e., those that received the components in at least 3 occasions). Third, no moderator analyses are presented, because only very few moderating effects were found that were inconsistent across phase comparisons and outcomes. Statistics for only the significant moderating effects are shown in Appendix J. These tables show that negative emotionality had a significant moderating effect on all main outcomes but for different phase comparisons, while the quality of the home environment had a moderating effect on only one phase comparison for parental anger. Finally, soothability and the number of life events had a moderating effect on different phase comparisons for PTSD symptoms, and no significant moderating effects were found for the baby's age. Other (i.e., nonsignificant) outcomes for these analyses are available upon request from the first author.
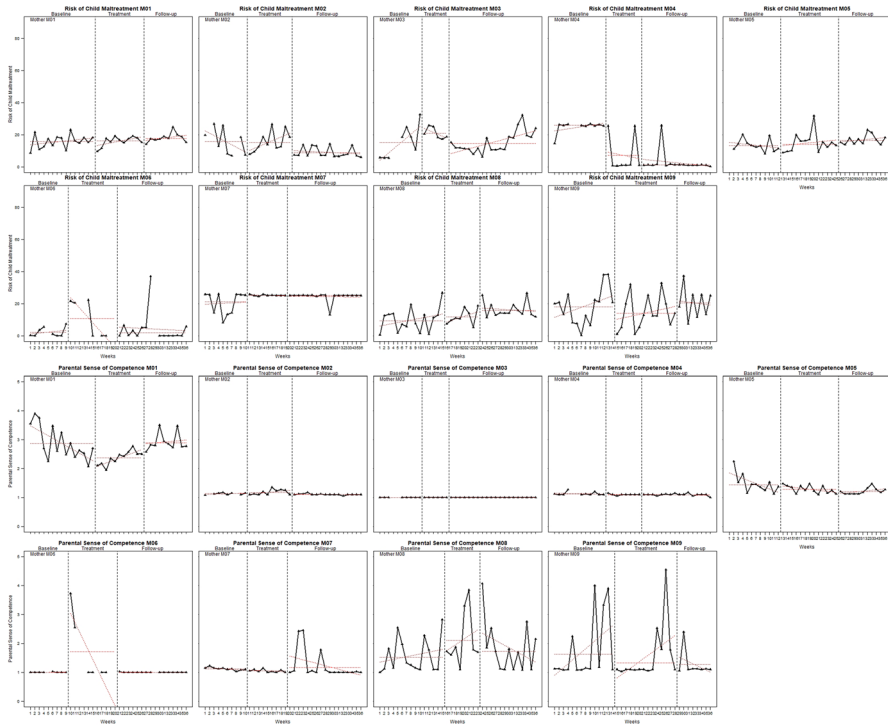
Fig. 4 Outcome graphs of risk of child maltreatment and parental sense of competence for participants M01–M09. *Note*. First and second row: Risk of child maltreatment; Third and fourth row: Parental sense of competence. Larger images can be viewed at https://osf.io/96k3y/

Results

Participant Characteristics

Appendix B shows the characteristics of our participating mothers ($N=9$), as well as their pre- and post-test assessment scores. The participating mothers were between 17 and 30 years old (median age = 23). One mother was not born in The Netherlands (i.e., M06). Roughly half of the mothers was living with the child's father ($n=5$), one was living with her mother, and one-third was living alone ($n=3$). Most of the mothers shared the care for their children with the children's fathers ($n=7$), and a little over half received professional support of some kind ($n=5$). Only one mother reported to have financial issues (i.e., M09), while the other mothers were mostly or always (i.e., M05, M07, and M09) able to get by. All the mothers reported to have experienced at least one life event in the past 6 months (e.g., got divorced/separated, got fired), ranging from 1 to 5 events in total (median = 3). At the pre-test, the ages of the infants varied between 3 and 8 months, and the minority had a son (i.e., M03, M07, M09).

The pre-test perceived stress scores ranged from 22 to 32 (median = 26), which may be considered average with a maximum possible score of 50. Scores on parental anger were generally low, and over half of the mothers ($n = 5$) reported no parental anger. The scores for PTSD symptoms ranged from 6 to 16 (median = 14), and a majority ($n = 7$) showed a symptomatic score (i.e., > 3) on at least one scale item. Just as many mothers ($n = 7$) scored 3 or more points on the IPARAN, which put them at an increased risk for child maltreatment.

Primary Outcomes

Group-Based Analyses

For the group-based analyses, we compared baseline versus T, B versus T and F, and T versus F for outcomes of perceived stress, parental anger, and PTSD symptoms, examining level change and slope change between phases. There was a significant slope change for parental anger, comparing B to T+F. During B, there was a small but nonsignificant increase in anger ($\beta_1(SE) = 0.01(0.01)$, $t = 1.14$, $p = 0.257$), while there was a slight decrease in anger during T+F, with a slope that was significantly different from the B slope ($\beta_3(SE) = -0.02(0.01)$, $t = -2.02$, $p = 0.044$). There were no significant differences in the level or slope change between B and T, or T and F for parental anger. For perceived stress and PTSD symptoms, no significant level or slope changes were found in any of the comparisons between B and T, B and T+F, and T and F. Statistics for all group-based analyses can be found in Appendix C.

Case-Based Analyses

For the case-based analyses, we conducted statistical analyses per mother, comparing B versus T, B versus T and F, and T versus F. We used the visual analyses to elaborate on the statistical analyses in two ways. First, we used agreement on the items about phase stability (for B, T, and F) to estimate whether the phase patterns were linear (or stable) enough for the statistical model to be appropriate. Second, agreement on the overall score indicating signs of an effect was used to detect treatment effects that may not have been detected in the statistical analyses. All outcomes of the case-based statistical and visual analyses can be found in Appendix D. An elaborate description of those outcomes per mother can be found in Appendix E.

A schematic overview of all treatment effects per mother has been included in Table 2. Only one mother, M04, showed positive treatment effects on both perceived stress and parental anger. Furthermore, mother M09 showed positive effects on perceived stress, and mother M06 showed positive effects on PTSD symptoms, but their scores may not be stable enough to draw an appropriate conclusion from the statistics. Mother M05 only showed negative effects on parental anger, although these analyses may have been less appropriate due to a lack of phase stability. Next, mother M07 showed positive effects on parental anger and negative effects on PTSD symptoms, although only the positive effect on parental anger may be meaningful in practice, because there was hardly any variation in PTSD symptoms for this mother.

Table 2 Schematic overview of individual treatment effects per mother and outcome

Mother	Primary outcomes			Secondary outcomes	
	Perceived stress	Parental anger	PTSD symptoms	Risk of child maltreatment	Parental sense of competence
M01		− −	+ +		+ +
M02	− −*		− −	− −	+ +
M03				+ +*	
M04	+ +	+ +		+ +*	
M05		− −*			+ +
M06			+ +*	+ +*	+ +*
M07		+ +	− −*		
M08					
M09	+ +*				− −*

+ +, positive (desired) treatment effect; − −, negative (undesired) treatment effect

*Visual analyses did not find phase stability

Furthermore, mother M01 showed positive effects on PTSD symptoms but negative effects on parental anger, while mother M02 showed negative effects on perceived stress and PTSD symptoms but positive effects on parental anger. However, the effects on perceived stress and parental anger for mother M02 may be less appropriate due to a lack of phase stability. Finally, no treatment effects were found for two mothers: mother M03 and M08.

Secondary Outcomes

Group-Based Analyses

There were no significant level or slope changes in any of the comparisons between B and T, B and T+F, and T and F for the risk of child maltreatment and parental sense of competence. Statistics for these group-based analyses can be found in Appendix F.

Case-Based Analyses

The outcome graphs that were used for the visual analyses of the secondary outcomes can be found in Fig. 4 and the outcomes of both the visual and statistical analyses can be found in Appendix G, with an elaborate description of those outcomes in Appendix H.

Table 2 shows two mothers, mothers M01 and M05, showed positive effects on only parental sense of competence, and one mother, mother M09, showed a negative effect on this outcome. Another two mothers, mother M03 and M04, showed a positive treatment effect on the risk of child abuse, although these outcomes may be less appropriate due to a lack of phase stability. Next, mother M02 showed a negative effect on the risk of child maltreatment but a positive effect on parental sense of competence. Furthermore, mother M06 showed positive effects on both outcomes,

but these also both seemed less appropriate, because there was a lack of phase stability. Finally, no treatment effects were found on these outcomes for two mothers: mothers M07 and M08.

Pre- and Post-test Differences

Wilcoxon signed-ranks tests were conducted to determine whether there were any significant changes between pre- and post-tests on the outcome measures. Assuming VoorZorg as an intervention is effective, it was hypothesized that participating mothers would improve on all outcomes at post-intervention, compared to pre-intervention. The analyses showed that the mothers did not score significantly higher at the pre-test compared to the post-test on perceived stress ($W = 20.50$, $p = 0.429$), parental anger ($W = 4.50$, $p = 0.829$), PTSD symptoms ($W = 15.00$, $p = 0.689$), or the risk of child maltreatment ($W = 4.00$, $p = 0.962$), and not significantly lower on parental sense of competence ($W = 8.50$, $p = 0.104$).

Discussion

Because interventions to reduce the risk of child maltreatment generally show small and inconsistent effects, it is important to test ways in which the effects of these can be improved. The present study examined whether the effectiveness of an evidence-based nurse home visitation program to prevent child maltreatment could be improved by adding intervention components that specifically target three risk factors for child maltreatment: perceived stress, parental anger, and PTSD symptoms. Nine mothers were assessed weekly during 36 weeks of the Dutch home visiting program VoorZorg, with intervention components implemented after 9–15 weeks for 6–14 consecutive weeks, leading to three study phases: baseline, treatment, and follow-up.

Overall, this study led to a multitude of analyses and—sometimes conflicting—outcomes. As a group, the nine mothers experienced less anger during the treatment phase and continued to experience less anger during follow-up. No group effects were found for other outcomes. For individual mothers, we found indices of treatment effects in almost half of all comparisons, but the visual analyses found a lack of phase stability in about half of the cases in which an effect was found, which may have weakened the evidence for a treatment effect. If we omit the effects that showed no phase stability, there were three mothers that only showed positive effects (i.e., on perceived stress and parental anger; on parental anger; on parental sense of competence), four mothers that did not show any treatment effects at all, and two mothers that showed both positive and negative treatment effects (i.e., positive on PTSD symptoms and parental sense of competence but negative on parental anger; positive on parental sense of competence but negative on PTSD symptoms and the risk of child maltreatment). This may indicate that the added components were effective for little over half of the participating mothers in at least one outcome, although almost

a quarter also experienced adverse effect in addition to positive effects, which would require further adaptations to the components.

There may be various reasons why, specifically, parental anger, rather than other outcomes, changed. First, the intervention component targeting parental anger was implemented most frequently across and within families (see Table 1). Second, this intervention component was the most elaborate, consisting of various subtopics (i.e., anger, ways to calm down, and anger-evoking attributes), and multiple treatment approaches (i.e., psychoeducation, visual representation, individualized case examples). It might be that this multifaceted approach resulted in an intervention component powerful enough to yield change. Third, compared to the other components, the component targeting anger required less activity from the mothers in between intervention sessions. That is, the stress component asked the mothers to regularly do a relaxation exercise, and the PTSD component asked the mothers with PTSD symptoms to seek professional help for their symptoms. In contrast, the anger component mainly required the mothers to rethink how they interpret difficult behavior in their children and how they can respond to this behavior. Fourth, the stress component may have added to the effectiveness of the anger component; arguably, it would be easier to deal with anger and frustrations in a constructive manner when the mother has adequate options to unwind first, even when this is not through a specific relaxation exercise. However, the mothers in this study reported only limited (variation in) parental anger, which may indicate social desirability or underreporting, and this outcome may be less representative of the actual prevalence of anger in the sample. In addition, the small effect that was found may not even be meaningful in practice, although the fact that we found a significant effect regardless may indicate a strong, consistent effect. On the other hand, on an individual level, there was one mother that showed an increase in parental anger, while two mothers showed an improvement, and the remainder of the mothers showed no clear effect. This could lead to a question whether the minimal positive effect we found for the mothers as a group should justify implementation in clinical practice, when some mothers, even if they are a minority, may be worse off because of it. Alternatively, when looking at this mothers' outcome graph, the negative effect arises from a decreasing trend during the baseline to an increasing trend during treatment and follow-up, both based on a relative outlier, and, given the fact that this mother, generally, hardly showed any anger, this "deterioration" may not be meaningful in practice.

Stress reduced during treatment in only one mother that also showed phase stability; her outcome graph was the textbook example of the anticipated component effect. Further examination showed that this mother reported to use the relaxation exercise more than 2 times per week ever since she received it in the first treatment week. Only one other mother reported weekly use of the relaxation exercise but at a lower frequency per week. Other mothers also reported using the exercise generally once a week, but not every week. This finding suggests that the relaxation exercise might be hard for many mothers to implement, which resulted in a lack of change for all other mothers, but that, for those who manage to use it regularly, it has benefits. To enhance the effects of this intervention component, it may be needed to add motivational techniques or offer more flexibility in types of exercises to support mothers in implementing this technique.

The PTSD screening component was not implemented as often as anticipated (i.e., 6 out of 9 mothers) and hardly led to transferral to treatment, which, in turn, did not lead to changes in PTSD symptoms. That is, the two mothers that did show a decrease in PTSD symptoms did not actually receive the PTSD component, suggesting a possible side effect of the other intervention components. Moreover, even if the mothers would have received the component and would have followed up with EMDR treatment, a reduction in symptoms would arguably have taken longer than we would be able to measure in this study. The outcomes on the individual level—one mother that showed an increase in symptoms and one mother that showed a decrease in symptoms, while the other mothers showed no significant differences—may, therefore, also be due to normal and/or random variation over time. Furthermore, given the risk factors that determine eligibility for the VoorZorg intervention (such as history of violence or abuse), the prevalence of PTSD (symptoms) was less than anticipated with only one mother scoring above the symptomatic threshold. However, this prevalence of 11% (i.e., 1/9) does not seem too far off from the 16–19% postpartum PTSD found in at-risk samples (see, e.g., Grekin & O'Hara 2014; Yildiz et al., 2017). Symptoms in this specific target population may, therefore, not be severe or prevalent enough to warrant specific intervention.

Given the limited effects on the targeted outcomes of perceived stress, parental anger, and PTSD symptoms, it may not be surprising that we, generally, did not see a reduction in risk of child maltreatment during the treatment period or follow-up. Important to note here is that all the mothers received an empirically supported home visiting program known to reduce risk of child maltreatment (Mejdoubi, 2014), and we expected it to do the same for the participants in our study—the added component just did not seem to enhance the effects of this program. Alternatively, we only used four dynamic risk factors to assess changes in the risk of child maltreatment, which may have limited the potential to find an effect. There was, however, one mother that showed an increase in the risk of child maltreatment, but this was also the mother that showed an increase in PTSD symptoms. Perhaps, her trauma-related issues and conditions were related to this increased risk.

The components did affect parental sense of competence, our other secondary outcome, in around a third of the mothers. It might be that the psychoeducation about stress, anger, and trauma that was part of the components strengthened the mothers' sense of doing quite well as parents. In addition, the seemingly most effective component of the three, reducing parental anger, may have led to behavioral changes in the mothers that increased their sense of parental confidence.

This study illustrates the promise of single-case research designs. We were, indeed, able to collect a vast amount of data from the participants in the small Voor-Zorg target population that mainly consists of lower educated mothers. Furthermore, through weekly assessments, we were able to gain insights in not only whether but also when and how changes occurred in the targeted outcomes before, during, and after the treatment phase. However, we also encountered several factors that may limit the usefulness of single-case research in this and future studies. For instance, several of our participants did not show a stable and/or linear outcome pattern per phase, which made it difficult to visually assess or statistically test differences between phases. Although we used protocolled visual analyses with three coders to

correct for this phenomenon, we often found that arguments could be made both in favor of and against signs of a treatment effect in several of the examined phase differences. This made it harder to draw (generalizable) conclusions from the present data. Arguably, the single-case research design may be more appropriate for more concrete outcomes that show a clear linear pattern and less appropriate for psychosocial outcomes such as those used in this study. In addition, psychosocial outcome measures that are better suited for this type of research design should be developed for future research. Alternatively, the single-case research design may be more suitable for ideal research circumstances (i.e., laboratory, efficacy studies) than real clinical practice, because the latter may add too much variation in external influences that obscure the ability to draw reliable conclusions from the single case study results, and this may reduce generalizability.

Although the present study has various strengths, including in-depth analyses of how key risk factors for child maltreatment respond to specific intervention components, some limitations should be noted. First, the treatment effects of the additional intervention components were measured for the full treatment period and for all intervention components together and not separately. While it is likely that effects of the intervention components are strongest for the targeted outcome, it cannot be ruled out that treatment effects are a result of the other intervention components and/or a combination of all components. Component-specific conclusions should, therefore, be interpreted in this light. Second, as Table 1 shows, not all intervention components were implemented as and when planned. A lack of treatment effects in the present study may, therefore, in part, be attributed to the execution of the intervention components, and not the contents of the intervention components. However, for these components to be relevant for clinical practice, they must not only be effective in theory but also feasible in practice. This may not only ask for further development of the components to better align with clinical practice but also for increased efforts to motivate nurses to implement these components. Third, although we set out to randomly assign the participants to multiple baselines, this random assignment to condition was not realized in practice. Even though the actual start of the treatment phase still may seem quite random, non-random factors that influenced the start of the treatment cannot be ruled out, and findings about the effectiveness of the intervention components should be viewed in that light. Fourth, although in line with the single-case research design, the limited number of only nine participants may have limited generalizability of the present outcomes.

Our study has several implications for enhancing the effects of home visiting programs to prevent child maltreatment. First, the component targeting parental anger can be easily implemented and seems to benefit the target population as a group. However, it has yet to be determined how adverse effects on few mothers can be prevented, and, until then, the advantages of this component may not outweigh the disadvantages. Second, for the component targeting stress, the relaxation techniques should be expanded in such a way that it is more feasible for mothers to implement them as part of their daily routines, because this proved essential to have an effect. Third, the effects of screening for PTSD symptoms could not be determined, although this study has shown that the motivation for the use of standardized assessment tools in clinical practice still needs to be improved, and these symptoms may

not be severe or prevalent enough to warrant intervention in the VoorZorg target population.

Declarations

Ethics Approval and Consent to Participate The study was retrospectively registered in the Netherlands Trial Register (NL8651) and approved by the Ethics Review Board of the Faculty of Social and Behavioral Sciences of the University of Amsterdam (2018-CDE-9640).

Conflict of Interest The authors declare no competing interests.

References

Abidin, R. R. (1983). *Parenting Stress Index.* Pediatric Psychology Press.

Ammerman, R. T., Putnam, F. W., Chard, K. M., Stevens, J., & Van Ginkel, J. B. (2012). PTSD in depressed mothers in home visitation. *Psychological Trauma: Theory, Research, Practice and Policy, 4*(2), 186–195. https://doi.org/10.1037/a0023062

Avellar, S. A., & Supplee, L. H. (2013). Effectiveness of home visiting in improving child health and reducing child maltreatment. *Pediatrics, 132*(Supplement 2), S90–S99. https://doi.org/10.1542/peds.2013-1021G

Barker, B., Iles, J. E., & Ramchandani, P. G. (2017). Fathers, fathering and child psychopathology. *Current Opinion in Psychology, 15*, 87–92. https://doi.org/10.1016/j.copsyc.2017.02.015

Beckerman, M., Van Berkel, S. R., Mesman, J., & Alink, L. R. A. (2018). Negative parental attributions mediate associations between risk factors and dysfunctional parenting: A replication and extension. *Child Abuse & Neglect, 81*, 249–258. https://doi.org/10.1016/j.chiabu.2018.05.001

Bigham, E., McDannel, L., Luciano, I., & Salgado-Lopez, G. (2014). Effect of a brief guided imagery on stress. *Biofeedback, 42*(1), 28–35.

De Brock, A. J. L. L., Vermulst, A. A., Gerris, J. R. M., & Abidin, R. R. (1992). *NOSI: Nijmeegse Ouderlijke Stress Index: Handleiding experimentele versie* [NOSI, Nijmegen parenting stress index, Manual experimental version]. Swets en Zeitlinger.

Byiers, B. J., Reichle, J., & Symons, F. J. (2012). Single-subject experimental design for evidence-based practice. *American Journal of Speech-Language Pathology, 21*(4), 397–414. https://doi.org/10.1044/1058-0360(2012/11-0036)

Casillas, K. L., Fauchier, A., Derkash, B. T., & Garrido, E. F. (2016). Implementation of evidence-based home visiting programs aimed at reducing child maltreatment: A meta-analytic review. *Child Abuse & Neglect, 53*, 64–80. https://doi.org/10.1016/j.chiabu.2015.10.009

Choi, J.-K., & Pyun, H.-S. (2014). Nonresident fathers' financial support, informal instrumental support, mothers' parenting, and child development in single-mother families with low income. *Journal of Family Issues, 35*(4), 526–546. https://doi.org/10.1177/0192513X13478403

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385–396. https://doi.org/10.2307/2136404

Cohen, S. & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan, & S. Oskamp (Eds.), *The social psychology of health* (pp. 31–67). Sage.

Darthmouth College Student Wellness Center (2019). *Guided imagery & Visualization: Special place* [Guided relaxation exercise audio recording]. Darthmouth College Student Wellness Center. https://students.dartmouth.edu/wellness-center/sites/students_wellness_center.prod/files/special_place.mp3

De Wit, M., Leijten, P., der Put, Van, Claudia, E., Asscher, J. J., Bouwmeester-Landweer, M., & Deković, M. (2020). Study protocol: Randomized controlled trial of manualized components in home visitation to reduce mothers' risk for child maltreatment. *BMC Public Health, 20*(1), 136. https://doi.org/10.1186/s12889-020-8237-4

Del Vecchio, T., Jablonka, O., DiGiuseppe, R., Notti, J., & David, O. (2017). Psychometric evaluation of the parent anger scale. *Journal of Child and Family Studies, 26*(11), 3013–3025. https://doi.org/10.1007/s10826-017-0824-3

der Put, V., Claudia, E., Bouwmeester-Landweer, M. B. R., Landsmeer-Beker, E. A., Wit, J. M., Dekker, F. W., Kousemaker, N. P. J., & Baartman, H. E. M. (2017). Screening for potential child maltreatment in parents of a newborn baby: The predictive validity of an instrument for early identification of Parents At Risk for child Abuse and Neglect (IPARAN). *Child Abuse & Neglect, 70*, 160–168. https://doi.org/10.1016/j.chiabu.2017.05.016

der Put, V., Claudia, E., Assink, M., Gubbels, J., van Solinge, B., & Noëlle, F. (2018). Identifying effective components of child maltreatment interventions: A meta-analysis. *Clinical Child & Family Psychology Review, 21*(2), 171–202. https://doi.org/10.1007/s10567-017-0250-5

Euser, S., Alink, L. R. A., Stoltenborgh, M., Bakermans-Kranenburg, M., & Van IJzendoorn, M. H. (2015). A gloomy picture: A meta-analysis of randomized controlled trials reveals disappointing effectiveness of programs aiming at preventing child maltreatment. *BMC Public Health, 15*(1), 1068. https://doi.org/10.1186/s12889-015-2387-9

Gavita, O. A., David, D., DiGiuseppe, R., & DelVecchio, T. (2011). The development and initial validation of the parent anger scale. *Procedia - Social and Behavioral Sciences, 30*, 505–511. https://doi.org/10.1016/j.sbspro.2011.10.099

Gilbert, R., Widom, C. S., Browne, K., Fergusson, D., Webb, E., & Janson, S. (2009). Burden and consequences of child maltreatment in high-income countries. *The Lancet, 373*(9657), 68–81. https://doi.org/10.1016/S0140-6736(08)61706-7

Grekin, R., & O'Hara, M. W. (2014). Prevalence and risk factors of postpartum posttraumatic stress disorder: A meta-analysis. *Clinical Psychology Review, 34*(5), 389–401. https://doi.org/10.1016/j.cpr.2014.05.003

Horrevorts, E. M. B., Van Grieken, A., Mieloo, C. L., Hafkamp-De Groen, E., Bannink, R., Bouwmeester-Landweer, M. B. R., Broeren, S., & Raat, H. (2017). Concurrent validity, discriminatory power and feasibility of the instrument for Identification of Parents At Risk for child Abuse and Neglect (IPARAN). *British Medical Journal Open, 7*(8), e016140. https://doi.org/10.1136/bmjopen-2017-016140

Huitema, B. E., & Mckean, J. W. (2000). Design specification issues in time-series intervention models. *Educational and Psychological Measurement, 60*(1), 38–58. https://doi.org/10.1177/00131640021970358

Kazdin, A. E. (2021). Single-case experimental designs: Characteristics, changes, and challenges. *Journal of the Experimental Analysis of Behavior, 115*(1), 56–85. https://doi.org/10.1002/jeab.638

Kock, J., Killian, E., & Bixler, M. (2003). *Anger management toolbox curriculum*. University of Nevada Cooperative Extension Curriculum Materials.

Kratochwill, T. R., Hitchcock, J. H., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2013). Single-case intervention research design standards. *Remedial and Special Education, 34*(1), 26–38. https://doi.org/10.1177/0741932512452794

Kumar, S. A., Franz, M. R., Brock, R. L., & DiLillo, D. (2020). Posttraumatic stress and parenting behaviors: The mediating role of emotion regulation. *Journal of Family Violence, 35*(5), 417–426. https://doi.org/10.1007/s10896-019-00124-5

Lang, A. J., & Stein, M. B. (2005). An abbreviated PTSD checklist for use as a screening instrument in primary care. *Behaviour Research and Therapy, 43*(5), 585–594. https://doi.org/10.1016/j.brat.2004.04.005

Lavi, I., Manor-Binyamini, I., Seibert, E., Katz, L. F., Ozer, E. J., & Gross, J. J. (2019). Broken bonds: A meta-analysis of emotion reactivity and regulation in emotionally maltreating parents. *Child Abuse & Neglect, 88*, 376–388. https://doi.org/10.1016/j.chiabu.2018.11.016

Le, Y., Fredman, S. J., & Feinberg, M. E. (2017). Parenting stress mediates the association between negative affectivity and harsh parenting: A longitudinal dyadic analysis. *Journal of Family Psychology, 31*(6), 679–688. https://doi.org/10.1037/fam0000315

Leijten, P., Weisz, J. R., & Gardner, F. (2021). Research strategies to discern active psychological therapy components: A scoping review. *Clinical Psychological Science, 9*(3), 307–322. https://doi.org/10.1177/2167702620978615

Martorell, G. A., & Bugental, D. B. (2006). Maternal variations in stress reactivity: Implications for harsh parenting practices with very young children. *Journal of Family Psychology, 20*(4), 641–647. https://doi.org/10.1037/0893-3200.20.4.641

Mejdoubi, J., den Heijkant, V., Silvia, C. C. M., Leerdam, V., Frank, J. M., Heymans, M. W., Crijnen, A., & Hirasing, R. A. (2015). The effect of VoorZorg, the Dutch nurse-family partnership, on child maltreatment and development: A randomized controlled trial. *PLoS ONE, 10*(4), e0120182. https://doi.org/10.1371/journal.pone.0120182

Mejdoubi, J. (2014). *The primary prevention of child maltreatment in early life: Study on the effectiveness of VoorZorg* [PhD thesis, VU University]. VU University Research Portal. https://research.vu.nl/en/publications/the-primary-prevention-of-child-maltreatment-in-early-life-study-

Moody, G., Cannings-John, R., Hood, K., Kemp, A., & Robling, M. (2018). Establishing the international prevalence of self-reported child maltreatment: A systematic review by maltreatment type and gender. *BMC Public Health, 18*(1), 1164. https://doi.org/10.1186/s12889-018-6044-y

Naparstek, B. (1994). *Staying well with guided imagery*. Warner Books.

Olds, D. L. (2012). Improving the life chances of vulnerable children and families with prenatal and infancy support of parents: The nurse-family partnership. *Psychosocial Intervention, 21*(2), 129–143. https://doi.org/10.5093/in2012a14

Peterson, C., Florence, C., & Klevens, J. (2018). The economic burden of child maltreatment in the United States, 2015. *Child Abuse & Neglect, 86*, 178–183. https://doi.org/10.1016/j.chiabu.2018.09.018

Pidgeon, A. M., & Sanders, M. R. (2009). Attributions, parental anger and risk of maltreatment. *International Journal of Child Health and Human Development, 2*(1), 57–69.

Pinheiro, J., Bates, D., DebRoy, S., Sarkar, D. & R Core Team. (2021). *_nlme: Linear and nonlinear mixed effects models* (R package version 3.1-152) [Computer software]. https://CRAN.R-project.org/package/nlme

R Core Team (2020). *R: A language and environment for statistical computing* (Version 4.1.2) [Computer software]. R Foundation for Statistical Computing. https://www.R-project.org/

Rodriguez, C. M. (2010). Parent-child aggression: Association with child abuse potential and parenting styles. *Violence and Victims, 25*(6), 728–741. https://doi.org/10.1891/0886-6708.25.6.728

Rodriguez, C. M., & Richardson, M. J. (2007). Stress and anger as contextual factors and preexisting cognitive schemas: Predicting parental child maltreatment risk. *Child Maltreatment, 12*(4), 325–337. https://doi.org/10.1177/1077559507305993

Sanders, M. R., Pidgeon, A. M., Gravestock, F., Connors, M. D., Brown, S., & Young, R. W. (2004). Does parental attributional retraining and anger management enhance the effects of the triple P-positive parenting program with parents at risk of child maltreatment? *Behavior Therapy, 35*(3), 513–535. https://doi.org/10.1016/S0005-7894(04)80030-3

Shapiro, F. (1989a). Efficacy of the eye movement desensitization procedure in the treatment of traumatic memories. *Journal of Traumatic Stress, 2*(2), 199–223. https://doi.org/10.1002/jts.2490020207

Shapiro, F. (1989b). Eye movement desensitization: A new treatment for post-traumatic stress disorder. *Journal of Behavior Therapy and Experimental Psychiatry, 20*(3), 211–217. https://doi.org/10.1016/0005-7916(89)90025-6

Tanious, R., & Onghena, P. (2021). A systematic review of applied single-case research published between 2016 and 2018: Study designs, randomization, data aspects, and data analysis. *Behavior Research Methods, 53*, 1371–1384. https://doi.org/10.3758/s13428-020-01502-4

Van der Stouwe, T., Leijten, P., Zijlstra, B. J. H. , Asscher, J. J., Dekovic, M., & Van der Put, C. E. (2021). *The added value of targeting specific risk factors for child maltreatment within an evidence-based home visitation program: A repeated single-case time series study* [Preregistration analytic plan]. https://doi.org/10.17605/OSF.IO/87MGA

Van Ee, E., Kleber, R. J., & Jongmans, M. J. (2016). Relational patterns between caregivers with PTSD and their nonexposed children: A review. *Trauma, Violence, & Abuse, 17*(2), 186–203. https://doi.org/10.1177/1524838015584355

Vlaeyen, J. W. S., Wicksell, R. K., Simons, L. E., Gentili, C., De, T. K., Tate, R. L., Vohra, S., Punja, S., Linton, S. J., Sniehotta, F. F., & Onghena, P. (2020). From Boulder to Stockholm in 70 years: Single case experimental designs in clinical research. *The Psychological Record, 70*(4), 659–670. https://doi.org/10.1007/s40732-020-00402-5

Wilbert, J., & Lueke, T. (2019). *Scan: Single-case data analyses for single and multiple baseline designs* (R package version 0.40)[Computer software]. https://CRAN.R-project.org/package/scan

Wolfe, K., Barton, E. E., & Meadan, H. (2019). Systematic protocols for the visual analysis of single-case research data. *Behavior Analysis in Practice, 12*(2), 491–502. https://doi.org/10.1007/s40617-019-00336-7

Yildiz, P. D., Ayers, S., & Phillips, L. (2017). The prevalence of posttraumatic stress disorder in pregnancy and after birth: A systematic review and meta-analysis. *Journal of Affective Disorders, 208*, 634–645. https://doi.org/10.1016/j.jad.2016.10.009

Authors and Affiliations

Trudy van der Stouwe[1] · **Patty Leijten[1]** · **Bonne J. H. Zijlstra[1]** · **Jessica J. Asscher[2]** · **Maja Deković[2]** · **Claudia E. van der Put[1]**

[1] Research Institute of Child Development and Education, University of Amsterdam, Amsterdam, The Netherlands

[2] Clinical Child and Family Studies, Utrecht University, Utrecht, The Netherlands