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Randomized controlled trial of the Circle of Security-Intensive intervention for mothers with postpartum depression: maternal unresolved attachment moderates changes in sensitivity

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ABSTRACT

Postpartum depression is related to inadequately sensitive caregiving, putting infants at risk for insecure attachment. Therefore, promoting sensitive maternal caregiving and secure child attachment is particularly important in postpartum depressed mothers and their infants. In this randomized-controlled-trial, we evaluated the efficacy of the Circle of Security-Intensive (COS-I)-intervention in supporting maternal sensitivity and mother-infant-attachment compared to treatment-as-usual (TAU) with unresolved-maternal attachment as a moderator of treatment effect. Eligible mothers with infants ($N=72$) 4-9 months-old were randomly assigned to treatment ($n=36$ dyads). Infant attachment was rated at follow-up (child age 16-18 months) (Strange-Situation-procedure). Maternal sensitivity was measured at baseline and follow-up (Mini-Maternal-Behavior-Q-sort). Maternal-unresolved-attachment was assessed at baseline (Adult-Attachment-Interview). We found no significant differences between treatments in infant attachment nor changes in mothers' sensitivity. However, in COS-I, unresolved-mothers exhibited significantly more change in sensitivity than non-unresolved-mothers, whereas in TAU, the opposite was true. These findings may help to optimize clinical use of COS-I.

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Circle of Security; postpartum depression; child attachment; unresolved attachment; mother-infant treatment

Approximately, 10–20% of all new mothers' experience postpartum depression (PPD) (Howard et al., 2014; O'Hara & Swain, 1996), characterized by intense, extensive, and stable depressive symptoms (Laurent et al., 2018). Sixty-seven percent of mothers with PPD experience an additional comorbid disease (Le Strat, Dubertret, & Le Foll, 2011), mostly anxiety disorders (Austin et al., 2010; Beck, Gable, Sakala, & Declercq, 2011), or underlying personality disorders (Grilo et al., 2010; Morey et al., 2010; Zimmerman,

Rothschild, & Chelminski, 2005), which enhances the risk for chronic courses of PPD, problematic parenting, and negative child outcomes (Field, 2018; Hoffman, Dunn, & Njoroge, 2017; Huntley, Wright, Pickles, Sharp, & Hill, 2017; McLaughlin et al., 2012; Netsi et al., 2018). In order to buffer the negative effects of PPD among the mother, infant, and their relationship, supporting these mothers in their parenting capacities can be essential (Barlow, Bennett, Midgley, Larkin, & Wei, 2015; Guedeney, Guedeney, Wendland, & Burtchen, 2014).

In clinical practice, the treatment of PPD usually includes pharmacotherapy, psychotherapy, counseling, and/or care management, with varying beneficial effects on symptom remission and caregiving behaviors (Brummelte & Galea, 2016; Frieder, Fersh, Hainline, & Deligiannidis, 2019). Treatment is usually aimed at addressing the mother's symptoms, but additional specific interventions for minimizing disturbances of the mother-infant interaction and attachment might be necessary to target the potential effects of PPD on the mother-infant relationship and the infant (Forman et al., 2007; Howard & Challacombe, 2018; Letourneau et al., 2015). Towards this aim, attachment-based interventions can be highly valuable.

Attachment-based interventions are derived from attachment theory and related research on infants and adults. A key aspect of such interventions is that they clearly underscore maternal sensitivity in interactions with the child in order to facilitate the development of secure rather than insecure child attachment; examples of insecure attachment include organized-insecure-avoidant/-ambivalent or disorganized relationships (De Wolff & van IJzendoorn, 1997; Dickerson Peck, 2003; Verhage et al., 2016). By definition, sensitivity is conceptualized as the mother's awareness of her child's feelings and experiences, attempts to accurately interpret the child's signals, and appropriate and timely responses to these signals, all of which can be accessed via observational measures of maternal caregiving behaviors (Ainsworth, 1969).

Adequate sensitivity ensures appropriate and contingent soothing, protecting, co-organizing, and comforting the child (Ainsworth, Blehar, Waters, & Wall, 1978, 2015; Bowlby, 1982, 1988). Inadequate sensitivity, which is frequently observed in mothers with clinical PPD (Bernard, Nissim, Vaccaro, Harris, & Lindhiem, 2018), is characterized by low responsiveness to the infant's signals, low verbal and nonverbal stimulation, and/or highly intrusive or withdrawn behaviors (Beebe et al., 2010; Field, 1994; Murray, Fiori-Cowley, Hooper, & Cooper, 1996).

The primary objective of an attachment-based intervention during infancy and early childhood is to improve maternal sensitivity and promote secure attachment in the child. Therefore, several behavioral and/or insight-oriented interventional approaches exist (for a comprehensive overview, see Steele & Steele, 2018). However, empirical evaluation of the use of these interventions in working with mothers with clinical PPD is limited (Cicchetti, Toth, & Rogosch, 1999; Stein et al., 2018; Tsivos, Calam, Sanders, & Wittkowski, 2015). Some studies have confirmed that group-based therapeutic approaches might be encouraging for mothers who are severely depressed or have psychopathological symptoms, although such evidence is rarely based on randomized controlled trial (RCT) data (Clark, Tluczek, & Brown, 2008; de Camps Meschino, Philipp, Israel, & Vigod, 2016; Mulcahy, Reay, Wilkinson, & Owen, 2010; Muzik et al., 2015). In the present study, the effectiveness of the Circle of Security-Intensive intervention was evaluated for the first time in mothers with PPD and their infants using an RCT framework.

The Circle of Security-Intensive (COS-I) intervention (Powell, Cooper, Hoffman, & Marvin, 2014; Woodhouse, Powell, Cooper, Hoffman, & Cassidy, 2018) is founded on the

principles of attachment theory and empirically derived knowledge. Conducted in a 20-session group format, the COS-I intervention allows for an individualized procedure through the formulation of a dyadic-specific treatment protocol for each mother-infant pair prior to the intervention. Each treatment protocol is based on videotaped interaction scenes (in the present study: free-play, diaper changing, reading a book together) for systematic video analysis within the group to address the core difficulties (termed “linchpin struggle”) of each mother-infant dyad with regard to the attachment and autonomy needs and signals of the child.

Recently, the efficacy of the Circle of Security (COS) intervention, applied in different versions (e.g. group vs. individual format), was examined in a meta-analysis including 10 COS intervention trials (Yaholkoski, Hurl, & Theule, 2016). Six of the included studies offered data using a pre- and post-intervention design and four studies using an intervention-control group design. The results showed a medium effect size of Hedges $g = 0.65$ ($p = .003$; $k = 4$) for efficacy of the COS intervention in enhancing the child’s secure vs. insecure attachment amongst a total of 254 parents. However, there was no significant effect observed for improving disorganized child attachment amongst a total of 242 parents. Further analyses indicated a medium effect size of $g = 0.60$ ($p = .012$, $k = 4$) for improvement in the quality of caregiving, a large effect size of $g = 0.98$ ($p < .001$, $k = 2$) for increased parental self-efficacy, and a medium effect of $g = 0.53$ ($p < .001$, $k = 3$) for a reduction in parental depression (Yaholkoski et al., 2016). However, lack of a control group, random assignment, small sample sizes, and attrition limit confidence in the results of the meta-analysis.

Furthermore, factors such as the mother’s attachment status might affect the effectiveness of the COS-I intervention. Psychotherapy research has shown that adult attachment might moderate outcomes of treatment for a healthy psychological status. Recently, a meta-analysis revealed that adults with low attachment security may benefit the most from therapy that focuses on interpersonal interactions and close relationships (Levy, Kivity, Johnson, & Gooch, 2018). Others have suggested that disorganized attachment might limit treatment success, perhaps due to difficulties in relying on or complying with the therapist (Adams, Wrath, & Meng, 2018; Bick, Dozier, & Moore, 2012; Bucci, Roberts, Danquah, & Berry, 2015; Duggan, Berlin, Cassidy, Burrell, & Tandon, 2009; Moran, Pederson, & Krupka, 2005). Disorganized attachment assessed using the Adult Attachment Interview (AAI; George, Kaplan, & Main, 1984; Main, Goldwyn, & Hesse, 2003; Steele & Steele, 2008), are related to adverse childhood experiences of unresolved loss, as well as physical or sexual abuse. Unresolved attachment can be of particular interest when the effectiveness of the COS-I intervention in targeting maternal sensitivity and the mother-infant attachment relationship is analyzed, considering that it has frequently been found to be associated with postpartum symptomatology, poor sensitivity, and/or insecure or disorganized attachment in the child (Atkinson et al., 2005; Choi et al., 2017; Dagan, Facompre, & Bernard, 2018; De Wolff & van IJzendoorn, 1997; Grekin, Brock, & O’Hara, 2017; Robakis et al., 2016; Verhage et al., 2016).

The objective of the current study was to test the efficacy of the COS-I intervention for promoting infant attachment and maternal sensitivity in mothers with PPD. Additionally, the study explored whether maternal unresolved attachment status moderated the effectiveness of the COS-I intervention. Because of ethical concerns associated with providing the mother-infant pair with no treatment or having a waitlist within the trial, treatment as usual (TAU) was considered as the most appropriate control albeit also an active comparator (Gold et al., 2017). At baseline, it was not established how effective TAU

would be within this trial. As a primary hypothesis, it was assumed that the COS-I intervention would lead to more favorable results than would the TAU as indexed by primary outcomes in rates of infant attachment: security vs. insecurity and organization vs. disorganization, as measured at follow-up. Furthermore, regarding secondary outcomes, improved levels of maternal sensitivity versus baseline at follow-up were considered for the COS-I intervention as compared to TAU. Additionally, it was hypothesized that changes in sensitivity would be moderated by the mother's unresolved (U) attachment, with greater improvement in sensitivity in non-U-mothers than in U-mothers.

Method

Recruitment

This study was conducted at the Department of Child and Adolescent Psychiatry, Psychotherapy and Psychosomatics at the University Medical Center of Hamburg-Eppendorf, Germany. Recruitment, baseline assessment, treatment, and follow-up assessment took place from January 2010 to April 2014. An a priori power analysis with a power of 80% and a p -value $< .05$ revealed a required sample size of $N = 80$ dyads with a medium effect size ($W = 0.3$) for comparing COS-I intervention and TAU on child attachment (secure vs. insecure-avoidant, insecure-resistant, disorganized) as the primary outcome. As previously described by Ramsauer et al. (2014), eligible mothers with infants participated in the baseline assessment after both custodial parents had been informed and had given consent to participate in this study. The follow-up-assessment took place when the child was aged 16–18 months. Figure 1 shows the flow of participants from recruitment through to follow-up.

Participants

The inclusion criteria were: infant age of four to nine months, mothers who were fluent speakers of the German language and had a DSM-IV diagnosis of depression. The exclusion criteria were: mothers with a DSM-IV diagnosis of psychosis, primary substance abuse, intellectual impairments ($IQ < 80$), and/or acute psychiatric crisis. The entire trial received ethical approval from the local ethics committee of the Medical Board of Hamburg, Germany in August 2009 (reference number PV3269).

Seventy-two mothers with infants participated in the study through random assignment after initial assessment ($n = 36$ dyads; TAU and COS-I intervention, respectively, see Figure 1). At follow-up, 31 mother-infant dyads from the TAU group and 34 mother-infant dyads from the COS-I intervention group completed the post-assessment, which included the laboratory assessment of infant attachment, and the mother's sensitivity rating was taken again. In the COS-I intervention group, two (5.5%) mothers dropped out during the COS-I protocol: one mother after session two because her child was placed in foster care and one mother after session nine because of lack of motivation for treatment. In the TAU group, five (13.8%) mothers refused to participate at follow-up and to complete the post-assessment. The mothers who dropped out did not differ from those mothers who completed post-assessment related to age ($M = 30.0$, $SD = 5.23$ vs. $M = 32.6$, $SD = 5.38$, $t(70) = 1.196$, $p = .236$) or education (number of school years; $M = 10.9$, $SD = 1.46$ vs. $M = 11.7$, $SD = 1.54$, $t(70) = 1.441$, $p = .154$).

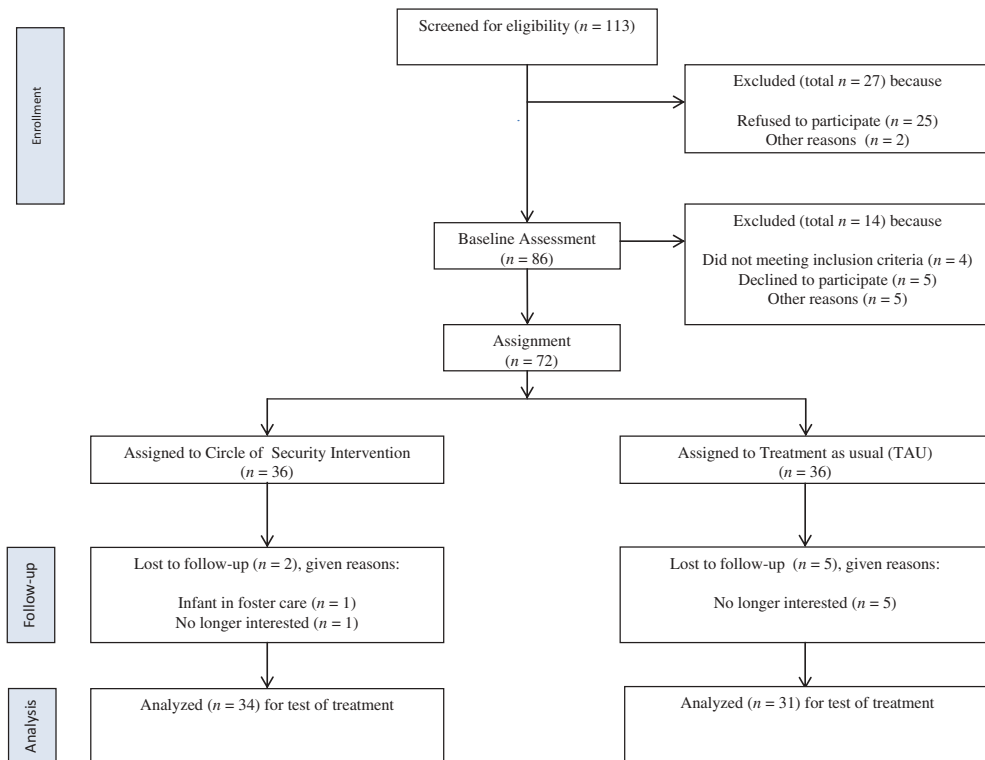


Figure 1. Flow of patients through study.

Procedures

In this study, mothers with infants responded to questionnaires to assess socio-demographics and to verify clinical data at baseline and follow-up. Two trained research assistants administered the Structured Clinical Interview for DSM-IV Axis-I and Axis-II psychopathology (SCID-I and -II) to the mothers at baseline (Wittchen, Wunderlich, Gruschwitz, & Zaudig, 1997). The mother and infant were invited to the video laboratory to record the interaction scenes for sensitivity rating at baseline (5-minutes of free-play and 5-minutes of changing diapers). Baseline assessment took place prior to randomization. At follow-up, mothers and their children participated in the Strange Situation procedure and in two interaction scenes again for sensitivity rating (5-minutes of free-play and 5-minutes of book sharing). Questions about the mothers' treatment history between pre- and post-assessment were asked. All mothers had access to adult psychiatric treatment, adult psychotherapy, and psychosocial services outside of the trial.

Description of intervention

Circle of Security-Intensive (COS-I) intervention

The COS-I intervention consisted of 20 group sessions, once a week, for a duration of 90 minutes. A COS-I intervention group began once a group of six eligible mothers with infants had been randomized to the COS-I intervention condition. During waiting time,

regular phone calls were offered, and outpatient appointments were scheduled as needed. Each group was facilitated by two trained COS-I intervention therapists (principle investigator, female psychologist). The infants were not present during group sessions, but childcare was provided as needed.

As guided by the treatment manual, COS-I intervention was divided into three phases. In Phase I, theoretical and empirical findings about attachment and human development were presented through video material introduced by the COS DVD (Version 5.0; Cooper, Hoffman, & Powell) and handouts, and the therapeutic goals for each mother were organized. Video-analysis of Phase I started in group sessions 3 to 8, with one mother's positive "underused" capacities on the Circle of Security graphic being shown and discussed in each session. The "shark music" concept was introduced in session 9. It is aimed at promoting an insight-oriented shift in the mother, towards her own uncomfortable, negative, or threatening emotions (procedural) or cognitions that can be re-actualized in the parent through certain attachment and/or autonomy needs of the child visualized around the Circle graphic. The self-reflective and dialectic process among the six mothers in the group deepened and individualized in sessions 10 to 15 through video analysis of specific segments, leading mothers to their individual "linchpin struggle." Session 16 was used for theory and discussion. At that time, we produced a new videotape of each mother and infant in a 5-minute play session and a 3-minute separation and reunion episode, in order to show them positive changes, underused capacities and/or persistent difficulties referring to the Circle in the following sessions. Group-sessions 17–19 included video-analyses of two mothers per session. Session 20 was used for processing the termination of therapy. The mothers were then awarded a COS-I parenting certificate. Six COS-I intervention groups comprised of 36 mothers were completed. Weekly supervision by Bert Powell, one of the developers of COS-I intervention, in addition to the use of the manual, assured treatment adherence and integrity in this study.

Treatment as usual (TAU)

TAU involved case management services and occasional dyadic mother-infant psychotherapy by a child psychiatrist and a child psychologist, who were unfamiliar with the COS-I intervention. Both followed a theoretical blend of supportive, psychodynamic, and/or behaviorally oriented work with varying foci on mother, infant, or interaction between them. Sometimes the father was also involved. A normal outpatient treatment session typically lasted 50 minutes. The mother-infant treatment varied according to the specific needs and demands of each mother-infant-dyad, and the mother completed treatment. The therapists documented TAU routinely in the electronic documentation system of the clinic (i.e. time, duration, and course of treatment). Psycho-dynamically oriented group supervision was regularly offered to the therapists once a month for 90 minutes, and individual supervision was offered as needed.

Measures

Maternal psychopathology

In order to classify the mother's diagnosis at baseline, trained researchers administered the German version of the Structured Clinical Interview for DSM-IV (SCID-I, SCID-II; Fydrich,

Renneberg, Schmitz, & Wittchen, 1997; Wittchen et al., 1997). The SCID-I for Axis-I diagnosis and the SCID-II for Axis-II diagnosis are a well-established method with satisfactory reliability and validity data (Gorman et al., 2004; Lobbestael, Leurgans, & Arntz, 2011; Maffei et al., 1997).

The Beck Depression Inventory-I (BDI-I; Beck & Steer, 1987; Beck, Steer, & Garbin, 1988) was used to verify maternal depressive symptoms. The BDI-I is a 21-item self-report questionnaire. Each item is scaled from zero to three and summed up to a global score ranging from 0–63, indicating the presence or absence and severity of depressive feelings or behaviors in the past week. Clinical cut-offs indicate “no to minimal” (0–9), “mild to moderate” (10–29), and “clinically relevant” depressive symptoms (> 30). Meta-analyses of the psychometric properties of the BDI-I have found a mean internal consistency of Cronbach’s $\alpha = .86$ for psychiatric patients. In this study, internal consistency was found to be high as well (Cronbach’s $\alpha = .91$).

Psychopathology was assessed on nine dimensions with the Symptom Checklist-90-Revised (SCL-90-R; Derogatis, 1977; Franke, 2002). The mother was asked to rate the severity of her experiences over the past seven days on a five-point Likert scale ranging from 0 (*not at all*) to 4 (*extremely severe*). The Global Severity Index (GSI) as the mean sum score of the 90 items was used to screen for global maternal psychopathology. T-transformed GSI scores above 60 are considered as being indicative of mental strain (Franke, 2002). Internal consistency (Cronbach’s α) of the subscales for psychotherapy inpatients was reported to range from $r_{\min} = 0.74$ to $r_{\max} = 0.88$, indicating satisfactory reliability (Franke, 2002). For the GSI score, internal consistency for the clinical norm samples was found to be excellent (Cronbach’s $\alpha = .97$; Franke, 2002). Adequate to excellent construct and convergent validity for the SCL-90-R scales have also been documented (Franke, 2002). In this study, internal consistency (Cronbach’s α) for the GSI score was .96.

Child attachment

Child attachment behavior to his or her mother at follow-up, the primary outcome measure in this study, was assessed by means of the Strange Situation procedure (SSP; Ainsworth et al., 1978). The SSP could not be assessed at baseline because of age constraints in relation to inapplicability of this tool to children below 12 months. The SSP follows a standardized protocol of eight 3-minute episodes of separation and reunion with the mother, designed to induce mild stress in the child and to activate attachment behavior. During the first separation, the child is left alone with a female stranger, and in the second separation, the child is left alone in the room. For infant attachment quality, the Ainsworth et al. rating procedure was used to classify the three organized patterns of attachment, i.e. secure (B), insecure-avoidant (A), and insecure-ambivalent (C) (Ainsworth et al., 1978). Disorganized/disoriented (D) infant attachment was rated on a nine-point scale through the Main and Solomon coding system (Main & Solomon, 1990).

The SSPs were coded by one principle coder (Fabienne Becker-Stoll). For inter-rater-reliability, a second rater (Anne Tharner) coded 15 (23%) out of 65 videotapes. Both coders were reliable ABCD coders, trained at the University of Minnesota by A. Sroufe and E. Carlson, and blind to treatment allocation. They agreed on ABCD classification for 12 of 15 infants (80%, $\kappa = .65$), for classification in secure vs. insecure groups for 13 of 15 infants (87%, $\kappa = .67$), and for classification in organized vs. disorganized groups for 14 of 15 infants (93.3%, $\kappa = .76$).

Maternal sensitivity

Maternal sensitivity, the secondary outcome measure in this study, was coded at baseline and follow-up according to the Mini-Maternal Behavior Q-Sort for Video Coding (Mini-MBQS-V; Moran, 2009a), a short (25-item) version of the Maternal Behavior Q-Set (MBQS; Moran, 2009b; Pederson, Moran, & Bento, 2009; Pederson et al., 1990). The mother's behavior is described by sorting the items based on the similarity between the description of the item and the observed behavior into five bins (*very like*, *like*, *neither*, *unlike*, and *very unlike mom*). The sensitivity score is calculated by the correlation between the descriptive sort and a criterion sort of a prototypically sensitive mother. Correlation scores vary from -1.0 (least sensitive) to 1.0 (prototypically sensitive). The Mini-MBQS-V was validated by Tarabulsy et al. (2009). Reliability was confirmed in 10-minute-mother-child play interactions when the child was aged 10 months ($r = .94$; $p < .0001$), and the convergent validity with the 90-item MBQS completed at 6 months ($r = .35$; Tarabulsy et al., 2009, p. 134). For the purpose of the present study, maternal sensitivity was coded by three independent raters (trained psychology students), unaware of any information about the mothers from the other measures. Video recording included five-minute free-play episodes at both measurement times. Diaper changing was included at baseline only, while book sharing was included at follow-up only. Raters completed intensive Mini-MBQS-V training using the manual developed by the authors (Pederson et al., 2009). For interrater reliability, 35 video sequences were independently rated. According to ICC classification, interrater reliability was excellent ($ICC = .877$, $p < .001$, Cronbach's $\alpha = .955$, $p < .001$).

Maternal unresolved attachment representation

Maternal unresolved attachment (U-status) as opposed to non-U-status at baseline was assessed by means of the Adult Attachment Interview and its scoring and classification system (AAI; George et al., 1984; Hesse, 1996; Main et al., 2003). The interviewees (mothers), therefore, were asked to respond to 20 questions capturing childhood experiences with primary caregivers, thoughts and feelings about how these experiences might influence their own personality as an adult, why they behaved as they did as a child, and the nature of the current relationship towards their caregivers (Main, Hesse, & Goldwyn, 2008). Several questions ask about traumatic experiences related to major loss or death of loved ones, and physical or sexual abuse, or overwhelming frightening experiences throughout life. Scoring is based on the verbatim transcript of each interview, considering content, linguistic focus, language use and coherence of the responses, and the cooperation with the interviewer. Based on the discourse responses and the interview as a whole, one of four adult attachment categories is assigned. These are secure-autonomous (F), insecure-preoccupied (E), and insecure-dismissing (Ds) as organized (non-U) attachment, and unresolved (U) or cannot classify (CC) as unresolved/disorganized (hereafter: unresolved, U) attachment classifications. The CC classification is identified via either contradictions or anomalies that occur throughout the AAI transcript, forcing placement into two opposing insecure categories, or by low coherency of transcripts. The U category is indicated by "lapses in the monitoring of reasoning or discourse during discussion of loss or other potentially traumatic experiences" (Main et al., 2008, p. 61), representing temporary breakdowns or lapses in the interviewee's discourse strategy.

Two raters (Iris Reiner, Tobias Nolte), who had passed the four-way Main and Hesse reliability test procedure, and were blind to treatment allocation, independently coded the AAI interviews. For interrater-reliability testing, 19 randomly selected AAI interviews were classified twice with 78% agreement ($\kappa = 0.38$) for U- and non-U-classification.

Data analysis

Data were analyzed using the Statistical Package for Social Science (IBM SPSS Statistics, Version 18). For analyses on the primary outcome measure of the study, the Chi-squared (χ^2) test of independence was performed. Initial group differences on the MBQS-V-sensitivity-scores were examined with *t*-tests. As the scoring results of the Mini-MBQS-V are correlative in nature, these correlations were Fisher-Z-transformed to allow further statistical analyses. Positive sensitivity difference terms (post-score minus pre-score) indicated higher treatment gains. For testing of differences in maternal sensitivity, repeated measures analysis of variance (2x2 ANOVA) was used with Time (baseline and follow-up) and Group (TAU vs. COS-I) as between factors, to examine the Time x Group interaction effect. A potential interaction effect between maternal unresolved attachment (U-status), as opposed to organized (non-U) attachment, and Group (TAU vs. COS-I intervention) on changes in maternal sensitivity was examined in a 2×2 ANOVA with between subject factors. A small effect size was indexed by partial (eta squared values) $\eta^2 < .01$, a medium effect size by partial $\eta^2 < .06$, and a large effect size by partial $\eta^2 < .14$ (Richardson, 2011).

Results

Descriptive statistics

Sample characteristics are described in Table 1. The TAU and COS-I groups were comparable with regard to mean age, infant gender, maternal education in years, status of living with a partner, and mean BDI-I and SCL-90-R-GSI scores. Most mothers showed clinically relevant depressive symptoms (BDI scores of 18–29; Hautzinger, Bailer, Worall, & Keller, 1994), and psychopathological symptoms (SCL-90-R, $56.61 > T_{GSI} < 63.59$; Franke, 2002, p. 29). With the exception of one African mother, all participants were Caucasian. Overall, the sample represented an urban population that ranged from lower to upper middle class.

Mothers in the TAU and COS-I intervention group were similar in terms of their DSM-IV Axis-I disorders and comorbidity rates. Specifically, the mothers in both groups (100%) met diagnostic criteria for DSM-IV depressive disorders (major depression, dysthymia, or adjustment disorder with depressive symptoms). With respect to comorbidity, 23 (65.7%) mothers in the TAU group and 21 (58.3%) mothers in the COS-I intervention group met criteria for anxiety disorders. Eight (22.9%) TAU-mothers and 13 (36.1%) COS-I-mothers met criteria for substance-related disorders. Nine (25.7%) TAU-mothers and 14 (38.9%) COS-I-mothers met criteria for eating disorders. Two (5.7%) TAU-mothers and two (5.6%) COS-I-mothers suffered from somatoform disorders. Ten (28.6%) TAU-mothers and eight (22.2%) COS-I-mothers met diagnostic criteria of one Axis-I disorder, and 25 (71.4%) TAU-mothers and 28 (77.8%) COS-I-mothers met criteria for two or more Axis-I disorders at the time of baseline assessment. In addition, 19 (52.8%) TAU-mothers and 25 (69.4%) COS-I-mothers were diagnosed with an

Table 1. Sample characteristics and maternal psychological functioning at baseline between the TAU and the COS-I treatment groups.

	TAU (<i>n</i> = 36)		COS-I (<i>n</i> = 36)		<i>t</i>	<i>df</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Maternal age (years)	31.63	4.86	32.79	5.85	-1.05	70	.297
Infant age (months)	6.33	2.75	6.03	2.63	0.48	70	.632
Maternal education (years)	11.75	1.38	11.56	1.71	0.53	66.96	.598
	<i>f</i>	%	<i>f</i>	%	χ^2	<i>df</i>	<i>p</i>
Infant male	19	52.8	21	58.3	0.23	1	.635
Living status with partner	31	86.1	30	83.3	0.11	1	.743
Marital status ^b							
Never married	20	57.1	21	58.3	1.80 ^a		.557
Married	13	37.1	15	41.7			
Divorced	2	5.7	0	0.0			
Birth order ^b							
Firstborn	28	80.0	26	72.2	0.59	1	.443
Second or third born	7	20.0	10	27.8			
Household income (€ per month) ^a							
< 1500	7	20.0	7	20.6	7.03	2	.030*
1500–3000	23	65.7	13	38.2			
> 3000	5	14.3	14	41.2			
	<i>M</i> ^b	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
BDI-I Total Score	21.04	11.13	18.50	9.62	1.03	69	.306
SCL-90-R GSI Score	60.77	8.38	59.44	10.4	0.19	58	.850

^a Two cells (33.3%) have an expected frequency lower than five. The minimal expected frequency is .99. Fisher's exact test.

^b *n* = 35. TAU = Treatment as usual; COS-I = Circle of Security-Intensive; BDI-I = Beck Depression Inventory; SCL-90-R = Symptom Checklist-90-Revised; GSI = Global severity Index.

Axis-II personality disorder (PD). Specifically, nine (25%) mothers in the TAU and COS-I intervention groups were diagnosed with borderline PD, and ten (27.8%) TAU-mothers and 13 (36.1%) COS-I-mothers were diagnosed with avoidant, dependent, or obsessive compulsive PD. Two (5.5%) COS-I-mothers were diagnosed with a paranoid PD and one (2.8%) with a schizoid PD. The group differences on the respective diagnostic variables were not significant.

Treatment history

Ten (27.8%) out of 36 TAU-mothers compared to five (13.8%) out of 36 COS-I-mothers had attended mother-infant day treatment at the Department of Child and Adolescent Psychiatry prior to TAU or COS-I intervention. The number of treatment days did not differ significantly between the TAU group (*M* = 26.7, *SD* = 34.85) and the COS-I intervention group (*M* = 20.4, *SD* = 34.77; *t*(70) = 0.62, *p* = .540).

In the TAU group (*N* = 36), five (13.9%) mothers refused to take part in the follow-up-assessment. Of the 31 TAU-mothers willing to participate at follow-up, 25 (80.7%) completed the questionnaire about treatment history. The duration of TAU consisted on average of 7.64 (*SD* = 4.78) mother-infant sessions once per week or at longer intervals. Eleven (44%) TAU-mothers reported taking medication. Specifically, 10 (90%) took antidepressants and 4 (36%) took atypical neuroleptics. Eighteen (72%) TAU-mothers were treated psychotherapeutically outside of the trial. Four (16%) TAU-mothers reported having been admitted to adult psychiatric inpatient treatment between pre- and post-assessment.

Across the six COS-I intervention groups ($N = 36$), two (5.6%) mothers dropped-out. The mothers participated on average in 19 ($SD = 6$) group sessions. Thirty-two (94%) COS-I-mothers completed the questionnaire about treatment history between baseline and follow-up. Sixteen (50%) COS-I-mothers reported taking medication. In particular, 11 (69%) took antidepressants, one mother (6%) a benzodiazepine, and four mothers (25%) atypical neuroleptics. Twenty (62.5%) COS-I-mothers reported external psychotherapeutic treatment. Three (9.4%) mothers reported adult psychiatric inpatient treatment. Mean time (in days) between the end of treatment and follow-up assessment was 161 ($SD = 168$) days in the TAU group and 105 ($SD = 80$) days in the COS-I intervention group ($t(33.7) = 1.57, p = .126$).

Intervention effects

Infant attachment

The distribution of infant attachment classification based on the SSP for each treatment group is shown in Table 2. Among the COS-I intervention group, one infant was rated as “cannot classify” (NTC) and was not considered in any further statistical analyses in order to obtain a clearer measure of disorganization (Granqvist et al., 2016). The majority of the infants in both treatment groups were rated as securely attached (TAU, 58.1%; COS-I intervention, 61.8%). Six (19.4%) infants in the TAU group and seven (20.6%) infants in the COS-I intervention group were rated as disorganized attached. Thus, no significant overall treatment group differences in rates of infant attachment security and disorganization were found at follow-up. These results do not support our primary research hypothesis that anticipated significantly higher rates of securely or organized attached infants at follow-up after COS-I treatment compared to infants in the TAU group.

Maternal sensitivity

At baseline, the mean level for maternal sensitivity during free-play for the TAU group ($n = 30$) was $M = 0.55$ ($SD = 0.41$), which was the same as in the COS-I intervention group ($n = 31$; $M = 0.55$; $SD = 0.41$). At baseline, scores for diaper changing were $M = 0.74$ ($SD = 0.24$) in the TAU group ($n = 30$) versus $M = 0.68$ ($SD = 0.33$) in the COS-I intervention group ($n = 31$), $t(59) = -.915, p = .364$. Since no significant differences between the TAU- and COS-I-intervention groups at baseline were found, maternal sensitivity was not used as a covariable in further analysis. At follow-up, mean sensitivity during free-play for the

Table 2. Infant attachment classification at follow-up in the TAU and COS-I intervention groups.

		TAU ($n = 31$)		COS-I ($n = 34$)		χ^2	df	P	w
		N	%	N	%				
Attachment classification	avoidant (A)	5	16.1	4	11.8	-	-	-	
	secure (B)	18	58.1	21	61.8				
	ambivalent (C)	2	6.5	1	2.9				
	disorganized (D)	6	19.4	7	20.6				
	cannot classify (CC)	0	0.0	1	2.9				
insecure vs. secure	insecure (ACD)	13	41.9	12	36.4	.208	1	.648	.10
	secure (B)	18	58.1	21	63.6				
disorganized vs. organized	disorganized (D)	6	19.4	7	21.2	.034	1	.854	.12
	organized (ABC)	25	80.6	26	78.8				

TAU = Treatment as usual; COS-I = Circle of Security-Intensive intervention.

Table 3. Results of 2×2 ANOVA for changes in maternal sensitivity.

	Source	$F(1/59)$	Sig. (2-sided)	Partial η^2
Free-Play	Time	23.882	.000	.288
	Group	.017	.898	.000
	Time x Group	.034	.854	.001
Diaper/Book	Time	7.315	.009	.110
	Group	1.861	.178	.031
	Time x Group	.003	.956	.000

2×2 ANOVA. Group: TAU = Treatment as usual vs. COS-I = Circle of Security-Intensive intervention. *F*-Tests: Main Effects of Time, Group and Interaction between Time and Group; $df = 1$; $df_{\text{Error}} = 59$; small effect partial $\eta^2 = .01$, medium effect partial $\eta^2 = .06$; large effect partial $\eta^2 = .14$.

TAU group ($n = 30$) was 0.83 ($SD = 0.14$) versus 0.81 in the COS-I intervention group ($n = 31$; $SD = 0.16$). With respect to book sharing, the TAU group ($n = 30$) score was 0.84 ($SD = 0.14$) versus 0.78 in the COS-I intervention group ($n = 31$; $SD = 0.19$). With similar increases in average changes in maternal sensitivity, there were no statistical differences of treatment effects between TAU and COS-I intervention groups on changes in maternal sensitivity across time (see Table 3).

Unresolved attachment as a moderator of treatment effect on maternal sensitivity

At baseline, 10 (32.3%) mothers in the TAU group ($n = 31$) and seven (22.6%) mothers in the COS-I intervention group ($n = 33$) were characterized by unresolved attachment (U-status). Regarding free-play, mean changes in sensitivity of the TAU group were 0.17 ($SD = 0.46$) for U-mothers and 0.31 for non-U-mothers. In the COS-I intervention group, changes were 0.63 ($SD = 0.39$) for U-mothers and 0.17 ($SD = .33$) for non-U-mothers. The 2×2 ANOVA with between subject factors indicated no significant main effects of Group ($F(1, 64) = 1.81, p = .184$, partial $\eta^2 = .029$) and U-status ($F(1, 64) = 1.92, p = .171$, partial $\eta^2 = .031$). However, a significant Group x U-status interaction effect on changes in maternal sensitivity ($F(1, 64) = 1.09, p = .012$, partial $\eta^2 = .100$) was found. The effect of group (TAU/COS-I intervention) on changes in

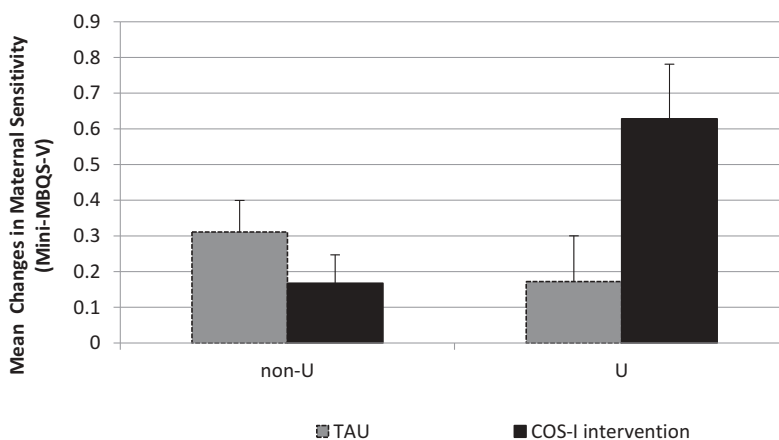


Figure 2. Results of a 2×2 ANOVA with between subject factors between maternal unresolved attachment (U-status), as opposed to organized attachment (non-U), and treatment group (TAU vs. COS-I intervention) on changes in maternal sensitivity.

maternal sensitivity was determined by the presence of unresolved attachment. For the TAU group, U-mothers showed lower levels of changes in sensitivity than non-U-mothers. For the COS-I intervention group, U-mothers exhibited higher levels of changes in sensitivity than non-U-mothers (see Figure 2).

Regarding diaper changing scores at baseline and book sharing scores at follow-up, mean changes in sensitivity of the TAU group were 0.14 ($SD = 0.34$) for U-mothers ($n = 10$) and 0.08 ($SD = 0.27$) for non-U-mothers ($n = 20$), compared to 0.32 in the COS-I intervention group ($SD = 0.29$) for U-mothers ($n = 8$) and 0.06 ($SD = 0.28$) for non-U-mothers ($n = 25$). The 2×2 ANOVA with between subject factors indicated no significant main effects of Group ($F(1, 63) = 1.00, p = .321$, partial $\eta^2 = .017$) and U-status ($F(1, 63) = 3.83, p = .055$, partial $\eta^2 = .061$), and no significant Group \times U-status interaction effect ($F(1, 63) = 1.41, p = .240$, partial $\eta^2 = .023$).

Discussion

This is the first clinically informed RCT of the COS-I intervention involving mothers from primary care referral pathways with PPD and their infants, and which considered the mothers' unresolved attachment status as a moderator of treatment changes. As a control condition, established mother-infant outpatient treatment (TAU) was used. The outcomes of this standard treatment were unknown prior to this trial. Some mothers received additional interventions available outside of the trial context (e.g. pharmacotherapy, social support, individual psychotherapy). Through randomization, the treatment groups (TAU, COS-I intervention) did not differ in sociodemographic aspects, psychological symptoms, diagnosis, and comorbidity rates prior to intervention, except for household income, which was significantly higher in the COS-I intervention than the TAU group.

We did not find any significant benefit of COS-I intervention against TAU for infant attachment security or organization at follow-up, or in changes in maternal sensitivity between baseline and follow-up: the majority of infants were securely attached in both groups, and both groups improved significantly in terms of maternal sensitivity. Mean sensitivity at baseline was lower in free-play than diaper changing scenarios, and closer to initial assessments including at stress-induction ($M = 0.62$; Krink, Muehlhan, Romer, Luyten, & Ramsauer, 2018; $M = 0.47$; Pereira et al., 2012). Moreover, mothers reporting higher levels of depressive symptoms showed lower sensitivity during free-play ($r = -.27^*$; COS-I intervention: $r = -.36^*$; TAU: $r = -.21$; * denotes $p < 0.05$). At follow-up, the level of sensitivity was similar to that found in non-clinical populations (e.g. $M = 0.66$ – 0.77 ; Atkinson et al., 2005; $M = 0.71$; Behrens, Parker, & Haltigan, 2011; $M = 0.73$; Pederson et al., 1990), and independent of depression. Contrary to our assumption, the mothers' sensitivity at the beginning of the study did not reflect the risk situation of clinical PPD, which clearly limited the possibility of observing intervention effects. One reason could be that the risk nature of the symptoms may have been compensated by higher levels of socioeconomic status of this urban sample. Another possible explanation is that there may be a sort of "attachment resilience", whereby parents who are at risk do not necessarily exhibit risk in relation to their ability to react appropriately to their infants' needs and promote secure attachment.

Overall, the results are in contrast to our primary research hypothesis that COS-I intervention would lead to higher rates of securely attached infants than would TAU,

given that COS-I intervention specifically targets parental sensitivity and children's attachment security, whereas TAU as used in the current study did not explicitly target these areas. These findings indicate that TAU, as a dyadic mother-infant treatment approach, and COS-I, as a parenting group intervention, were similarly effective in fostering maternal sensitivity and infant attachment security. This is supported by the finding that following the intervention, the distribution of infant attachment classification among our clinical sample was comparable to that found in low-risk non-clinical normative Western populations, and divergent from those obtained in at-risk samples with maternal depression. These findings were indeed meta-analytically established by van IJzendoorn, Schuengel, and Bakermans-Kranenburg (1999) wherein the proportions of infant security in the COS-I intervention group (61.8%) and TAU group (58.1%) were similar to those of normative samples (51%) and higher than those in maternal depression samples (41%). Furthermore, regarding infant's disorganized attachment, the proportion in the COS-I intervention group (21.2%) and TAU group (19.4%), were similar to those of normative samples (18.5%) and maternal depression samples (20.9%; van IJzendoorn et al., 1999). However, our finding of a non-significant benefit of COS-I intervention on infant attachment classification might be due to insufficient statistical power because of the small sample size (type II error), despite randomization.

The non-significant interaction effect of COS-I intervention, as compared to TAU, on maternal changes in sensitivity between baseline and follow-up during free-play, as well as diaper changing at baseline and book sharing at follow-up, can also be explained by the fact that COS-I intervention and TAU were two active interventions administered by skilled clinicians and tested in a small trial (Weisz, Jensen-Doss, & Hawley, 2006).

However, when unresolved (U) attachment versus organized (non-U) attachment was considered as a moderator of treatment outcome, COS-I intervention produced superior effects on the changes in sensitivity of U-mothers with PPD in mother-child play, in comparison to non-U-mothers with PPD. In TAU, and as expected based on earlier findings (see introduction), U-mothers' improvement in sensitive caregiving was significantly poorer than that of non-U-mothers indicating limited gains of a non-attachment based mother-infant intervention for U-mothers, and that U-mothers were particularly susceptible to positive changes in sensitivity through COS-I intervention. Furthermore, post-hoc t-tests revealed no significant differences in the non-U- and U-mothers' depression scores (BDI), neither at baseline ($t(71) = -0.29, p = .775$) nor at follow-up ($t(21.9) = -1.28, p = .213$). At baseline, mean depression scores in the non-U-group ($n = 54$) was $M = 19.89$ ($SD = 10.10$) and in the U-group ($n = 19$) 19.08 ($SD = 11.91$). At follow-up, mean depression scores in the non-U-group ($n = 41$) was $M = 12.90$ ($SD = 9.08$) and in the U-group ($n = 17$) 17.59 ($SD = 13.88$). Thus, it could be argued that the COS-I provides the mothers with a way to protect the infant from their inner vulnerability, which enhances the U-mothers' awareness of their own vulnerability toward attachment-related needs and behaviors, resulting in more sensitive caregiving. The introduction of the shark music concept in session 9 and the use of video-feedback as two core elements of the COS-I intervention might be linked to this.

It is possible that the COS-I model is mostly suited when aiming to disrupt negative circles of transgenerational transmission of trauma during the transition to parenthood, and perhaps less superior to TAU when a mother is "only depressed" and not unresolved. Considering that PPD mothers are normally at greater risk for depression throughout their

whole lives and that exposure to trauma is linked to greater levels of symptomatology for a number of psychological issues over the course of their development, including in the prenatal and postnatal periods, attachment-based intervention may more meaningfully address developmental issues linked to parenting that may have a bearing on the personal adjustment of these mothers.

Overall, further prospective studies are warranted to verify this moderation, including investigations that also consider greater symptomatology (i.e. personality disorder) and genetic and neurological markers, in order to deepen the understanding of the differential susceptibility hypothesis of what works for whom (Bakermans-Kranenburg & Van IJzendoorn, 2015; Slade & Holmes, 2019). Additionally, there is a need to discriminate the mitigating effect of unresolved trauma and unresolved loss, which might play different roles in PPD and treatment efficacy (Madigan et al., 2014).

Remarkably, the U-mothers were more frequently ($n = 9/50\%$) comorbid with regard to their diagnosis of an active eating disorder than the organized mothers ($n = 11, 24\%$; $\chi^2 = 4.098$; $p = .043$). Research has shown that bodily changes following pregnancy, birth, and breastfeeding can predispose women to exacerbations of eating disorder symptoms and the development of mood symptoms during the postpartum period (Astrachan-Fletcher, Veldhuis, Lively, Fowler, & Marcks, 2008; Koubaa, Hallstrom, & Hirschberg, 2008; Micali, Simonoff, & Treasure, 2011). Prior studies also found disproportionately high incidences of unresolved attachment in women with eating disorders (Gander, Sevecke, & Buchheim, 2015; Kuipers, van Loenhout, van der Ark, & Bekker, 2016; Pace, Guiducci, & Cavanna, 2017). As an expression of a “disorder of the self” (Amianto, Northoff, Abbate Daga, Fassino, & Tasca, 2016), this result merits further examination in the postpartum period.

As a parenting group intervention, COS-I intervention is not specially designed for mothers with PPD, unresolved attachment, and clinical needs. However, the combination of individualized, structured, and manual-guided treatment stressing the needs in the Circle of Security model as a foundation for intervention, as well as attachment-related dynamics in the mother, might be useful for helping U-mothers in particular to see the world from the child’s point of view and sensitively follow his/her play, i.e. to treat the child as a mental agent, as the findings suggest. Moran et al. (2005) emphasized an urgent need to consider mental issues of unresolved attachment in early interventions to bring about changes in the mother’s behavior towards the child. Sensitive parental support in early social interaction, such as interactive play, is predictive of better capacities for emotional and behavioral regulation in later infancy, and lower rates of problematic behaviors in the early school years (Murray, 2014). Given that infants of mothers with PPD and unresolved attachment are a vulnerable group (Halligan, Murray, Martins, & Cooper, 2007; Lyons-Ruth et al., 2013; Murray & Cooper, 1996), COS-I intervention should be considered preferable to TAU. The findings described herein might help to optimize the scope of the clinical use of COS-I intervention. However, further research is necessary to validate the result of positive changes in sensitivity of U-mothers attributed to COS-I intervention in the short- and long-term.

Important limitations of the present study pertain to the generalizability of the findings. As a clinical trial, we targeted mothers with clinically diagnosed PPD, seeking mother-infant treatment in primary child psychiatric outpatient care, who voluntarily participated in this study. This process of referral may have created a sampling bias in

favor of more severely depressed mothers with infants, and a lower- to upper-middle class sample, as represented in this study. Despite increased rates of comorbid anxiety and personality disorders, the level of additional psychosocial risk factors (e.g. low income, low level of education) was rather low in our sample. These risk factors are likely to impact maternal sensitivity and infant attachment negatively, even when the mother is no longer depressed (Howard & Challacombe, 2018), and are often linked to insecure maternal attachment (Apter, Devouche, Gratier, Valente, & Nestour, 2012; Smith-Nielsen et al., 2016). Given the absence of other such risk factors, the mothers with clinical PPD and comorbid disorders of the present sample might be able to somehow compensate for the potential negative effects of psychopathological symptoms and additionally benefit from either treatment.

For ethical reasons, a randomized waiting list or untreated control group was unacceptable. Therefore, in the best interest of our patients, we opted for usual clinical mother-infant treatment practices (i.e. TAU), against which we measured the effectiveness of the COS-I intervention. Randomized allocation was employed in an effort to reduce unwanted sources of variance. However, household income as a baseline variable varied significantly between the COS-I intervention and TAU groups. Because of time and cost, we were unable to increase the sample sizes for randomization of income level. Therefore, the data that resulted were likely influenced by this bias, i.e. mothers with lower incomes might benefit more from early intervention than would mothers with higher incomes. Future studies must choose a design that enables inferences by minimizing this level of uncertainty.

Despite the significant findings here, further studies with bigger sample sizes are needed to replicate our finding of the moderating effects in terms of how mothers with PPD and unresolved attachment respond to different interventional approaches. Continuous scoring of unresolved loss or abuse would provide further understanding of moderating processes beyond the mothers' U-classification (Jacobvitz & Reisz, 2019), especially in smaller samples. Overall, (multi-site) replication trials may verify the beneficial effects of COS-I intervention in outperforming TAU in direct randomized comparisons. Clearly, there is a need for follow-up assessment in order to study potentially delayed or "sleeper" effects (Bakermans-Kranenburg, IJzendoorn, & Juffer, 2003) on child attachment, and further developmentally and clinically relevant domains. Finally, as a practical consequence of the implementation of the study design using pre- and post-assessment, the behavior of either the patient or therapist might have changed, thereby enhancing or altering TAU, which has to be considered in order to understand the generalizability of our findings.

In conclusion, this is the first study implementing and evaluating COS-I intervention compared to typical mother-infant care (TAU) as a clinical effectiveness trial. Among the infants, there were slightly higher rates of secure attachment at follow-up in the COS-I intervention group compared to TAU, albeit without the statistical significance needed to meaningfully deduce whether the intervention actually worked. Furthermore, TAU and COS-I intervention similarly affected positive changes in sensitivity at follow-up. Moreover, when taking account of mothers' unresolved attachment, COS-I intervention might be particularly recommended over TAU, in order to significantly enhance maternal sensitivity while playing with the child.

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