







Regular Article

Maternal cognitive functioning and psychopathology predict quality of parent-child relationship in the context of substance use disorder: A 15-month longitudinal study

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Abstract

This longitudinal study aimed to investigate the role of maternal cognitive functioning and psychopathology in parent-child relationship quality during residential treatment for mothers with Substance Use Disorder (SUD), in order to identify factors that may enhance or limit intervention effects.

We assessed cognitive functioning (Esame Neuropsicologico Breve-2 [ENB-2]) and psychopathology (Symptom Checklist-90 Revised [SCL-90-R]) in 60 mothers diagnosed with SUD (Mage = 30.13 yrs; SD = 6.79) at treatment admission. Parent-child relationship quality was measured during free-play interactions using the Emotional Availability Scales every three months from admission (Child Mage = 17.17m; SD = 23.60) to the 15th month of the residential treatment.

A main effect of maternal psychopathology and an interaction effect of time and cognitive functioning were found. More maternal psychopathology predicted lower mother-child relationship quality. Mothers with higher cognitive functioning presented a better treatment trajectory, with an increase in mother-child relationship quality, whereas mothers with lower cognitive functioning showed a decrease in relationship quality after initial improvement.

These findings suggest that maternal psychopathology and cognitive functioning may influence the treatment of parent-child relationships in the context of SUD, although causality is not yet established. Implications for assessment and intervention are discussed.

Keywords: substance use disorder; cognitive functioning; psychopathology; parent-child relationship; treatment

(Received 31 March 2023; revised 28 December 2023; accepted 30 December 2023; First Published online 29 January 2024)

Introduction

Maternal Substance Use Disorder (SUD) constitutes a major public health problem that affects both individuals and their families, especially their young children (Messina et al., 2015). Offspring of mothers with SUD are at higher risk to experience poor quality parent-child relationships, characterized by maladaptive parenting practices that may result in the extremes of abuse and neglect (Peleg-Oren & Teichman, 2006), and by developmental, emotional and behavioral difficulties subsequent to substance consumption that occurs prenatally (Beeghly & Tronick, 1994; Behnke & Smith, 2013) or in the home (Spehr et al., 2017). Hurdles in the parent-offspring relationship often begin during pregnancy, where drug use represents one of the first stages of maladaptive child care (Eyler & Behnke, 1999; Hagan et al., 2016; van IJzendoorn et al., 2020). Prenatal substance use impedes central caregiving tasks,

that include the promotion of the unborn baby's welfare, reducing risky behaviors, and ensuring a safe prenatal journey for the expected child (Curet & Hsi, 2002; Rubin, 1976). Pregnant women with SUD often show poor maternal-fetal bonding (Mikhail et al., 1995), characterized by low cognitive awareness of fetal characteristics and by avoidance of required medical screenings (Mayes, 2002) as a result of the continuous consumption of substances (Shieh & Kravitz, 2002). At the same time, newborns that have been exposed to substances in utero are at higher risk to present unfavorable physical and autonomic characteristics at delivery, such as reduced growth, higher activity and irritability, low levels of arousal as well as disturbances in sleep and feeding patterns (Behnke & Smith, 2013; LaGasse, 2003). Although it is still not clear to which extent they represent a direct effect of in utero exposure to a specific substance or rather a cumulative effect of diverse risk factors (e.g. consumption of multiple substances and quality of the child's environment), these behavioral manifestations are likely to promote additional relational difficulties in the perinatal period, affecting the comprehensibility of infant signals and constituting an adjunct source of stress for parents, especially mothers (Frank et al., 2001; Liles et al., 2012; Messina et al., 2015).

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Cite this article: Porreca, A., De Carli, P., Filippi, B., Bakermans-Kranenburg, M. J., van IJzendoorn, M. H., & Simonelli, A. (2025). Maternal cognitive functioning and psychopathology predict quality of parent-child relationship in the context of substance use disorder: A 15-month longitudinal study. *Development and Psychopathology* 37: 439–450, <https://doi.org/10.1017/S0954579424000026>



The literature on maternal SUD highlights that poor quality parent-child interactions are likely to persist during infancy (Frigerio *et al.*, 2019; Tronick *et al.*, 2005), toddlerhood (Eiden *et al.*, 2011), preschool (Salo *et al.*, 2009), and school age, with challenges resulting from both parent and child characteristics (Tronick *et al.*, 2005). On the parent side, mothers with SUD tend to be less sensitive and responsive to children's emotional signals both at a neural (Kim *et al.*, 2017; Lowell *et al.*, 2020; Rutherford *et al.*, 2021) and a behavioral level (Eiden, 2001; Flykt *et al.*, 2012; Frigerio *et al.*, 2019; Porreca *et al.*, 2016; Salo *et al.*, 2009, 2010). During interactive play they are more inclined to be directive and interfering with offspring activities (Bauman & Dougherty, 1983; Bauman & Levine, 1986; Rodning *et al.*, 1991; Johnson *et al.*, 2002; Pajulo *et al.*, 2001), whereas during disciplinary situations they are more prone to adopt either harsh limit-setting strategies or laxness (or both) in response to their child's challenging behaviors (Miner & Clarke-Stewart, 2008; Thompson Gershoff, 2000). Negative parenting behaviors have also been observed during feeding interactions, resulting in less engagement and flexibility (LaGasse, 2003; Minnes *et al.*, 2005). Globally, these strategies tend to be ineffective and related to negative developmental sequelae in children, including insecure and disorganized attachments (Swanson *et al.*, 2000) as well as internalizing and externalizing problems (Bada *et al.*, 2007; D'Onofrio *et al.*, 2007; Misri *et al.*, 2006). In their extreme forms, parental maladaptive practices can assume the shape of severe abuse or neglect, where the parent fails to take care of the child's basic needs (Barnard & McKeganey, 2004), increasing the risk of involvement with child welfare services, and the subsequent child removal from home (Dakof *et al.*, 2010; Matos *et al.*, 2014).

On the child's side, the persistence of the neurodevelopmental and emotional characteristics associated with prenatal exposure are likely to further exacerbate poor quality parent-child interactions (Coles & Platzman, 1993; Eiden *et al.*, 2011; Mattson *et al.*, 2001; O'Connor *et al.*, 2002), undermining the readability of child signals and, consequently, adequate parental responses (Behnke & Smith, 2013; O'Connor *et al.*, 2002). Moreover, children of parents with SUD are at increased risk of cognitive, linguistic, and physical delays (Behnke & Smith, 2013; Lewis *et al.*, 2004), as well as the manifestations of emotional (e.g. social withdrawal, depression, and anxiety), or behavioral problems (e.g. aggression, delinquency, and substance use) throughout childhood and adolescence (Bada *et al.*, 2007; Kilpatrick *et al.*, 2000; Minnes *et al.*, 2014). As a consequence of negative transactional patterns resulting from the encounter between parents' and children's difficulties, offspring of caregivers with SUD are at higher risk of being exposed to low quality attachment relationships across different situations and ages (Frigerio *et al.*, 2019; LaGasse, 2003; Thompson Gershoff, 2000), which could play a role in the intergenerational transmission of substance use, increasing offspring's susceptibility to addiction later in life (Strathearn *et al.*, 2019).

Information about the "normative" development of mother-child relationships over time in the context of SUD is almost absent, with the majority of extant work presenting cross-sectional data or data on treatment effects. A previous longitudinal study showed that, without the support of appropriate and focused interventions, difficulties in mother-child exchanges tend to persist over the course of the first years of life (Blackwell *et al.*, 1999). Specifically, only children, but not parents, seemed to show gains in their emotional competencies, albeit their scores remained low compared to low-risk and other high-risk groups (Blackwell *et al.*, 1999).

Nevertheless, a growing body of literature points out that, when appropriately addressed through targeted interventions, quality of parent-child relationships in groups with SUD can be effectively improved (Belt *et al.*, 2012; Suchman *et al.*, 2012). Early and preventive interventions are identified as a window for providing effective treatment in the condition of SUD, improving parent-child relationship quality and preventing infants' physical and emotional problems (Belt *et al.*, 2012; Howell *et al.*, 1999; Niccols *et al.*, 2012; Suchman *et al.*, 2010). For example, psychodynamic group therapy was found effective in reducing hostile and intrusive maternal behaviors towards children (Belt *et al.*, 2012), whereas attachment and mentalization-based interventions enhancing maternal mentalizing abilities supported the improvement of relationship quality (Pajulo *et al.*, 2012; Suchman *et al.*, 2018; Suchman *et al.*, 2010). These interventions were administered both in outpatient (e.g. Suchman *et al.*, 2018) or residential treatment (e.g. Berlin *et al.*, 2014), two of the most commonly adopted settings for the treatment of women with substance use disorder (Daley *et al.*, 2000). The results of these studies suggest the persistence of positive outcomes over time (Smith *et al.*, 2010; Suchman *et al.*, 2010).

Given the complexity of SUD, various authors point to the need to identify mechanisms that support or hamper intervention effects, especially in the context of parenting (Belt *et al.*, 2012; Bosk *et al.*, 2019; Suchman *et al.*, 2012). For example, the presence of additional symptoms of psychopathology co-occurring with substance use could constitute an adjunct risk factor for caregiving practices, further exacerbating difficulties in parental responses and quality of parent-child relationships (De Palo *et al.*, 2014; Dixon *et al.*, 2018; Hans, 1999; Porreca *et al.*, 2020; Salloum & Brown, 2017; Yilmaz & Dilbaz, 2016; Zuckerman & Brown, 1993). The comorbidity of substance use and severe psychological distress measured at treatment intake has been extensively reported to have a negative impact on program response, with higher risks of poor outcomes and dropouts in adults with SUD with (Haller *et al.*, 2002; Haller & Miles, 2008; Howell *et al.*, 1999) and without children (Herbeck *et al.*, 2005). This association was found for several psychiatric disorders (Elmqvist *et al.*, 2016; Herbeck *et al.*, 2005; Petry & Bickel, 2000; Strantz & Welch, 2012; Williams & Roberts, 2009; Zweben *et al.*, 2012) and dysfunctional personality traits (Fernandez-Montalvo & López-Goñi, 2010). Although comorbid psychological distress tend to generally decrease during and after program completion, both in residential (Schinka *et al.*, 1999) and outpatient services (Suchman *et al.*, 2008, 2018), the effect of its changes may vary according to the specific type of treatment and to the outcomes considered. For example, some studies reported that decreases in depressive symptoms were specifically related to improvements in maternal caregiving behaviors (Suchman *et al.*, 2012), yet other work highlighted that mothers with SUD presenting more severe clinical profiles tended to benefit more from treatment in terms of reflective functioning although they displayed a slower alleviation in their symptoms over time (Suchman *et al.*, 2017).

Other studies examined the role of cognitive functioning, given the strong associations between chronic use of drugs and structural and functional brain changes, especially in the prefrontal area (Ceceli *et al.*, 2021; Goldstein & Volkow, 2011). Impairments in executive functioning have been linked to treatment abandonment in adults with SUD (Brorson *et al.*, 2013; Teichner *et al.*, 2002), distinguishing between completers and dropouts (Aharonovich *et al.*, 2006). Moreover, cognitive

functioning significantly improved in individuals completing treatment (Vergara-Moragues et al., 2017). Additionally, cognitive functioning presents relevant links with psychopathology, being negatively associated with symptoms of depression (Taylor Tavares et al., 2007), obsessive-compulsive disorders (Penadés et al., 2007), and psychotic disorders (MacDonald et al., 2005). Notably, recent research provided evidence for the role of parental cognitive functioning in adequate caregiving practices, supporting the development of favorable parent-child relationships (Bridgett et al., 2017; Martin et al., 2020; Rutherford et al., 2018). Cognitive resources are often impaired in parents with SUD, contributing to poor quality parent-child relationships (Porreca et al., 2018). Thus, in the condition of SUD psychopathology and cognitive impairments might coexist, with the risk to aggravate parenting quality and negatively affect the course of treatment.

A better comprehension of the mechanisms underlying maladaptive parenting practices and affecting treatments provided to parents with SUD is necessary, in order to be able to timely intervene and to mitigate the negative impact of the side effects of substance use on child developmental outcomes. Although some studies focused on the impact of psychopathology (Herbeck et al., 2005) and cognitive functioning (Brorson et al., 2013; Teichner et al., 2002) in SUD treatment, little is known about these mechanisms in the context of parenting. Some studies provided evidence for the role of psychopathological symptoms in interventions provided to mothers with SUD (Haller & Miles, 2008; Howell et al., 1999; Suchman et al., 2012). As far as we know, no study considered the role of cognitive functioning in intervention effects on mothers with SUD. This aspect could be of particular importance given that impaired cognitive processes could reduce the resources dedicated to both parental demands and treatment requirements.

To fill this gap in the literature, the present study aims to investigate the role of psychopathological distress (Objective 1) and of cognitive functioning (Objective 2) measured at treatment intake on the quality of the parent-child relationship during a residential treatment program for mothers with SUD and their children, a setting usually characterized by structured daily care and a focus on intensive recovery activities (Reif et al., 2014). Specifically, we conducted a naturalistic study of longitudinal outcomes, with observation of the degree and direction of change in parent-child relationship over time (Caruana et al., 2015). Naturalistic studies are often carried out in clinical settings in order to study prediction of treatment outcomes and trajectories in complex contexts where more structured research protocols (e.g. RCTs) might not yet be feasible (Philips & Falkenström, 2021). Naturalistic longitudinal studies can provide important hypotheses about treatment processes and are characterized by high ecological validity (Borckardt et al., 2008; Leichsenring, 2004). In line with previous studies (Brorson et al., 2013; Suchman et al., 2012; Teichner et al., 2002), we expected to find significant associations between parental psychopathological distress (H1), cognitive functioning (H2) and quality of the parent-child relationship at admission and with changes in the parent-child relationship over time. Specifically, we expected greater psychopathological distress and lower cognitive functioning measured at intake to be associated with lower parent-child relationship quality at the beginning of treatment, and more modest improvements in parent-child relationship quality over time. Moreover, we expected to find a significant interaction between parental psychopathological distress and cognitive

Table 1. Demographic characteristics of the sample

	<i>M (SD)</i>	<i>N (%)</i>
Maternal characteristics		
Age (years)	30.13 (6.79)	
Education (years)	9.71 (2.41)	
Age of the onset of drug use (years)	18.22 (3.34)	
Familiar history of SUD		27 (47%)
Significant losses		36 (60%)
Experience of maltreatment		41 (68%)
Poly-drug use		50 (86%)
Primary substance of abuse:		
Cocaine		6 (10%)
Heroin		43 (73%)
Drug related illness (e.g., hepatitis C.)		33 (55%)
Children's characteristics		
Age (months)	17.17 (23.60)	
Gender (male)		29 (48%)
Desired pregnancy		28 (47%)
Prenatal drug exposure		50 (83%)

functioning in predicting the quality of the parent-child relationship (H3), with mothers with higher psychopathology and lower cognitive functioning exhibiting worse parent-child relationship outcomes during treatment.

Methods

Participants and procedure

The study involved 60 mothers with SUD (mean age = 30.13 years; $SD = 6.79$) and their children (48% male, mean age = 17.17 months; $SD = 23.60$) attending a residential treatment for substance use. Inclusion criteria were: Italian speaking and reading, recent enrollment in the residential setting (within 1–2 weeks), presence of SUD, with caregiving responsibilities for at least 6 days per week of a child aged between 0 and 7 years old and co-residing with the child in the facility. Mothers with more than one child chose with which child they took part in the study. Exclusion criteria included diagnosed psychotic disorders in an active phase and significant cognitive impairment due to physical problems in the mother that prevented the execution of the tasks, or significant developmental delays or neurodiverse development in the child. The diagnosis of SUD was based on the mothers' medical history and urine toxicology. Sample characteristics were collected through a structured interview. They are presented in Table 1. Most of the participants presented an early onset of drug use ($M = 18.22$; $SD = 3.34$) and a pattern of poly-drug use (86%), with heroin as primary substance of use (73%). Moreover, with respect to past events in the family of origin, more than a half of the participants reported having experienced the death of a significant person (60%) and some or multiple forms of maltreatment (68%) between childhood and early adolescence. Most of the children were exposed to substances in utero (83%). In most cases (78%), the mothers' entrance to the facility was mandatory, after a Juvenile Court Decree. The participants were enrolled in the study after their admission to the facility. A research assistant met with all eligible participants

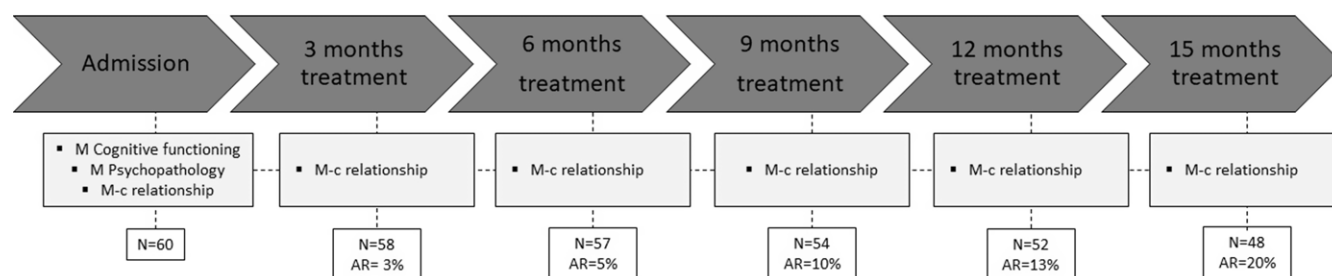


Figure 1. Phases of the study. AR = attrition rate since admission.

individually and presented the project to them. Mothers interested in taking part in the study (92% of the eligible patients entering the treatment) received information and gave their written informed consent. Information on socio-demographic and clinical variables, maternal cognitive functioning, and psychopathological symptoms was collected at enrollment. Parent-child relationship quality was measured through observation of parent-child interactions at enrollment and every 3 months during the following 15 months of treatment. Figure 1 displays the phases of the study.

The residential treatment

The facility offers a psychodynamic-oriented comprehensive program which includes pharmacological, educational and psychological intervention, and parent counseling as described in Stocco et al. (2012). Educational intervention is provided on a daily basis by psychologists and professional educators and includes practical strategies, guidance and supervision targeted at: personal wellbeing (eating, hygiene, organization of spaces), handling of the SUD condition (abstinence, prevention of relapses, administration of substitutive or psychological treatment), management of personal relationships (with partner, friends, relatives and the family of origin), parenting (feeding, cleaning, changing, clothing), and adherence to residential tasks and guidelines (e.g. preparation of meals, cleaning of spaces). Psychological treatment is provided through individual psychotherapy and group psychotherapy. Both these treatments foresee one session per week and are carried out by expert clinicians trained in psychodynamic psychotherapy. The interventions are characterized by a focus on the clinical relationship with the aim of modifying the clients' internal representations and defenses and promoting adaptive coping strategies. Parent counseling sessions were available on request. These sessions were carried out individually, without the child, by an expert clinician trained in psychodynamic psychotherapy, who used different approaches based on the client's needs, ranging from supporting the mother in the achievement of the objectives of the educational intervention to approaches addressing mothers' mental representations of themselves (both as individual and as parent) and of the relationship with their significant others. All the participants received at least 1 session of parental counseling, up to 3 consecutive sessions in case of particularly severe difficulties. The scheduling of the sessions differed according to the issues treated and in line with the mothers' requests (from weekly to monthly sessions). The sessions could be requested at any point during the residential treatment. Consultations with psychiatrists and pediatricians external to the facility are scheduled when needed. The different types of intervention are coordinated in weekly staff meetings monitoring treatment of each mother-child pair.

Measures

Parent-child relationship quality

Mothers and children were videotaped during 15-minute free-play episodes that were subsequently assessed by trained coders. The procedure was carried out at admission and repeated every 3 months, during the first 15 months of treatment, for a total of 6 measurements. Quality of parent-child relationship was assessed coding mother-child interactions using the Emotional Availability Scales — 4th ed. (EAS; Biringen, 2008). The coding system includes six scales assessing both parenting behaviors (*sensitivity, structuring, non-intrusiveness, and non-hostility*) and child interactive behaviors (*responsiveness and involvement*), providing a multifaceted measure of parent-child interaction. Each scale is rated on a 7-point Likert scale, with higher scores referring to more optimal behaviors. Scores between 5.5 and 7 indicate the presence of proper interactive features in the individual. Scores around 4 indicate inconsistency (i.e., behaviors that are appropriate in some way but that are not fully optimal). Scores of 3 or below point out less optimal interactions. Scores lower than 2 indicate low qualities on that dimension. For the present study the videos were coded by two independent raters trained in the system. To minimize the risks of halo effects and of biases linked to the child's developing age, the videos were assigned to the coders randomizing dyads and time points of observation. Moreover, the raters were kept blind with respect to the objectives of the study and to the participants' clinical and treatment condition. Inter-rater reliability was calculated using Intraclass Correlation Coefficients on a randomly selected subsample of 20% of the cases, with values ranging from 0.80 to 0.95. For the purposes of the present study, a composite measure (i.e. Parent-child interaction quality) including both parent and child scale scores was computed as an index of the global quality of parent-child relationship. Analysis yielded good internal consistency of the composite measure ($\alpha = .80$).

Maternal psychopathological symptoms

Maternal psychopathological symptoms were measured at admission through the Symptom Checklist-90 Revised (SCL-90-R; Derogatis, 1994; Sarno et al., 2011), a self-report questionnaire aimed at assessing the presence of psychopathological symptoms on nine primary symptom dimensions (*somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism*) and psychological distress according to three global distress indexes (*Global Severity Index, Positive Symptom Total, and Positive Symptom Distress Index*). Each item is rated on a 5-point Likert scale, ranging from 0 (not at all) to 4 (extremely). Raw scores are converted into T-scores and compared to normative values being classified as above/below clinical range. The SCL-90 is normed for both clinical

and nonclinical populations. The Italian translation and adaptation of the SCL-90-R (Sarno et al., 2011) has been shown to have good internal consistency ($\alpha = 0.68\text{--}0.97$) in adolescents and adults.

For the purposes of the present study, we considered only the Global Severity Index as a measure of overall parental psychopathological distress ($\alpha = 0.97$).

Maternal cognitive functioning

Cognitive functioning was investigated at admission through the Esame Neuropsicologico Breve-2 (ENB-2; Mondini et al., 2003, 2011), a comprehensive neuropsychological battery standardized for the Italian population. The battery includes 16 subtests: digit span, immediate and delayed recall prose memory, interference memory at 10 and 30 s, trail making test part A and B, token test, word phonemic fluency, abstract reasoning, cognitive estimation, overlapping figures, spontaneous drawing, copy drawing, clock drawing, and ideomotor praxis test. These subtests cover the cognitive domains of attention, memory, comprehension, executive functioning, perception, and praxis abilities. The scoring system yields a score for each subtest and a total score, the Global Cognitive Index, ranging from 0 to 100. The scores can be classified as average, borderline, and below average, according to established norms weighted for different age-ranges ($M = 83.51$, $SD = 6.52$ for 15–20-year-olds, $M = 85.65$, $SD = 5.40$ for 21–30-year-olds, $M = 84.91$, $SD = 5.66$ for 31–40-year-olds, $M = 80.72$, $SD = 6.98$ for 41–50-year-olds). The battery has good psychometric characteristics, good differential validity in discriminating normative and clinical groups, and sufficient test-retest reliability (range from 0.57 to 0.97) (Mondini et al., 2003, 2011). Moreover, the battery has already been successfully applied to adults with SUD (Parolin et al., 2016; Porreca et al., 2018). For the purposes of the present study, we considered only the Global Cognitive Index that summarizes the individual's cognitive functioning.

Plan of analysis

As a preliminary analysis, we performed a confirmatory factor analysis of the EAS scales at t1 and tested for measurement invariance in the factorial structure across the 6 assessments in order to check the hypothesized one factor solution. Then, in order to achieve the most unbiased analysis possible, we imputed the missing data in the EAS scores, taking into account the longitudinal nature of the data with observations nested in participants. We imputed the data producing 5 different datasets, and after performing the analysis in each of this dataset, we pooled the results (Honaker et al., 2011). Next, we implemented a model comparison approach to determine the best predictive mixed linear models of the EAS scores across time. In order to find the best fitting model, we started with a model including only the linear effect of time as predictor and then added step by step the quadratic effect of time, the main effects of global cognitive functioning, psychopathological symptoms, as well as the interaction between these parental factors. The choice of the best model was based on a procedure of model selection depending on AIC scores and AIC weights (Wagenmakers & Farrell, 2004). The best model was repeated with non-imputed data as a sensitivity analysis, for which the results are presented in the Supplemental Materials. Concerning the variable participation to parental counseling, given the heterogeneity of the treatment provided due to the different number of sessions, different scheduling and different contents, all mothers were considered as a group in the sets of analyses. This is

Table 2. Descriptive analyses of the variables of the study

Variable	<i>M</i>	<i>SD</i>	1	2
1. Parent-child interaction quality	4.16	0.64		
2. Cognitive functioning	80.74	7.69	.13*	
3. Psychopathology	0.92	0.57	–.31**	–.15**

Means, standard deviations, and correlations of the variables of the study at admission. *N* = xx. * indicates $p < .05$. ** indicates $p < .01$.

in line with dose-response studies on psychological treatment suggesting that at least 4 consecutive sessions are needed to observe clinically significant differences in improvements between groups (Robinson et al., 2020). All analyses were performed in R (R Development Core Team, 2021), using the “Amelia” package (Honaker et al., 2011) to impute missing data, the “lme4” package (Bates et al., 2015) to perform the mixed models and the “effects” (Fox, 2003) and “ggplot2” (Wickham, 2009) packages to produce the plot. R-codes are available upon request.

Results

In Table 2 we present the descriptive analyses of the variables of the study.

A confirmatory factor analysis on the EAS scores at t1 was performed in order to test the one factor factorial structure hypothesized (Bornstein et al., 2012; Garvin et al., 2012). Results yielded a satisfactory solution ($\chi^2(5) = 9.12$, $p = 0.10$, CFI = 0.98, TLI = 0.94, RMSEA = 0.12 [0–0.24]) and requirements indicating weak measurement invariance ($\Delta\chi^2 = 121.17$, $df = 25$, $p = .15$) were met for the six assessments. Therefore, we considered the one factor solution confirmed and the EAS scales were averaged into one score (i.e. Parent-child interaction quality). The description of the CFA model is presented in Figure S1 in the supplemental materials. Table 2 presents means and standard deviations of the variables of the study at admission (t1) and the bivariate correlations. In order to determine the best model to explain the variability in EAS scores, we provide AIC and AIC weights for each hypothesized model in Table 3.

The best fitting model was the last one, including both cognitive functioning and symptomatology, as well as the interactions between these factors and the quadratic and linear effects of time. The parameters of the selected model are presented in Table 4, showing a significant negative main effect of maternal self-reported psychopathological symptoms, and significant interactions between both the linear and quadratic effects of time and cognitive functioning. Notably, no interaction between time and symptomatology reached the statistical significance threshold. Table S1 in the supplemental materials shows the parameters of the selected model fitted on participants with complete data without imputation of the missing data, as a sensitivity analysis. Results remain essentially unaltered.

In order to explore the interpretation of the moderating role of cognitive functioning on the quadratic effect of time, a simple slope analysis was implemented. Results show that for mothers with low levels of cognitive functioning (i.e., 1 SD below the mean), the quadratic effect of time was significant and negative ($b = -0.95$, $SE = 0.47$, $t = -2.02$, $p = .04$), while for mothers with high levels of cognitive functioning the quadratic effect of time was significant and positive ($b = 1.09$, $SE = 0.46$, $t = 2.37$, $p = .02$). The graphic representation of the quadratic effects for high and low levels of executive functioning is presented in Figure 2. For sake of

Table 3. Models selection

Model	Model description	df	AIC	AIC weigth	BIC
0	Time	6	615.223	0.000	638.540
1	Time + Cognitive Functioning	7	590.268	0.000	617.111
2	Time + Psychopathology	7	608.162	0.000	635.365
3	Time + Cognitive Functioning + Psychopathology	8	585.397	0.007	616.075
4	Time + Time ²	10	606.465	0.000	645.326
5	Time + Time ² + Cognitive Functioning	11	580.255	0.071	622.438
6	Time + Time ² + Psychopathology	11	600.186	0.000	642.933
7	Time + Time ² + Cognitive Functioning + Psychopathology	12	578.686	0.295	624.704
8	Time + Cognitive Functioning + Time*Psychopathology	8	599.529	0.000	630.207
9	Time + Psychopathology + Time*Psychopathology	8	615.003	0.000	646.092
10	Time + Cognitive Functioning + Psychopathology + Time*Cognitive Functioning + Time*Psychopathology	10	600.841	0.000	639.189
11	Time + Time ² + Cognitive Functioning + Time* Cognitive Functioning + Time ² *Cognitive Functioning	13	582.594	0.025	632.447
12	Time + Time ² + Psychopathology + Time* Psychopathology + Time ² *Psychopathology	13	599.058	0.000	649.577
13	Time + Time ² + Cognitive Functioning + Psychopathology + Time* Cognitive Functioning + Time ² *Cognitive Functioning + Time* Psychopathology + Time ² *Psychopathology	16	575.905	0.602	637.261

completeness, we tested also a model with only linear effects of time (i.e., no quadratic main effect of time and no interactions between the quadratic terms and cognitive functioning and psychopathology). Results show a non-significant (even if close to the significance threshold, i.e., $p = .07$) interaction between the linear effect of time and cognitive functioning. The parameters of this model can be found in Table S2 in the supplemental materials.

Discussion

The aim of the present study, using a naturalistic correlational design, was to investigate the role of psychopathological symptoms and cognitive functioning in the development of the quality of the parent-child relationship during a residential treatment program for mothers with SUD. In line with our expectations, we found a negative association between maternal self-reported psychopathological distress and observed parent-child interaction quality, suggesting that higher distress at admission in the facility was associated with poorer caregiving and relational quality with the offspring. Previous research highlighted that the co-occurring presence of psychopathological symptoms with the condition of substance use (Dixon *et al.*, 2018; Salloum & Brown, 2017;

Table 4. Parameters of the selected model predicting parent-child interaction quality

	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Intercept	3.913	0.658	5.944	.000
Time	− 11.542	7.743	− 1.491	.138
Time ²	− 14.568	5.581	− 2.610	.009
Cognitive functioning	0.007	0.008	0.865	.387
Psychopathology	− 0.343	0.110	− 3.125	.002
Time*cognitive functioning	0.158	0.091	1.732	.084
Time ² *cognitive functioning	0.169	0.066	2.560	.010
Time*psychopathology	1.231	1.243	0.990	.323
Time ² *psychopathology	1.749	0.941	1.859	.063
Random effects				
σ^2	0.20			
τ_{00} ID	0.18			
τ_{11} ID.time_quad	0.16			
ρ_{01} ID	− 1.00			
ICC	0.47			
Marginal R^2 / conditional R^2	0.122 / 0.538			

Swendsen, 2000; Yilmaz & Dilbaz, 2016) represents a risk factor for poor caregiving practices (De Palo *et al.*, 2014; Hans, 1999; Porreca *et al.*, 2020; Zuckerman & Brown, 1993). Attunement to child signals is reduced both by the parents' efforts to attend psychological needs subsequent to psychopathology (Berg-Nielsen *et al.*, 2000; Zahn-Waxler *et al.*, 2002), and to manage psychophysical needs related to substance dependence, consumption, and abstinence (Rutherford & Mayes, 2017).

Furthermore, previous research provided evidence that the co-occurrence of substance use and severe psychological distress measured at intake represents a negative prognostic factor for treatment response, with a higher risk of poor outcomes and treatment dropout (Haller *et al.*, 2002; Herbeck *et al.*, 2005; Howell *et al.*, 1999). Notably, self-reported psychopathological symptoms at admission to the facility did not allow us to distinguish among different trajectories within our group of participants, suggesting a need to further investigate the impact of psychopathology on treatment outcome. The severity of symptoms might have changed during the 15 months of observation and variability in change may have prevented the identification of diverging pathways of parent-child interaction quality. This possibility is in line with data suggesting that much of the psychopathological distress experienced by individuals with SUD could be linked to withdrawal symptoms and is likely to decrease after a period of 2–3 weeks, even without specific treatment (Wetterling & Junghanns, 2000). Moreover, this assumption is also consistent with studies indicating that integrated treatment programs providing parenting support can decrease maternal distress with different impact according to the type of treatments and to the outcome variable (Huebner, 2002; Lowell *et al.*, 2023; Smith *et al.*, 2010; Suchman *et al.*, 2010; Suchman *et al.*, 2012).

In accordance with our second hypothesis, mothers with higher cognitive functioning displayed significant increase in quality of mother-child relationship, whereas mothers with lower cognitive resources presented a poorer treatment course. Parental cognitive resources have been found to be important indexes of appropriate

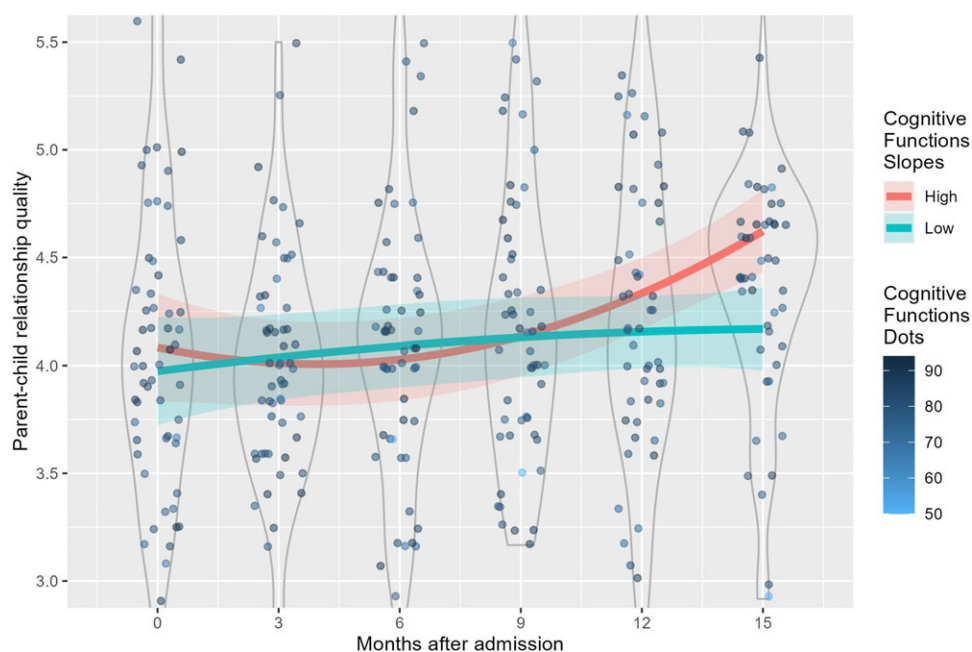


Figure 2. Simple slope analysis of the moderating role of cognitive functioning on the association between time and parent-child interaction quality. The blue slope refers to parent-child relationship quality in the group of mothers with high cognitive functioning whereas the red slope indicates the trajectory in mothers with low cognitive functioning.

parenting (Deater-Deckard et al., 2012), allowing caregivers to organize emotions, thoughts, and attitudes into integrated plans of action, both in clinical and nonclinical samples (Dix, 2000; Shaffer et al., 2017). The results of the present study suggest that cognitive functioning measured at intake differentiates not only parent-child relationship quality at admission but also its trajectory over time in mothers with SUD. In line with this finding, a growing body of research has identified cognitive functioning as an important prognostic factor for the treatment of substance use, with individuals with lower executive functioning being at higher risk to relapse or to abandon treatment (Aharonovich et al., 2006; Brorson et al., 2013; Teichner et al., 2002).

Notably, for both groups we found a quadratic effect of time, suggesting that change might be nonlinear and discontinuous in this clinical population (Hayes et al., 2007). Several authors suggested that the process of change in psychotherapy is characterized by destabilization before change (Hager, 1992; Hayes et al., 2007; Hayes & Strauss, 1998). Thus, before providing a stable environment and increasing patients' readiness and resources for change, therapy may introduce a variety of experiences that interrupt, challenge, and destabilize old patterns (Hayes et al., 2007). From this perspective, treatment course could be characterized by discontinuous transitions, where significant changes are preceded by critical fluctuations and instabilities (Schiepek et al., 2003). Specifically, in our group, mothers with higher cognitive functioning presented first a decrease in quality of parent-child interactions, followed by a gradual improvement, whereas mothers with low cognitive resources showed the opposite pattern, characterized by a decrease in relationship quality after an initial improvement.

We hypothesize that cognitive functioning in mothers with SUD might intervene as moderating factor for better or poorer treatment outcome. Of course, this moderator interacts with the specific treatment that in our case was characterized by a psychodynamic-oriented comprehensive approach, composed of both psychotherapeutic and educational sessions mostly focused on individual adult functioning (e.g. substance use, psychological disease, adjustment, and traumatic experiences), and to a lesser extent on quality of parenting. In the present study, dyads whose

mothers presented higher cognitive resources seemed to benefit more from the treatment offered by the residential community. Anyway, the process of change appeared to be slow and results required a rather long time to become observable (Greenson, 2018; Knekt et al., 2011), suggesting the need to integrate the treatments provided with modules specifically focused on parent-child relationship which could be more rapid and effective in supporting quality of care (Lowell et al., 2023; Mayes, 2023; Suchman et al., 2004, 2006).

Mothers with lower cognitive resources presented fewer benefits during this type of intervention, showing an asymptotic curve of growth that quickly reached its upper limit and arrested during the course of treatment. This result is in line with studies indicating that individuals with SUD exhibiting low executive functioning benefit less from complex treatments, due to difficulties in learning and retaining new material (Aharonovich et al., 2006; Alterman et al., 1986), and in the acquisition of different coping behaviors (McCrary & Smith, 1986). Notably, mothers with lower cognitive functioning presented an initial increase in quality of the parent-child relationship, suggesting that shorter interventions repeated over time could be more effective in targeting quality of parenting in this population. This hypothesis seems in line with meta-analytic work providing evidence that families with multiple problems benefit more from interventions structured in a moderate number of sessions and with easily accessible themes (Bakermans-Kranenburg et al., 2003; Juffer et al., 2017).

Finally, concerning our third hypothesis, we did not find an interaction between adult psychopathology and cognitive functioning in shaping the development of the parent-child relationship. This finding could be related to low statistical power linked to the small sample of participants in our study and should be further investigated in the future (Nosek et al., 2022; van IJzendoorn & Bakermans-Kranenburg, 2021).

Taken together, the results of the present study suggest that both parental psychopathology and cognitive functioning at intake may be linked to the ongoing of parent-child relationship quality in the context of maternal SUD, although with different trajectories. While psychopathological symptoms did not differentiate amongst diverse

patterns of change during treatment, the quality of cognitive functioning discriminates between different trajectories of change.

The current study has some limitations. The first limitation concerns the small sample with limited statistical power for multivariate analyses such as the ones conducted in the current exploratory study. The inclusion of a larger group could provide more valid information on the associations of psychopathology and cognitive functioning with parent-child relationship quality in mothers with SUD. A second limitation of the study is linked to the adoption of a naturalistic study design characterized by the absence of a comparison to a randomized group without intervention or administered a different treatment, which could help to examine whether the treatment is really effective in stimulating change in the SUD parents. It might be that shorter interventions, characterized by a more specific focus on parenting and on relationship quality are more effective in enhancing quality of parent-child interactions (Bakermans-Kranenburg et al., 2003; Suchman et al., 2004). Moreover, it might be that an intervention characterized by more easily accessible contents which requires less cognitive efforts might be profitable for parents with low cognitive functioning (Aharonovich et al., 2006; Bakermans-Kranenburg et al., 2003; Porreca et al., 2022). A third limitation concerns the lack of repeated measurements of the independent variables over time. Psychopathology and cognitive functioning may be modified by the residential program and these changes could partly explain any effects of treatment on parenting quality. Finally, no measures of maternal reflective functioning were included, which could be particularly relevant with respect to parenting quality in the context of SUD, given its associations with parenting behaviors and treatment outcomes in this clinical group (Pajulo et al., 2012; Suchman et al., 2011). In our study this aspect was captured only to some extent through the observational coding system adopted and, thus, should be further investigated in future research, also in light of studies identifying associations between parental executive functioning and reflective abilities (Håkansson et al., 2018).

Conclusions

In conclusion, this is the first study providing evidence that both parental psychopathology and cognitive functioning are associated with changes in the quality of parent-child relationships in the context of a residential treatment for maternal SUD, although with different sequelae. While psychopathological symptoms were associated in a global way with quality of mother-child relationship, cognitive performances seemed to differentiate between diverging patterns of change during treatment.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/S0954579424000026>.

Acknowledgments. The authors thank Casa Aurora (Comunità di Venezia scs), the director of the facility (Dr Nicoletta Capra), the coordinator (Dr Cappelletto) and the Psychotherapists (Dr De Palo, Dr Prandini, Dr Dalla Cia), for giving the permission to conduct the study and for helping in recruitment and data collection. We thank Micol Parolin for providing supervision in the administration of neuropsychological testing. Special thanks go to the families that took part in the research and to Zeynep Biringen and Marjo Flykt that supervised the first draft of the manuscript providing insightful suggestions for its development.

Funding statement. This work was supported by Comunità di Venezia scs

Competing interests. None.

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