Child Psychiatry & Human Development (2019) 50:835–845
https://doi.org/10.1007/s10578-019-00886-5

ORIGINAL ARTICLE

An Investigation of the Impact of Childhood Trauma on Quality of Caregiving in High Risk Mothers: Does Maternal Substance Misuse Confer Additional Risk?

Denise Hatzis[1] · Sharon Dawe[1,2] · Paul Harnett[3] · Natalie Loxton[1]

Published online: 30 March 2019

Abstract
The quality of caregiving is often compromised when mothers have co-occurring difficulties such as substance misuse and problems associated with extreme emotional dysregulation. These, in turn, are associated with poor child outcomes. The aim of the current study was twofold. First, to investigate the potential differences in risk factors associated with poor child outcome by comparing three groups: substance misusing mothers (Substance Misusing Mothers; SMM); mothers matched on demographic characteristics (Matched Comparison Mothers; MCM) and mothers recruited from the community (Matched Control Comparison; MCC). Second, to investigate the underlying mechanisms which are associated with poor child outcome by testing a mediated moderation model to ascertain (i) whether environmental risk and borderline psychopathology was a mediator between maternal childhood trauma and quality of caregiving and (ii) maternal substance misuse status moderated outcome. There were no significant differences found between the SMM and MCM groups on the key variables, but significant differences on all variables for both SMM and MCM compared to CCM. The moderated mediation analysis found that while there was significant mediation of environmental risk and borderline pathology between maternal childhood trauma and child outcome, this was not moderated by maternal substance abuse status. The importance of environmental-risk as a mechanism leading to reduced caregiving quality suggest treatment programs need to consider targeting these factors in high risk families.

Keywords Substance · high-risk · Emotional availability · Environmental risk · Borderline personality

Introduction

Extensive investigation of the quality of caregiving in mothers with substance misuse problems typically report compromised caregiving. For example, substance misusing mothers have been found to display poorer emotional availability [1], less maternal responsiveness and reciprocity during interactions [2], and less sensitivity to the cues of their children [3]. In turn, these infants are more likely to show disorganised and/or disorientated attachment styles [4]. The poor quality of caregiving has been observed in studies using a range of observational measures and paradigms [2, 3, 5, 6] and in studies of mothers in residential treatment compared to non-substance misusing mothers recruited from health clinics [7] and from well baby clinics [1, 8], although there are inconsistent findings [9–11]. A recent systematic review and meta-analysis [12] providing a synthesis of 24 studies, found that substance misusing mothers showed poorer maternal sensitivity when studies compared substance misusing mothers with mothers matched on demographic characteristics (effect size = .28).

There are, however, a range of factors that have been shown to impact on maternal sensitivity that are typically present in individuals with substance misuse problems such

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s10578-019-00886-5) contains supplementary material, which is available to authorized users.

✉ Denise Hatzis
d.hatzis@griffith.edu.au

[1] School of Applied Psychology, Griffith University, Mt Gravatt Campus, 176 Messines Ridge Road, Brisbane, QLD 4122, Australia

[2] Australian Centre for Child Protection, University of South Australia, Adelaide, SA, Australia

[3] School of Psychology, University of Queensland, St Lucia, Brisbane, Australia

as childhood trauma [13], adult psychopathology, including borderline personality disorder [14], impulsive and dysregulated affect [15] and social and financial disadvantage [16]. Each of these have been associated with compromised quality of caregiving in mother–infant dyads. Firstly, there is a well-established link between maternal childhood trauma and the quality of parenting [17–19] with mothers who have experienced childhood trauma showing greater intrusiveness and hostility in their interactions with their infants [20], and poorer maternal sensitivity [21]. Secondly, child outcomes are also compromised when mothers have difficulties in emotion regulation and coping skills [22], and impairment in interpersonal relationships, all features of Borderline Personality Disorder (BPD) [23]. Indeed, studies of caregiving in this population consistently demonstrate compromised caregiving that include less touch and involvement in children's play [24], more intrusiveness and negativity during mother–infant interactions [25, 26], and reduced responsiveness to their children [27]. Finally, there is an extensive literature suggesting socio-economic risk factors such as maternal education, income, maternal age at child birth, marital status, ethnic minority status, also impact negatively on the quality of caregiving [28]. Substance misusing mothers often experience ongoing adversity including, involvement in criminal activity, and exposure to sexual assault and victimisation [29–31], and general poverty and marginalisation [32, 33].

Thus, while maternal substance misuse is associated with compromised quality of caregiving, a greater understanding of the potential mechanisms that underpin this association would inform intervention and support options for these mothers. The current study builds on extant literature by comparing the quality of caregiving and factors that impact on this construct in three groups: mothers with a substance misuse problem, mothers matched on demographic risk factors but who do not have a substance misuse problem and mothers drawn from a community sample. The quality of caregiving, maternal childhood trauma, environmental risk and borderline features were compared in three groups: mothers recruited from substance abuse treatment services (substance misusing mothers: SMM), non-substance misusing mothers matched on key characteristics of environmental risk (matched comparison mothers: MCM) and, a community sample of mothers who were matched only on maternal age and child age (community control mothers: CCM). We hypothesis that SMM will have significantly higher scores on childhood trauma, borderline personality features and environmental risk and lower scores on caregiving quality in comparison to the MCM group; and the MCM group will have significantly higher scores on childhood trauma, borderline personality features and environmental risk and lower scores on caregiving quality in comparison to the CCM group.

Further, we investigated the potential pathway between maternal childhood trauma and quality of caregiving to determine whether this was mediated by the severity of borderline personality features and environmental risk factors and was moderated by maternal substance abuse status [34].

Method

Participants and Procedure

A sample of 51 Australian mothers and their children (12–42 months) participated in the study. The SMM comprised 17 mothers currently in treatment for opioid and/or poly-substance dependence in either residential or outpatient clinics. The MCM reported that they had not used substances in the last twelve months and had no history of treatment for substance misuse problems. They were matched on years of education, source of income, maternal age and child age. This group consisted of 17 mothers recruited from services providing assistance to socially disadvantaged mothers (e.g., non-government organisations) and located in a socio-economically disadvantaged area. The CCM consisted of 17 mothers, who similarly reported no current or history of substance misuse, matched on maternal age and child age only. Mothers were included if they had English language fluency, had no suicidal ideation or apparent psychotic thought process, did not have a diagnosed learning disability, and had a child aged between 12 and 42 months.

Assessments took place in a consulting room either in the University Psychology Clinic, at a local family support centre or in the participant's home. Assessment duration was 90–120 min and consisted of the completion of measures and videotaping of a 20-min period of mother–child interaction to code the quality of caregiving. Mothers were asked to "be with your child as you normally would at home". A standardised age appropriate set of toys was placed on a play mat on the floor next to a comfortable chair and a small table containing magazines. All procedures were approved by the university and hospital Human Ethics Committees. Mothers received a AUD30.00 gift voucher as compensation for their time and travel.

Measures

The Childhood Trauma Questionnaire (CTQ) [35] is a standardized 28-item self-report scale which includes three validity items assessing minimization/denial and a further 25-items measuring the severity of maternal childhood trauma with five clinical subscales (5 items each): emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect. Each item is scored using a five-point Likert scale with responses ranging from "never"

to "very often". The CTQ has good internal consistency ranging from .79 to .96 [36–38] and convergent validity with the Childhood Trauma Interview [37]. Furthermore, measurement invariance has been found across adult and adolescent clinical inpatients (including substance use) and non-clinical populations [36, 39]. The total score used in this study was calculated by summing the totals of the five abuse subscales: emotional abuse, physical abuse, sexual abuse, physical neglect and emotional neglect. The mean minimization/denial score was .47 (*SD* = *.70*), which is within the acceptable range of less than one [35]. Cronbach's α for the current study was .95.

The Personality Assessment Inventory-Borderline Scale (PAI-BOR) [40]. The PAI-BOR is a 24-item measure that assesses the four major features of BPD: affective instability, identity problems, negative relationships and self-harm. Each feature has six items per subscale, totalling 24 items in the scale overall. Each item is scored on a Likert scale (0 = false, not at all true; 1 = slightly true; 2 = mainly true; 4 = very true). It is widely used [41, 42] with high internal consistency (α = .88) [40], good reliability (α = .93) and evidence for concurrent and incremental validity [41]. A set of criteria was developed to identify individuals with symptoms consistent with a diagnosis of BPD, based on the total score (raw score ≥ 38) [43]. In this study a total raw score of the 24-items was used to indicate each participant's severity of symptoms. Cronbach's α for the current study was .92.

Assessment of Environmental Risk A composite environmental risk score drawing from the work of Sameroff, Seifer, Baldwin, A., and Baldwin, C. [44] and informed by Evans, Li, and Whipple [45] was calculated. This score was based on ten risk factors consisting of: pregnant before age 21; overcrowding (four or more children in the same household); single parent household; receipt of government benefits as major source of income; maternal education less than 12 years; partner alcohol consumption greater than four standard drinks a day; racial minority status (non-white); living with extended family or without children; high maternal stress - score in the severe range (i.e., greater than 26) on the Stress Scale of Depression Anxiety and Stress Scale [46]. Finally, the risk factor of low social support (i.e., a total score of 48 or less) was operationalised using the Multidimensional Scale of Perceived Social Support [47]. These ten items were scored dichotomously (1 = present; 0 = absent).

The *Emotional Availability Scale (EAS)* [48] was used in this study to assess the quality of caregiving in dyadic interactions between the mothers and their child. The videotaped observation of free play was coded for four maternal domains (sensitivity, structuring, nonintrusiveness and nonhostility) and two infant domains (child responsiveness and child involvement). Coding was undertaken in accordance with the EAS manual [48]. The total observed emotional availability score as reported in the correlation table and mediation moderation analysis was calculated by summing the totals of the six domains (range of scores were 42–174).

Fifteen percent of the videotaped mother–infant interactions were randomly chosen and recoded by an independent trained coder for inter-rater reliability, including five per cent of tapes coded by the method trainer (Zeynip Biringen). Interrater reliability was assessed using a two-way mixed, consistency, single measure intra-class correlation, with correlations for the six scales and caregiving total, ranging from .83 to .94, which was consistent with Salo et al. [1] who reported interrater reliabilities ranging between .85 and .92 between the raters and method trainer [48].

Power Calculations

In order to ensure sufficient power to test the proposed model, an a priori sample size calculation was undertaken. The sample ($n = 51$) is close to the minimum suggested sample size of 54 for a power of .80 when conducting mediation analyses with a large correlation between the predictor and mediator (i.e., $r = .59$, e.g., [49–51], and a medium correlation (i.e., $r = .39$, e.g., [52, 53]) between the mediators and criterion variables, using percentile-corrected bootstrapping [54]. In assessing the power for the moderation effect the G*Power software package was used [55]. As moderation effects tend to be smaller [56] a larger sample is required (suggested sample size $n = 60$) to achieve sufficient power (80 percent) to detect a smaller effect size of $f^2 = .15$ at $\alpha = .05$.

Analysis Plan

Differences between groups on demographic variables were tested using Analysis of Variance (ANOVA) for continuous variables and Chi squared (χ^2) for categorical variables. ANOVAs were used to test for differences in observed emotional availability, maternal childhood trauma, borderline personality features and environmental risk. This was followed by a series of planned comparisons to test for differences between the three groups. These analyses consisted of two planned contrasts to assess differences between (1) the SMM and MCM (i.e., two high risk groups) and the CCM; and (2) the two high risk groups of mothers.

Analyses were undertaken to test the mediational variables and moderating role of substance misuse on observed emotional availability, using the PROCESS macro version 3.1 Model 7 [57] in IBM SPPS Version 23. This macro assesses the magnitude of the indirect effects of the predictor variable (history of childhood trauma) on the outcome variable (emotional availability) via the mediating variables (environmental risk and borderline personality features). Following Hayes [57] recommendations, we tested for the significance of the indirect effects and calculated 10,000

bootstrapping samples to estimate the 95 percent bias-corrected and accelerated confidence intervals (CI) of the indirect effect.

Simultaneously with the mediation model, we tested whether substance misuse moderated the association between childhood trauma and the outcome variables of interest. Using the PROCESS analysis, we also included an interaction term (childhood trauma × substance misuse) in addition to the variables that were included in the mediation model (i.e., borderline personality features and environmental risk). As the mediation and moderation models are tested simultaneously, this technique estimates not only the statistical effect of the mediators, but also controls for the variance accounted for by the moderator and visa-versa. An additional advantage of using such a bootstrapping approach, is that assumptions of normality are not required [57] and hence multiple mediators and moderator variables can be tested in one overall model design [58].

Results

Sample Characteristics

Table 1 displays the demographic characteristics and Table 2 shows the differences between the three groups for the environmental risk factors. The SMM and MCM were more likely to be sole parents, living in unstable accommodation and receiving Government benefits as their major source of income compared to CCM. It is notable that 58.82%, that is over half of the SMM, had four or more risk factors current in their life, compared to 35.29% in the MCM. In contrast, none of the mothers from the CCM were identified as experiencing such severe levels of socio-economic risk. In addition to the above, information on current substance misuse and lifetime use of substances was obtained for the total sample. None of the mothers in the MCM or the CCM reported current (last 12 months) use of heroin, amphetamine, cannabis, opioids or other illicit drugs. Of the SMM, 11 reported that their primary drug of use was opioids, with 10 currently on opioid replacement therapy; four reported that their primary drug of use was methamphetamine and two reported that their primary drug of use was cannabis. Eight (47%) of the mothers had been in their current treatment episode for less than six months, three (18%) for more than six months and less than four years and six (35%) for more than four years.

Differences in Maternal Characteristics in Substance Misusing Mothers, Matched Comparison Mothers and Community Control Mothers

A one-way between group analysis of variance (ANOVA) with three levels (i.e., SMM, MCM and CCM) was performed on measures of observed emotional availability, maternal history of childhood trauma, environmental risk and borderline personality features. Levene's test was non-significant for all four measures (observed emotional availability score, $p = .51$; maternal childhood trauma, $p = .69$; environmental risk, $p = .24$; and borderline personality features, $p = .27$), indicating that for each group the assumption of homogeneity of variance was not violated. As shown in Table 3, there was a significant group difference

Table 1 Demographic characteristics

	Exposure group						Overall group difference F or χ^2
	SMM		MCM		CCM		
	M	*SD*	*M*	*SD*	*M*	*SD*	
Maternal age	31.88	7.02	32.29	5.58	34.35	6.33	.74
Number of children	2.47	1.58	2.47	1.58	1.65	.99	.16
Ethnicity %							3.23*
Australian	94.11		82.35		70.59		
Non-Australasian	5.90		17.65		29.41		
Education %							8.21*
< 10 years	47.00		29.4		5.90		
< 12 years	11.80		11.8		29.40		
> 12 years	41.20		58.8		64.70		
Child age in maths	26.11	9.47	26.76	8.84	25.88	8.32	.04
Child gender %							.15
Male	53		53		47		
Female	47		47		53		

SMM Substance_Misusing_Mothers, *MCM* Matched_Comparison_Mothers, *CCM* Community_Control_Mothers

*$p < .05$; **$p < .01$

Table 2 Environmental risk factors and cut-off scores

	Risk cut-off	Number (%) of risk			Overall Group Differences χ^2
		SMM $n=17$	MCM $n=17$	CCM $n=17$	
Maternal age	≤ 21 when pregnant	1 (5.88)	0	0	1.58
Family size	≥ 4 children	3 (17.64)	3 (17.64)	2 (11.76)	.82
Marital status	Sole parenting	10 (58.82)	9 (52.94)	0	15.26***
Income	Receiving govt benefits	15 (88.23)	16 (94.11)	0	8.23*
Educational achievement	< 12 years of education	8 (47.05)	5 (29.41)	1 (5.88)	39.65***
Maternal life stress	≥ Score of 26 on DASS_Stress	6 (35.29)	2 (11.76)	3 (17.64)	2.90
Maternal social support	≤ Score of 48 on social support	8 (47.05)	7 (41.17)	2 (11.76)	6.06*
Living situation stability	Living with extended family or without children	5 (29.41)	2 (11.76)	0	7.80*
Maternal race	Non-white	0	4 (23.52)	4 (23.52)	7.20*
Partner alcohol consumption	≥ 4 drinks per day	6 (35.29)	1 (5.88)	3 (17.64)	4.95*
Total risk score	≥ 4 risk factors	10 (58.82)	6 (35.29)	0	33.28***

SMM Substance_Misusing_Mothers, *MCM* Matched_Comparison_Mothers, *CCM* Community_Control_Mothers

*$p < .05$; ***$p < .001$

Table 3 Group differences and planned contrasts on outcome measures

Variables	SMM *M* (*SD*) $n=17$	MCM *M* (*SD*) $n=17$	CCM *M* (*SD*) $n=17$	*F* (2,48) *F* (1,48) *t* (48)	Effect sizes ω^2 r	Group differences
Observed emotional availability						
ANOVA	30.29 (6.56)	33.70 (6.98)	39.06 (5.78)	7.98***	.21	
Planned Contrast 1				−3.68**	.47	SMM, MCM < CCM
Planned Contrast 2				1.54	.24	SMM = MCM
Borderline personality features						
ANOVA	33.23 (12.33)	29.35 (15.14)	17.52 (11.04)	6.78**	.18	
Planned Contrast 1				3.57***	.46	SMM, MCM > CCM
Planned Contrast 2				−.87	−.14	SMM = MCM
Childhood trauma						
ANOVA	56.29 (22.29)	52.23 (23.59)	37.70 (21.93)	3.17*	.08	
Planned Contrast 1				2.46*	.33	SMM, MCM > CCM
Planned Contrast 2				−.52	−.05	SMM = MCM
Environmental risk						
ANOVA	3.64 (1.45)	3.00 (1.58)	.88 (.92)	19.46***	.42	
Planned Contrast 1				6.08***	.66	SMM, MCM > CCM
Planned Contrast 2				−1.39	−.21	SMM = MCM

SMM Substance_Misusing_Mothers, *MCM* Matched_Comparison_Mothers, *CCM* Community_Control_Mothers

Planned Contrast 1 = comparison of (SMM and MCM) and CCM; Planned Contrast 2 = comparison of SMM and MCM only

F values for group differences using ANOVA. *t* values are provided for Planned Contrasts 1 and 2

*$p < .05$; **$p < .01$; ***$p < .001$

for observed emotional availability, borderline personality features and maternal childhood trauma. Planned contrasts revealed that SMM and MCM had significantly poorer results on all measures compared to CCM. However, in contrast to our proposed hypothesis, SMM and the MCM mothers did not differ from one another on observed emotional availability, borderline personality features, maternal childhood trauma, or environmental risk.

Analyses Investing Potential Factors Contributing to Observed Emotional Availability: Mediation and Moderation

Pearson product moment correlations were examined to measure the strength of the relationships between a maternal history of childhood trauma, the mediating variables (environmental risk and borderline personality features) and observed emotional availability. There were significant correlations between proposed mediators, maternal childhood trauma and the three constructs relating to observed emotional availability (see Table 4). A multiple mediation moderation analysis with the simultaneous entry of both mediators and the moderator was conducted.

The Mediation Model

As shown in Fig. 1, environmental risk factors and borderline personality features were entered as parallel mediators and substance misuse as the moderator. Table 5 provides the specific indirect effects of a history of childhood trauma on observed emotional availability and the interaction terms for the moderation analysis. Notably, confidence intervals that do not include zero indicate these effects are significant. With the two mediating variables entered simultaneously,

Table 4 Correlations of means and SD of study variables (N = 51)

Variables	1	2	3	4	5	M (SD)	Observed range
1. Maternal sensitivity	–					5.55 (1.23)	3–7
2. Child responsiveness	.86***	–				5.70 (1.47)	2–7
3. Observed emotional availability	.94***	.92***	–			34.35 (7.30)	18–42
4. Borderline personality features	−.30*	−.19	−.26	–		26.70 (14.37)	0–58
5. Childhood trauma	−.30*	−21	−.27*	.52***	–	48.74 (23.58)	25–117
6. Environmental risk	−.41***	−.38*	−.40**	.69***	.61***	2.50 (1.78)	0–6

*$p < .05$; **$p < .01$; ***$p < .001$

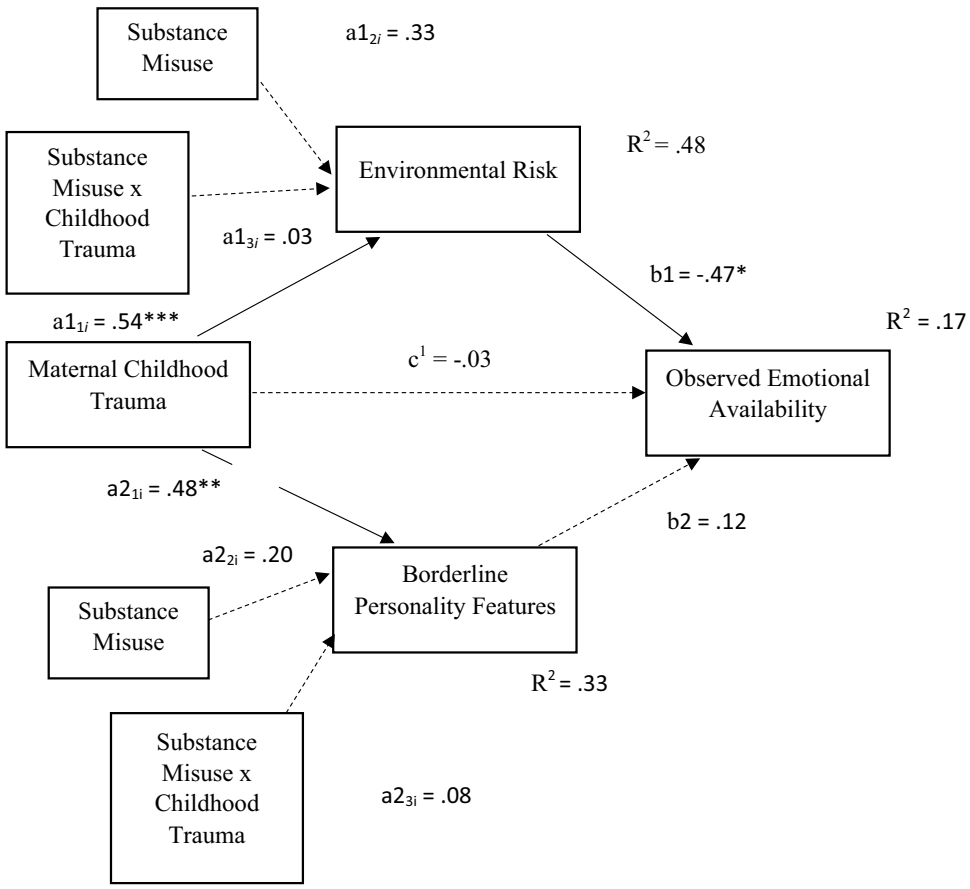

Fig. 1 Multiple mediation moderation model allows for the simultaneous analysis of—(i) borderline personality features and environmental risk as mediators of the association between maternal childhood trauma and observed emotional availability and (ii) substance misuse as a moderator on the relationship between maternal childhood trauma and **a** environmental risk and **b** borderline personality features. All values are standardized regression coefficients. Each 'a' path is the effect of Childhood Trauma on the mediating variables. The 'b' paths present the associations between the mediating variables and total scores of Observed Emotional Availability. *$p < .05$; **$p < .01$; ***$p < .001$. Solid lines indicate significant direct and indirect effects. Broken lines indicated no significant indirect effect. R^2 = variance accounted for the model

Table 5 Moderation mediation model reporting unstandardized indirect effects (N = 51)

	Bootstrap estimate	SE	BC 95% CI lower	BC 95% CI upper
Environmental risk	−.075*	.035	−.151	−.020
Borderline personality features	.015	.029	−.027	.098
Childhood trauma × substance misuse on environmental risk	−.008	.039	−.098	.061
Childhood trauma × substance misuse on borderline personality features	.006	.018	−.031	.044

Based on 10,000 bootstrap samples

BC bias-corrected, *CI* confidence interval

*Indirect effect is significant when the CI does not pass through zero. Unstandardized indirect effect reported

there was a significant *specific* indirect effect via environmental risk but not via borderline personality features. In other words, (i.e., when controlling for shared variance between the two mediators) there was a significant indirect effect via environmental risk when controlling for borderline personality features, but no significant indirect effect via borderline personality features when controlling for environmental risk on observed emotional availability.

The Moderating Model

In addition to the mediation analysis, we simultaneously tested whether substance misuse moderated the relationship between history of childhood trauma and the outcomes of interest (i.e., substance misuse × environmental risk and substance misuse × borderline personality features). As presented in Table 5, the results showed that substance misuse did not moderate the link between history of childhood trauma and environmental risk or borderline personality features.

Discussion

This study adds to a large literature on the quality of caregiving in mothers with substance misuse problems. There is extensive evidence indicating that caregiving is influenced by a range of characteristics that extend beyond maternal substance use. The current study focused on maternal childhood trauma, environmental adversity and borderline personality features. The first analysis investigated differences across three groups of mothers: those in treatment for substance abuse problems, mothers matched on demographic characteristics and mothers drawn from a community sample. There were no differences between the two high risk groups on the quality of the caregiving, experiences of maternal childhood trauma severity or borderline personality features. However, compared to the mothers from the community sample, both high risk groups showed lower observed emotional availability, higher adverse experience of childhood trauma and more features of adult borderline personality. While the differences between the two high risk groups did not reach statistical significance, it is notable that the effect size fell into the small to medium range ($r = .24$) and that scores were consistently higher in the SMM group compared to the CCM group (see Supplementary Table 1 for a comparison of effect sizes across this and related studies).

The findings relating to elevated scores on measures of childhood trauma in both risk groups fits with an extensive body of literature documenting compromised adult outcomes in people with exposure to childhood adversity. Similarly, these two groups also reported higher levels of distress and poorer emotional regulation, measured by severity of borderline features. These results are also consistent with prior research that has documented the adversity affecting mothers with substance misuse problems [59–62] and suggest that substance misuse per se is not sufficient to explain the poorer quality of caregiving observed in this group of women.

Further analyses were undertaken to investigate a potential pathway between exposure to childhood trauma and quality of caregiving. Factors identified in previous studies were selected as potential mediators; severity of borderline personality features and environmental adversity, and were entered into the model which simultaneously tested substance abuse status as a moderator. As expected, maternal childhood trauma, environmental risk and borderline personality features were all strongly correlated with quality of the caregiving across the total sample at the univariate level. Importantly, the relationship between maternal childhood trauma and observed emotional availability was mediated by environmental risk. There was also a significant association between maternal childhood trauma and borderline personality features, but no specific indirect effect between maternal childhood trauma and caregiving via the severity of borderline personality features. Notably, substance misuse was not a moderating factor in this analysis. Together these results suggest that the quality of caregiving these mothers provide to their infants is impaired when they are under a

high level of stress associated with environmental adversity. While there is a clear association between maternal childhood trauma and severity of borderline personality features, this does not directly impact on quality of caregiving.

Thus, this study once again underscores the relationship between early experiences of trauma and the impact that this has on caregiving [20, 63]. Importantly, the sample was drawn from diverse sources thereby ensuring that there was a range of risk and clinical characteristics that provided the opportunity to test the mediation model, albeit in a small sample.

These findings have important clinical implications. In recent years, there has been a growing interest in the development of parenting programs that provide support to vulnerable families. Accompanying this has been a shift away from a focus on the behavioural management of children, to a greater focus on the quality of the caregiving relationship. Some of these programs such as Minding the Baby [64], the Mother and Toddlers Program [65] and Parents Under Pressure [66, 67] have an explicit focus on the quality of caregiving. These programs are developed for high risk women; young first time pregnant mothers and mothers with substance misuse, thus it is highly likely that many of these women will come to treatment with a history of childhood trauma. However, the results of our study indicate that childhood trauma was not directly associated with the quality of caregiving but was mediated by environmental risk. Thus, programs supporting high risk mothers need to be both cognisant of the potential impact childhood trauma has had on women, and focus on supporting mothers facing environmental challenges. However, the extent to which borderline personality features may also contribute to the quality of caregiving when mothers have had childhood adversity cannot be confirmed in the current study as this pathway was not significant.

The mediating pathway of environmental risk draws attention to the ongoing importance of ensuring that interventions targeting vulnerable mothers include an ecological perspective that considers the complexity of adversity that they live with [68]. These mothers often experience financial hardship and social isolation [62] and face ongoing adversity such as domestic violence [69]. While many of the environmental risks in the current study are historical and therefore unchangeable (e.g., adolescent pregnancy) others are more malleable and could potentially be the focus of interventions (e.g., social support, stress and financial disadvantage that may be related in part to poor budgeting and/or unemployment).

Limitations

There are several limitations to this study. The first limitation is related to the relatively small sample size for both the planned comparisons and mediation analysis. Despite showing no significant difference between substance misusing mothers and the matched comparison mothers on all variables, the effect sizes calculated were comparable with previous research studies, indicating this sample showed similar trends and population characteristics with other research in the field exploring quality of caregiving. However, given the large correlations between the predictor (childhood trauma) and mediating variables (environment risk and borderline personality features) and the medium correlation between environmental risk and maternal sensitivity, the recommended sample size to test the mediated effect (using 95% bias-corrected bootstrapping) with .8 power is approximately 54 participants [54]. As noted, the lack of a significant indirect effect of borderline personality features and the quality of caregiving appears due to the considerable shared variance between borderline features and environmental risk (and consequent reduction in the unique effect of borderline personality features and caregiving quality with environmental risk). Therefore, it is suggested that detection of the indirect effect via borderline personality features in this study was limited, as the overlap between environmental risk and such personality features was too great. Thus, research with larger samples is necessary to further test our proposed model and its predicted associations.

Secondly, as with any cross-sectional study, causal effects cannot be established [70]. However, Preacher and Hayes [71] support the use of mediational analysis in behavioural research when the proposed indirect effects can be established on theoretical grounds, which is the case in this research. Furthermore, previous research findings support the associations between childhood trauma, psychopathology with specific reference to borderline personality features, environmental risk and poor quality of caregiving over time. The findings from this cross-sectional study add to this body of work.

Thirdly, inclusion of present trauma specifically domestic violence [30]; other psychiatric diagnosis (e.g., depression) [72]; and importantly the impact that all of these factors have on child behaviour and optimal child development [73–75] should be considered in future research studies given the complex nature of family dynamics in high risk mothers in the context of a history of childhood trauma. These factors were outside the scope of this current study.

Summary

Our results demonstrate that high risk mothers with and without substance misuse show compromised caregiving compared to a matched community sample. Further, these two groups were significantly different on measures of maternal childhood trauma and adult psychopathology, i.e., borderline personality features. An indirect pathway

from maternal childhood trauma via environmental risk to the quality of caregiving was found. This data underscores the importance of addressing maternal childhood trauma in the further development of attachment-focused parenting programs for high risk mothers and their children. The ongoing exposure to environmental adversity would also suggest that programs need to ensure that case management support addressing these environmental factors is either included within the program itself or that liaison with other services is undertaken.

Acknowledgements The Denise Hatzis gratefully acknowledges receiving a Griffith University Postgraduate Research Scholarship that was awarded to her (2011-2014; CRICOS Provider Number: 00233E), to support candidature in the Doctor of Philosophy in Clinical Psychology (062206F) in the School of Applied Psychology.

Compliance with Ethical Standards

Conflict of interest All Author declares that they have no conflict of interest.

Ethical Approval Study was conducted in accordance with APA ethical standards and approved by Griffith University Human Ethics (Protocol GU Reference No: PSY/34/13/HREC) and Human Research Ethics Committee Metro North Hospital and Health Services (Protocol Reference No: HREC/14/QPCH/249).

References

1. Salo S, Kivisto K, Korja R, Biringen Z, Tupola S, Kahila H et al (2009) Emotional availability, parental self-efficacy beliefs, and child development in caregiver–child relationships with buprenorphine-exposed 3-year-olds. Parenting 9(3–4):244–259
2. Eiden R (2001) Maternal substance use and mother–infant feeding interactions. Infant Ment Health J 22(4):497–511
3. Howard J, Beckwith L, Espinosa M, Tyler R (1995) Development of infants born to cocaine-abusing women: biologic/maternal influences. Neurotoxicol Teratol 17(4):403–411
4. Espinosa M, Beckwith L, Howard J, Tyler R, Swanson K (2001) Maternal psychopathology and attachment in toddlers of heavy cocaine-using mothers. Infant Ment Health J 22(3):316–333
5. LaGasse LL, Messinger D, Lester BM, Seifer R, Tronick E, Bauer CR et al (2003) Prenatal drug exposure and maternal and infant feeding behaviour. Arch Dis Child Fetal Neonatal Ed 88(5):F391–F399
6. Tronick E, Messinger D, Weinberg MK, Seifer R, Shankaran S, Wright LL et al (2005) Cocaine exposure is associated with subtle compromises of infants' and mothers' social–emotional behavior and dyadic features of their interaction in the face-to-face still-face paradigm. Dev Psychol 41(5):711–722
7. Sarfi M, Smith L, Waal H, Sundet JM (2011) Risks and realities: dyadic interaction between 6-month-old infants and their mothers in opioid maintenance treatment. Infant Behav Dev 34(4):578–589
8. Salo S, Politi J, Tupola S, Biringen Z, Kalland M, Halmesmaki E et al (2010) Early development of opioid-exposed infants born to mothers in buprenorphine-replacement therapy. J Reprod Infant Psychol 28(2):161–179
9. Neuspiel DR, Hamel SC, Hochberg E, Greene J, Campbell D (1991) Maternal cocaine use and infant behavior. Neurotoxicol Teratol 13(2):229–233
10. Ukeje I, Bendersky M, Lewis M (2001) Mother–infant interaction at 12 months in prenatally cocaine exposed children. Am J Drug Alcohol Abuse 27(2):203–224
11. Uhlhorn SB, Messinger DS, Bauer CR (2005) Cocaine exposure and mother–toddler social play. Infant Behav Dev 28(1):62–73
12. Hatzis D, Dawe S, Harnett P, Barlow J (2017) Quality of caregiving in mothers with illicit substance use: a systematic review and meta-analysis. Subst Abuse 11:1–15
13. Minnes S, Singer LT, Kirchner HL, Satayathum S, Short EJ, Min M et al (2008) The association of prenatal cocaine use and childhood trauma with psychological symptoms over 6 years. Arch Womens Ment Health 11(3):181–192
14. Sansone RA, Sansone LA (2011) Substance use disorders and borderline personality: common bedfellows. Innov Clin Neurosci 8(9):10–13
15. Dawe S, Loxton NJ (2004) The role of impulsivity in the development of substance use and eating disorders. Neurosci Biobehav Rev 28(3):343–351
16. Hatch SL (2007) Economic stressors, social integration, and drug use among women in an inner city community. J Drug Issues 37(2):257–280
17. Ammerman RT, Shenk CE, Teeters AR, Noll JG, Putnam FW, Van Ginkel JB (2013) Multiple mediation of trauma and parenting stress in mothers in home visiting. Infant Ment Health J 34(3):234–241
18. Bert SC, Guner BM, Lanzi RG (2009) The influence of maternal history of abuse on parenting knowledge and behavior. Fam Relat 58(2):176–187
19. Lyons-Ruth K, Bureau J-F, Easterbrooks MA, Obsuth I, Hennighausen K, Vulliez-Coady L (2013) Parsing the construct of maternal insensitivity: distinct longitudinal pathways associated with early maternal withdrawal. Attach Hum Dev 15(5–6):562–582
20. DeOliveira C, Wolfe V, Bailey H (2004) In: Children CfRoVAWa (ed) The effect of childhood maltreatment on the parent–child relationship: project summary. CANADA Centre for Research on Violence Against Women and Children, London
21. Mielke EL, Neukel C, Bertsch K, Reck C, Mohler E, Herpertz SC (2016) Maternal sensitivity and the empathic brain: influences of early life maltreatment. J Psychiatr Res 77:59–66
22. Beck JG, Grant DM, Clapp JD, Palyo SA (2009) Understanding the interpersonal impact of trauma: contributions of PTSD and depression. J Anxiety Disord 23(4):443–450
23. Fonagy P, Target M, Gergely G, Allen JG, Bateman AW (2003) The developmental roots of borderline personality disorder in early attachment relationships: a theory and some evidence. Psychoanal Inq 23(3):412–459
24. White H, Flanagan TJ, Martin A, Silvermann D (2011) Mother–infant interactions in women with borderline personality disorder, major depressive disorder, their co-occurrence, and healthy controls. J Reprod Infant Psychol 29(3):223–235
25. Crandell LE, Patrick MPH, Hobson RP (2003) 'Still-face' interactions between mothers with borderline personality disorder and their 2-month-old infants. Br J Psychiatry 183(3):239–247
26. Hans SL, Bernstein VJ, Henson LG (1999) The role of psychopathology in the parenting of drug-dependent women. Dev Psychopathol 11(04):957–977
27. Newman L, Stevenson CS, Bergman LR, Boyce P (2007) Borderline personality disorder, mother–infant interaction and parenting perceptions: preliminary findings. Aust N Z J Psychiatry 41(7):598–605
28. Cyr C, Euser EM, Bakermans-Kranenburg M, van Ijzendoorn MH (2010) Attachment security and disorganization in maltreating and

high-risk families: a series of meta-analyses. Dev Psychopathol 22(1):87–108
29. Chapple CL (2003) Examining intergenerational violence: violent role modeling or weak parental controls? Violence Vict 18(2):143–162
30. Widom CS, Czaja SJ, Dutton MA (2008) Childhood victimization and lifetime revictimization. Child Abuse Negl 32(8):785–796
31. Widom CS, White HR (1997) Problem behaviours in abused and neglected children grown up: prevalence and co-occurrence of substance abuse, crime and violence. Crim Behav Ment Health 7(4):287–310
32. Cancian M, Slack K, Yang M (2010) In: Poverty IfRo (ed) The effect of family income on risk of child maltreatment. Discussion Paper No. 1385-10. University of Wisconsin, Madison
33. Sedlak AJ, Mettenburg J, Basena M, Petta I, McPherson K, Greene A et al (2010) National incidence study of child abuse and neglect (NIS-4): report to Congress. U.S. Department of Health and Human Services, Administration for Children and Families, Washington, DC
34. Bornstein MH, Hahn CS, Suwalsky JTD, Haynes OM (2011) Maternal and infant behavior and context associations with mutual emotion availability. Infant Ment Health J 32(1):70–94
35. Bernstein D, Fink L (1998) Childhood Trauma Questionnaire: A retrospective self-report manual San Antonio. The Psychological Corporation, TX
36. Bernstein D, Ahluvalia T, Pogge D, Handelsman L (1997) Validity of the Childhood Trauma Questionnaire in an adolescent psychiatric population. J Am Acad Child Adolesc Psychiatry 36(3):340–348
37. Bernstein D, Fink L, Handelsman L, Foote J, Lovejoy M, Wenzel K et al (1994) Initial reliability and validity of a new retrospective measure of child abuse and neglect. Am J Psychiatry 151(8):1132–1136
38. Paivio SC, Cramer KM (2004) Factor structure and reliability of the Childhood Trauma Questionnaire in a Canadian undergraduate student sample. Child Abuse Negl 28(8):889–904
39. Bernstein D, Stein J, Newcomb MD, Walker E, Pogge D, Ahluvalia T et al (2003) Development and validation of a brief screening version of the Childhood Trauma Questionnaire. Child Abuse Negl 27(2):169–190
40. Morey LC (1991) Personality assessment inventory. PAR Psychological Assessment Resources, Inc, Lutz
41. Gardner K, Qualter P (2009) Reliability and validity of three screening measures of borderline personality disorder in a nonclinical population. Personal Individ Differ 46(5–6):636–641
42. Trull TJ, Stepp SD, Solhan M (2006) Borderline personality disorder. In: Hersen M, Thomas JC (eds) Comprehensive handbook of personality and psychopathology: adult psychopathology, vol 2. Wiley, Hoboken
43. Trull TJ (1995) Borderline personality disorder features in nonclinical young adults: 1. Identification and validation. Psychol Assess 7(1):33–41
44. Sameroff A, Seifer R, Baldwin A, Baldwin C (1993) Stability of intelligence from preschool to adolescence: the influence of social and family risk factors. Child Dev 64(1):80–97
45. Evans GW, Li D, Whipple SS (2013) Cumulative risk and child development. Psychol Bull 139(6):1342–1396
46. Lovibond SH, Lovibond PF (1995) Manual for the Depression, Anxiety Stress Scale. Psychology Foundation Monograph, Sydney
47. Zimet GD, Dahlem NW, Zimet SG, Farley GK (1988) The multidimensional scale of perceived social support. J Pers Assess 52(1):30
48. Biringen Z (2008) The Emotional Availability (EA) Scales, 4th edn. Emotionalabailability.com, Boulder
49. Dixon L, Browne K, Hamilton-Giachritsis C (2005) Risk factors of parents abused as children: a mediational analysis of the intergenerational continuity of child maltreatment (Part I). J Child Psychol Psychiatry 46(1):47–57
50. Herman JL (1989) Childhood trauma in borderline personality disorder. Am J Psychiatry 146(4):490–495
51. Perry N, Newman LK, Hunter M, Dunlop A (2015) Improving antenatal risk assessment in women exposed to high risks. Clin Child Psychol Psychiatry 20(1):84–105
52. Fraser JG, Harris-Britt A, Thakkallapalli EL, Kurtz-Costes B, Martin S (2010) Emotional availability and psychosocial correlates among mothers in substance-abuse treatment and their young infants. Infant Mental Health Journal. 31(1):1–15
53. Macfie J, Swan SA (2009) Representations of the caregiver–child relationship and of the self, and emotion regulation in the narratives of young children whose mothers have borderline personality disorder. Dev Psychopathol 21(3):993–1011
54. Fritz MS, Mackinnon DP (2007) Required sample size to detect the mediated effect. Psychol Sci 18(3):233–239
55. Faul F, Erdfelder E, Buchner A, Lang A-G (2009) Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. Behav Res Methods 41(4):1149–1160
56. Aguinis H, Beaty J, Boik R, Pierce C (2005) Effect size and power in assessing moderating effects of categorical variables using multiple regression: a 30-year review. J Appl Psychol 90(1):94–107
57. Hayes AF (2013) Introduction to mediation, moderation, and conditional process analysis: a regression-based approach. The Guilford Press, New York
58. Hayes AF, Rockwood NJ (2017) Regression-based statistical mediation and moderation analysis in clinical research: observations, recommendations, and implementation. Behav Res Ther 98:39–57
59. Eiden R, Godleski S, Colder CR, Schuetze P (2014) Prenatal cocaine exposure: the role of cumulative environmental risk and maternal harshness in the development of child internalizing behavior problems in kindergarten. Neurotoxicol Teratol 44:1–10
60. Kettinger LA, Nair P, Schuler ME (2000) Exposure to environmental risk factors and parenting attitudes among substance-abusing women. Am J Drug Alcohol Abuse 26(1):1–11
61. Nair P, Schuler ME, Black MM, Kettinger L, Harrington D (2003) Cumulative environmental risk in substance abusing women: early intervention, parenting stress, child abuse potential and child development. Child Abuse Negl 27(9):997–1017
62. Suchman N, McMahon TJ, Slade A, Luthar S (2005) How early bonding, depression, illicit drug use, and perceived support work together to influence drug-dependent mothers' caregiving. Am J Orthopsychiatry 75(3):431–445
63. Fuchs A, Möhler E, Resch F, Kaess M (2015) Impact of a maternal history of childhood abuse on the development of mother–infant interaction during the first year of life. Child Abuse Negl 48:179–189
64. Sadler LS, Slade A, Close N, Webb DL, Simpson T, Fennie K et al (2013) Minding the baby: enhancing reflectiveness to improve early health and relationship outcomes in an interdisciplinary home visiting program. Infant Ment Health J 34(5):391–405
65. Suchman N, DeCoste C, Castiglioni N, Legow N, Mayes L (2008) The mothers and toddlers program: preliminary findings from an attachment-based parenting intervention for substance-abusing mothers. Psychoanal Psychol 25(3):499–517
66. Dawe S, Harnett P (2007) Reducing potential for child abuse among methadone-maintained parents: results from a randomized controlled trial. J Subst Abuse Treat 32(4):381–390
67. Barlow J, Sembi S, Parsons H, Kim S, Petrou S, Harnett P et al (2018) A randomized controlled trial and economic evaluation of the parents under pressure program for parents in substance abuse treatment. Drug Alcohol Depend 194:184–194
68. Valentino K (2017) Relational interventions for maltreated children. Child Dev 88(2):359–367

69. Wekerle C, Wall A-M, Leung E, Trocmé N (2007) Cumulative stress and substantiated maltreatment: the importance of caregiver vulnerability and adult partner violence. Child Abuse Negl 31(4):427–443
70. Maxwell SE, Cole DA, Mitchell MA (2011) Bias in cross-sectional analyses of longitudinal mediation: partial and complete mediation under an autoregressive model. Multivar Behav Res 46(5):816–841
71. Preacher KJ, Hayes AF (2008) Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behav Res Methods 40(3):879–891
72. Hill J (2009) Developmental perspectives on adult depression. Psychoanal Psychother 23(3):200–212
73. Fusco RA (2015) Socioemotional problems in children exposed to intimate partner violence: mediating effects of attachment and family supports. J Interpers Violence 32(16):2515–2532
74. Fusco RA, Fantuzzo JW (2009) Domestic violence crimes and children: a population-based investigation of direct sensory exposure and the nature of involvement. Child Youth Serv Rev 31(2):249–256
75. Quinlivan JA, Evans SF (2005) Impact of domestic violence and drug abuse in pregnancy on maternal attachment and infant temperament in teenage mothers in the setting of best clinical practice. Arch Womens Ment Health 8(3):191–199