Maternal childhood abuse and neglect predicts offspring development in early childhood: The roles of reflective functioning and child sex

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ABSTRACT

Background: Recent evidence suggests that offspring of mothers having been exposed to childhood abuse and neglect (CA&N) are at increased risk of developmental problems and that boys are more affected by maternal CA&N than girls. Since impairments in reflective functioning (RF) have been associated with maternal CA&N and offspring development, RF could represent a key mechanism in these intergenerational risk trajectories.

Objective: This study evaluated mediating (RF) and moderating (child sex) mechanisms in the association between maternal CA&N and child development.

Participants and setting: In a longitudinal setting, 111 mothers completed measures during pregnancy and between 11 and 36 months postpartum.

Methods: CA&N and impairments in RF were assessed during pregnancy and offspring development was measured during the longitudinal follow-up using the Ages and Stages Questionnaires (ASQ-3). Child development was operationalized in two ways: using the global score at the ASQ-3 and using a dichotomous score of accumulation of delays across domains of development.

Results: Structural equation modeling indicated that RF mediated the association between maternal CA&N and offspring development. Child sex moderated the association between CA&N and the clustering of developmental problems (Wald = 5.88, $p = 0.02$), with boys being particularly likely to accumulate developmental delays when their mother experienced CA&N (RR = 2.62). Accumulation of developmental problems was associated with impairments in maternal RF in girls and with maternal exposure to CA&N in boys.

Conclusions: Results provide novel insights on the role of mentalization and child sex in the association between maternal CA&N and child development.

1. Introduction

Maternal exposure to childhood abuse and neglect (CA&N) has long-lasting consequences on functioning, mental health, and physical health (Afifi, Boman, Fleisher, & Sareen, 2009; Afifi et al., 2014; Anda et al., 2006). CA&N also has documented intergenerational impacts. Indeed, offspring of mothers having been exposed to CA&N were shown to be more likely to present biological (Brand et al., 2010; Buss et al., 2017; Moog et al., 2018), behavioral (Bouvette-Turcot et al., 2019; Choi et al., 2019; Leen-Feldner et al., 2013; Stepleton et al., 2018), and developmental problems (Choi et al., 2017; Folger et al., 2017,2018; McDonnell & Valentino, 2016; Racine, Plamondon, Madigan, McDonald, & Tough, 2018; Sun et al., 2017) in early childhood than children born to mothers without histories of CA&N. Identifying prenatal precursors of the intergenerational impact of maternal CA&N on offspring development, which could be mitigated through therapeutic interventions, is considered a priority in trauma research (Berthelot, Garon-Bissonnette, Lemieux, Drouin-Maziade, & Maziade, 2020; Berthelot, Lemieux, & Maziade, 2019; Shonkoff, 2016). The present study aims to identify such a mechanism by evaluating whether impairments in mentalization abilities in pregnant women mediate the association between maternal history of CA&N and offspring development.

1.1. Maternal CA&N and offspring development

Maternal CA&N has been associated with negative outcomes across numerous spheres of offspring development. Most studies have reported on socioemotional development (Choi et al., 2017; Folger et al., 2017; McDonnell & Valentino, 2016; Sun et al., 2017). They found that the severity of maternal CA&N was associated with offspring being more distressed and sad when frustrated or punished (Bosquet Enlow, Englund, & Egeland, 2018) and showing more internalized and externalized behavior problems (Fenerci & DePrince, 2018; Pereira, Ludmer, Gonzalez, & Atkinson, 2018; Rijlaarsdam et al., 2014). Two studies with diverse samples of mothers, one a large sample of highly traumatized mothers (almost 70 % exposed to CA&N) (Folger et al., 2017) the other a community sample of mothers (McDonnell & Valentino, 2016), also reported that maternal CA&N significantly increases offspring socioemotional developmental risk.

To our knowledge, research on the association between maternal exposure to CA&N and offspring global development is scarce. Sun et al. (2017), in their large sample of 1,293 mothers from the community, reported that mothers having been exposed to CA&N or other adverse life events were between 1.76–2.21-times more likely to report significant concerns regarding their child's development. Their concerns about their child's development also increased with the severity of exposure to CA&N (Sun et al., 2017). In a sample of 311 mothers from the community, Folger et al. (2018) found that each additional adverse experience in childhood was associated with an 18 % risk increase in child suspected developmental delay, defined, in their study, as one domain in the delay range or two or more domains in the monitoring range using the Ages and Stages Questionnaires (Squires, Twombly, Bricker, & Potter, 2009) completed by mothers. Lower scores on each developmental domain (communication, problem solving, personal-social, gross motor, and fine motor) were also associated with the severity of exposure to maternal CA&N (Folger et al., 2018). However, Racine et al. (2018) reported no direct association between maternal CA&N and offspring developmental risk. They rather showed that maternal CA&N was indirectly associated with child development through biological (i.e., pregnancy and infant health risk) and psychosocial (i.e., maternal prenatal psychosocial risk and hostile behavior) mechanisms.

Moreover, the determinants of child development may be different in boys and girls. Indeed, brain development (Etchell et al., 2018) and development in multiple domains such as socioemotional (Chaplin & Aldao, 2013), fine motor skills and language (Peyre et al., 2019) were shown to follow different pathways in boys and girls. Boys are generally at higher risk of developmental delays (Kerstjens et al., 2013), neurodevelopmental disorders (Kigar & Auger, 2013), and externalizing problems (Chaplin & Aldao, 2013) than girls. Recent evidence has shown that toddler boys would be more vulnerable to the effects of maternal adverse childhood experiences (Letourneau et al., 2019). Nonetheless, studies on the intergenerational impact of CA&N rarely include child sex.

1.2. Reflective functioning in parents having been exposed to CA&N

Over the last two decades, the theory of mentalization gained attractiveness for understanding risk and resilience trajectories in people exposed to CA&N, both in theoretical work (Fonagy & Bateman, 2016; Luyten & Fonagy, 2019) and empirical research (Ensink, Berthelot, Begin, Maheux, & Normandin, 2017; Ensink, Normandin, Plamondon, Berthelot, & Fonagy, 2016; Quek et al., 2017). Mentalization, operationalized as reflective functioning (RF), refers to the ability to perceive and interpret human behaviors in terms of intentional mental states such as emotions, wishes, goals, or desires (Fonagy, Gergely, Jurist, & Target, 2002). Mentalizing abilities are developmentally acquired and emerge from attachment relationships. Thus, the development of mentalization may be compromised in the context of CA&N since maltreating parents, by definition, fail to recognize or consider their children's mental states in meaningful moments. In addition, children exposed to CA&N may integrate that the world is scary and unpredictable and defensively cut themselves off from thinking of their attachment figures in terms of mental states (Allen, Fonagy, & Bateman, 2008). Either way, children are deprived of opportunities to develop their understanding of the psychological world and their mentalizing abilities.

For decades, validated measures that assessed RF were interview-based, time- and labor-intensive and required highly trained coders (Fonagy & Luyten, 2016). Whereas the original interview format measures of RF have the advantage of capturing the complexity of mentalizing processes, concerns have been raised regarding the ability of such coding protocols to capture pseudomentalizing and, in particular, hypermentalization (Newman-Morris et al., 2020). The Reflective Functioning Questionnaire (RFQ; Fonagy, Luyten et al., 2016) has thus been developed to capture two broad types of impairments in RF that are particularly common in mental health disorders, namely hypomentalization and hypermentalization (Fonagy & Luyten, 2016). Hypermentalization refers to

the tendency to be overly certain and excessively detailed about mental states of self or others without appropriate evidence to support these representations. This tendency is typically observed in long and in-depth interpretations of mental states that have little relation to available evidence. The opposite tendency, hypomentalization, reflects an inability or unwillingness to consider the complexity of mental states of self and others. Mental states are hence perceived as being completely opaque and unapproachable (Badoud et al., 2015; Fonagy, Luyten et al., 2016). Hypomentalization thus manifests through an excessively concrete thinking and an absence of effort to tease out mental states underlying behaviors. Since its publication, the RFQ has been widely used with community and clinical samples, and significant associations have been observed between the severity of exposure to CA&N and on one hand, hypomentalization (Kristiansen et al., 2019; Li, Carracher, & Bird, 2020) and on the other hand, hypermentalization (Li et al., 2020; Macfie et al., 2020). Such associations between CA&N and RF appeared less clear when using the Adult Attachment Interview or the Parent Development Interview (Berthelot et al., 2015; Stacks et al., 2014), suggesting that the RFQ may provide complementary information to the original coding protocols by tapping more specifically into the degree of impairments in RF rather than assessing the complexity of mentalization processes.

Recent evidence has shown that mentalization in parents is associated with offspring development. For example, in a sample of six-month old preterm babies, children of mothers with high RF were comforted by the return of their mothers after a short separation period and showed more self-soothing behaviors when distressed, whereas children of mothers with poor RF experienced more negative emotions during periods of reunification with their mothers and showed less self-soothing behaviors (Heron-Delaney et al., 2016). In a sample of high-risk pregnant women followed-up postnatally with their child, children of mothers with high RF reported significantly less aggressive behaviors at four time points between 6 and 20 months of age than those of mothers with poor RF (Smaling, Huijbregts, van der Heijden, van Goozen, & Swaab, 2016). A recent review concluded that good maternal RF promotes child behavioral development (Camoirano, 2017). To our knowledge, studies on the mediating role of impairments in reflective functions in the association between maternal CA&N and child global development have yet to be conducted.

1.3. The present study

Our main goal was to investigate whether impairments in RF mediated the association between maternal CA&N and child development between 11 and 36 months and whether this association was moderated by child sex. We considered covariates (maternal psychopathology and sociodemographic risk) that have been associated with maternal CA&N and offspring development in previous research (Folger et al., 2018; Racine et al., 2018). In addition to considering a continuous score of child development as primary outcome, we also computed a score of clustering of developmental problems across five domains of development (≥ 2 domains in the delayed range) since minor developmental delays in early childhood would bear little predictive significance in regard to later development (Gould et al., 2019). Our hypotheses were that maternal CA&N would influence child development indirectly through the mothers' RF, and that this effect would be particularly apparent in young boys.

2. Methods

Pregnant women were recruited between September 2015 and September 2018 during prenatal classes. Nurses briefly explained the research project and potential participants were asked to complete, on site, a contact information sheet and the Childhood Trauma Questionnaire (Bernstein et al., 2003). Participants were then contacted by the research team during the third trimester of pregnancy (T1). Those who agreed to participate received, by mail or electronically, the complete set of self-reported questionnaires, including assessments of prenatal psychological symptoms, RF and sociodemographic data. Between 11 and 36 months postpartum, eligible mothers were invited to participate in the longitudinal follow-up. Those who agreed to the follow-up received the complete set of questionnaires, including mother-report questionnaires on child development. Inclusion criteria were being aged 17 years or older at T1, not suffering from a severe psychiatric disorder (e.g., psychosis), not reporting premature childbirth (< 37 weeks), severe peri-partum complications or child congenital disorder, and having a child aged between 11 and 36 months. The study received ethical approval from the Comité d'éthique de la recherche avec des êtres humains de l'Université du Québec à Trois-Rivières (CER-15-210-07.02) and the Comité d'éthique de la recherche du Centre Intégré Universitaire de Santé et de Services Sociaux de la Mauricie-et-du-Centre-du-Québec (CER2014-027-00).

2.1. Participants

Two hundred and thirty-five women completed all measures during the third trimester of pregnancy. Eleven women declined further participation, 26 could not be reached, 68 did not complete the entire set of questionnaires at T2, and 19 were excluded based on the inclusion criteria. Participants who did not complete T2 were more likely to have experienced CA&N (37.9 %) than mothers who participated in the follow up (24.3 %), $\chi2(1) = 5.01, p = 0.03$. However, participants did not differ from those who did not complete all measures at the follow-up in terms of education, $\chi2(7) = 5.64, p = 0.58$, and household income, $\chi2(10) = 10.19, p = 0.42$.

The present study thus comprised 111 women aged between 17 and 41 years old at T1 ($M = 28.31, SD = 4.18$), the vast majority being primiparous (87.8 %). At T2, their children (53.2 % girls) were around 15 months old ($M = 14.99, SD = 6.33$). Women were mainly French-speaking Caucasians (98.1 %), employed (full- or part-time; 85.5 %) and in common-law relationships or married (94.5 %). Three mothers had separated between T1 and T2 and were single at follow-up. Eight percent had an annual family income below the low-income cutoff for a family with one child in Canada at T2 (Can\$ 33 396) (Statistics Canada, 2017). The majority of mothers had some post-secondary education (91.8 %): 2.7 % had no high-school diploma, 5.4 % had a high-school diploma, 44.1 % had some

collegial or professional training, and 47.8 % had a university degree. Overall, participants were predominantly in common-law relationships (very common in the province of Quebec where the research was conducted), highly educated and financially well resourced.

2.2. Measures

2.2.1. Sociodemographics

We developed a sociodemographic risk index based on extensively researched risk factors for parenting and child development. Using such indices would be a better strategy than considering each variable independently as they capture the more complex phenomena of cumulative risk (Moore, Vandivere, & Redd, 2006). Our index ranges from 0 to 4 and sums binary scores (absent vs. present) of four recognized risk factors: not having graduated from high school, having a familial income below the low-income cut-off for a family with one child, being younger than 20 years old during pregnancy and having a criminal record.

2.2.2. Maternal child abuse and neglect

Maternal CA&N was assessed using the 28-item self-reported French version (Lacharité, Deshaulniers, & St-Laurent, 2002) of the Childhood Trauma Questionnaire (CTQ-28) (Bernstein et al., 2003). Responses to each item are rated on a 5-point Likert scale, ranging from 0 (*never true*) to 5 (*always true*), with higher scores reflecting more severe exposure to CA&N. The CTQ-28 assesses five types of CA&N with validated cut-offs for each subscale: physical (≥ 8), psychological (≥ 10) and sexual abuse (≥ 8) as well as physical (≥ 8) and psychological neglect (≥ 15) (Walker et al., 1999). Participants were classified in the CA&N group when they reached the cut-off in at least one subscale. The CTQ-28 shows a good validity across diverse clinical and general populations (Bernstein et al., 2003). In this study, Cronbach's alpha for the total CTQ score was $\alpha = .90$.

2.2.3. Maternal psychopathology

Maternal psychopathology was considered as a potential confounding variable in this study. Prenatal depressive, post-traumatic, and dissociative symptoms were assessed using the French versions of the *Edinburgh Postnatal Depression Scale* (EPDS; Cox, Holden, & Sagovsky, 1987), the *PTSD Checklist for DSM-5* (PCL-5; Wilkins, Lang, & Norman, 2011), and the *Dissociative Experiences Scale* (DES; Wilkins et al., 2011). For more details on measures and psychometrics properties, see (Berthelot, Lemieux, Garon-Bissonnette, Lacharité, & Muzik, 2019).

2.2.4. Maternal impairments in reflective functioning

The French version (Badoud et al., 2015) of the Reflective Functioning Questionnaire (RFQ; Fonagy, Luyten, et al., 2016) was used to evaluate the participants' capacity to think about themselves and others in terms of mental states. Responses are rated on a 7-point Likert scale from 1 (*completely disagree*) to 7 (*completely agree*). The RFQ yields two subscales reflecting distinct types of impairments in RF. The *Certainty about mental states* scale is indicative of an assumption of being excessively knowledgeable about mental states. Contrariwise, the *Uncertainty about mental states* scale refers to a complete lack of knowledge about mental states (Badoud et al., 2015). A median-scoring method is used to compute the two subscales from the same 26 items. For instance, high disagreement with the item "I don't always know why I do what I do" reflects certainty about mental states. For this scale, the response is rescored so that "strongly disagree" obtains a 3 and "disagree" a 2. A response ranging from "neither agree nor disagree" to "strongly agree" is rescored 1 or 0. On the contrary, high agreement with this item reflects uncertainty about mental states. For this scale, the response is rescored so that "strongly agree" obtains a 3 and "agree" a 2. A response ranging from "strongly disagree" to "neither agree nor disagree" is rescored 0 or 1. For both subscales, higher scores reflect higher levels of impairments (hypermentalization or hypomentalization). In our sample, scores on the Certainty scale ranged from 0–62 and scores on the Uncertainty scale ranged from 0−28. The original English version as well as a French short-version show good psychometric properties (Badoud et al., 2015; Fonagy, Luyten, et al., 2016). In this study, Cronbach's alpha was $\alpha = .83$ for the Uncertainty scale and $\alpha = .90$ for the Certainty scale.

2.2.5. Child development

The French version of the Ages and Stages Questionnaire, Third Edition (ASQ-3) was used to assess mother-reported child development (Squires et al., 2009). The version of the ASQ-3 used differed according to the age of the child. The ASQ-3 consists of 30 items reflecting child behaviors, scored on a 3-point scale: "yes" (10) (always or often), "sometimes" (5) and "not yet" (0). The ASQ-3 yields five subscales each including six items screening for developmental delays in different domains (See Table S1 in the Electronic Supplement). Scores for each domain range from 0 to 60 and higher scores indicate better developmental outcomes. In our study, the total ASQ-3 score was calculated by merging scores from each version into a single variable. Similar approaches, consisting of combining different age versions of the instrument into a single outcome variable, have been used by other authors (for instance, Steenis, Verhoeven, Hessen, & van Baar, 2015; Veldhuizen, Clinton, Rodriguez, Wade, & Cairney, 2015). Clustering of developmental problems was considered when scores met the clinical cut-offs in at least two domains. Psychometric properties (test-retest and inter-rater reliability, predictive validity) are good to excellent (Squires et al., 2009). In this study, Cronbach's alpha for the ASQ-3 total score was $\alpha = .87$ (12 months version).

2.3. Statistical analysis

First, data screening for normality and outliers detected that CTQ total scores presented two univariate outliers (cases with

standardized scores over 3.29). Mahalanobis distances ($p < .001$) showed no other multivariate outliers. In order to reduce their impact, we changed the two outliers by a raw score on the CTQ of one unit larger than the next highest score in the distribution (score of 58) (Tabachnick & Fidell, 2013). After this transformation, variables were normally distributed. Second, we evaluated potential confounding variables (maternal psychopathology and sociodemographic risk, maternal and child age) to consider in further analyses using Pearson's correlations. Third, we evaluated whether child sex interacted with maternal CA&N in the prediction of child development using multiple linear regressions (for continuous total ASQ-3 score) and logistic regressions (for the categorical score of clustering of developmental delays). We calculated the relative risk (RR) of presenting a clustering of developmental delays for boys and girls of mothers with CA&N using gender-matched children of mothers without CA&N as the reference group. Child sex was included as a moderator in subsequent structural equation modeling (SEM) analyses if outcomes were shown to be associated with sex. Forth, SEM analyses were performed with AMOS 24.0, using maximum likelihood parameter estimates, to examine the adequacy of two theoretical models, one for the continuous score of child development and one for the dichotomous score of risk clustering. In these models, maternal CA&N was the exogenous variable, child development was the endogenous variable, and impairments in RF was the mediator. Potentially confounding variables that correlated with child development were also included in the models as exogenous variables. RF was operationalized as a latent variable that was estimated through the two subscales of the RFQ (i.e., Certainty about mental states and Uncertainty about mental states). Adequacy of model fit was assessed through several indices: a nonstatistically significant chi-square value, a CFI value ≥ 0.95, a NFI value ≥ 0.95 and a RMSEA value ≤ 0.06 (Hooper, Coughlan, & Mullen, 2008). Finally, the indirect pathways between maternal CA&N and child development via RF impairments were assessed using Bootstrapping with 10,000 bootstrap samples. The indirect pathways were considered significant when the 95 % confidence interval did not include 0.

3. Results

3.1. Sample characteristics and covariates

Characteristics of study participants are presented in Table 1 and ASQ-3 scores are presented as supplementary material (Table S1). Among the 111 women in our study, 24.3 % reported CA&N. Between 10 and 24 % of offspring presented a developmental delay in one of the five domains assessed and 18.9 % displayed a clustering of developmental problems. Correlations between variables are presented in Table 2. Sociodemographic risk, maternal psychopathology and maternal and child age were not associated with offspring development (total score and dichotomous score of clustering of developmental delays). The Certainty and Uncertainty scales of the RFQ were strongly negatively correlated. Both scales were thus used to estimate a latent variable of hypomentalization in the SEM models, reflective of high levels of uncertainty and low levels of certainty about mental states.

3.2. Moderating role of child sex

The interaction between maternal CA&N and child sex in the regression analysis for the continuous score of child development was not significant ($p = .36$). In the model without the interaction term, we found that maternal CA&N ($\beta_{CA\&N} = -1.35$; t = -2.55; $p = .01$), but not child sex ($\beta_{sex} = -12.64$; t = -1.51; $p = .16$), significantly predicted child development. Child sex however moderated the association between maternal CA&N and the clustering of developmental problems in offspring since the interaction term in the logistic regression was significant (Wald = 5.88, $p = .02$, OR = 5.31). The relative risk of presenting a clustering of developmental delays was 2.62 in boys of mothers with CA&N and 1.48 in girls of mothers with CA&N, in comparison to gender-matched children of mothers without histories of CA&N (Table 3).

3.3. Mediating role of deficits in RF in the association between maternal CA&N and child development

The first model (Fig. 1) evaluated the associations between the severity of maternal CA&N, mothers' hypomentalization and the

Table 1
Characteristics of study participants in terms of exposure to CA&N, impairments in RF, clinical symptoms, and offspring development (N = 111).

Variable		Mean (SD)	% above the clinical cut-off
Maternal CA&N	Total CA&N score	30.99 (7.95)	24.3
	Psychological abuse	6.60 (2.28)	12.6
	Physical abuse	5.34 (1.42)	4.5
	Sexual abuse	5.77 (3.14)	6.3
	Psychological neglect	7.61 (3.14)	4.5
	Physical neglect	5.83 (1.62)	11.7
Maternal RF	Certainty	26.06 (12.73)	
	Uncertainty	8.05 (7.16)	
Maternal psychopathology	Depressive symptoms	7.35 (5.03)	8.1
	Post-traumatic stress symptoms	9.39 (10.85)	4.5
Child development	Dissociative symptoms	16.07 (7.40)	8.3
	Clustering of developmental delays	0.84 (1.19) [a]	18.9

Note: [a] Mean (SD) for the clustering of developmental delays refers to the number of delays in the five domains of the ASQ-3.

Table 2
Pearson bivariate correlations between CA&N, RF, child global development as well as clustering of delays as well as possible confounding variables (n = 111).

| Variable or measure	1	2	3	4	5	6	7	8	9	10
1. Severity of maternal CA&N										
2. RF Uncertainty	0.20*									
3. RF Certainty	−0.18	−0.50***								
4. Child global development	−0.23*	−0.30**	0.26**							
5. Clustering of development delays	0.24*	0.19*	−0.23*	−0.71***						
6. PTSD symptoms	0.43***	0.31**	−0.24*	0.01	0.08					
7. Dissociative symptoms	0.27**	0.29**	−0.15	−0.03	0.03	0.55***				
8. Depressive symptoms	0.20*	0.49***	−0.36***	−0.01	0.10	0.63***	0.36***			
9. Maternal age (years)	−0.14	−0.02	0.07	−0.07	0.01	−0.17	−0.09	−0.15		
10. Children age (months)	−0.07	−0.02	−0.11	0.06	0.17	0.04	−0.14	0.25*	−0.12	
11. Maternal sociodemographic risk	0.38***	0.14	−0.06	−0.09	0.15	0.18	0.01	0.06	−0.19*	0.17

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3
Relative risk of presenting a clustering of developmental delays for children of mothers with CA&N in comparison to children of mothers without CA&N in boys and girls.

	No CA&N		CA&N	
Sex	Risk of clustering developmental delays	RR	Risk of clustering developmental delays	RR
Female	5/42 = 0.119	1 (reference group)	3/17 = 0.176	1.48
Male	8/42 = 0.191	1 (reference group)	5/10 = 0.50	2.62

Note: RR: Relative risk.
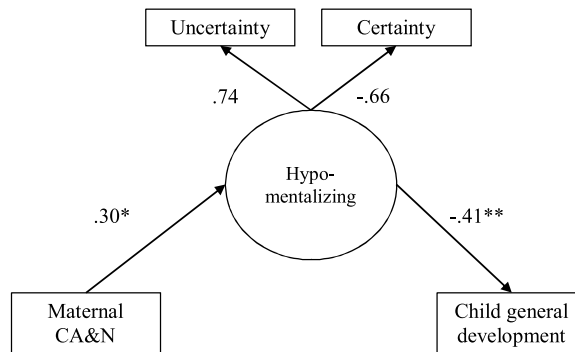
Fig. 1. Structural equation modeling of the association between maternal exposure to CA&N, maternal RF and child general development.
Note. Non-significant paths were removed from the model; Continuous scores of maternal CA&N, RF and child general development were used.
* $p < 0.05$; ** $p < 0.01$.

continuous score of child development. Indices revealed an excellent fit for the model: $\chi2(2) = 2.19$, $p = .34$, CFI = 1.00, NFI = .96, RMSEA = .03 with 90 % CI [.00, .19]. The indirect effect of maternal CA&N on child development via hypomentalization was significant ($\beta = -0.12$, $p = .05$, 95 % CI: -0.29 to -0.005) and maternal CA&N had no direct effect on child development.

3.4. Determinants of clustering of developmental problems in boys and girls

The second model (Fig. 2) evaluated the associations between exposure to maternal CA&N, mothers' hypomentalization and the clustering of delays in different domains of child development. Since the risk of showing delays in the five domains of development was different for boys and girls of mothers with histories of CA&N, two distinct models were evaluated according to child sex. No association between maternal CA&N and maternal hypomentalization was observed in the two models. Clustering of developmental problems was independently associated with maternal CA&N in boys and with maternal hypomentalization in girls.

4. Discussion

The main objective of the study was to evaluate the role of impairments in RF in the association between CA&N and child general development between 11 and 36 months, and whether this association was moderated by child sex. Overall, results confirmed the
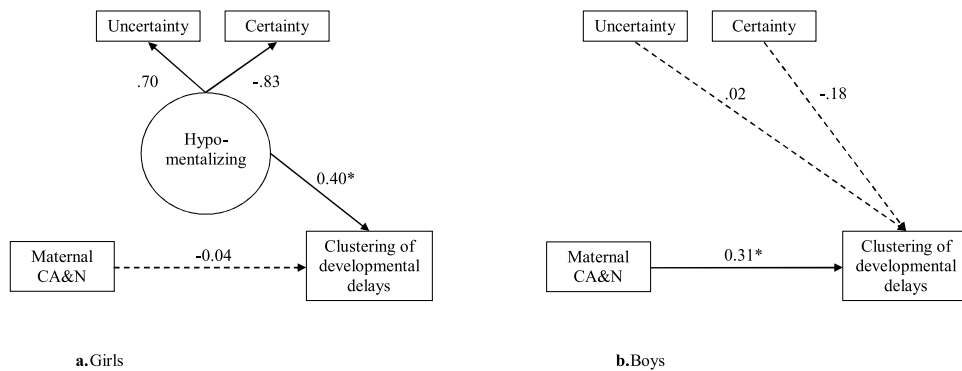
Fig. 2. Structural equation modeling of the association between maternal exposure to CA&N, maternal RF and clustering of developmental delays in boys and girls.

Note. Non-significant paths were removed from the model; Dotted lines display non-significant association; Continuous scores of maternal RF and dichotomous scores of maternal CA&N and child general development were used; RF was not operationalized as a latent variable in model 2B since factor loading did not yield good indices; Both models showed a good fit for the data: (2A) $\chi2(2) = 0.88$, $p = .65$, CFI = 1.00, NFI = .97, RMSEA = .000 with 90 % CI [.20, .69]; (2B) $\chi2(2) = 0.73$, $p = .70$, CFI = 1.00, NFI = .96, RMSEA = .000 with 90 % CI [.21, .73].
* $p < 0.05$; ** $p < 0.01$.

theoretical model: CA&N prospectively predicted child general development and this association was indirectly mediated by mothers' impairments in RF. Different pathways were observed in boys and girls who clustered developmental problems.

Our study builds on the scarce literature concerning the adverse effects of maternal CA&N on child general development (Folger et al., 2018; Racine et al., 2018) and offers additional evidence that offspring of mothers having been exposed to CA&N are more likely to present poor developmental outcomes than offspring of mothers without CA&N. In contrast with Racine et al. (2018), we did not observe significant effects of maternal psychological symptoms on child development using established questionnaires of depressive, post-traumatic stress, and dissociative symptoms.

We reported, however, that low levels of certainty and high levels of uncertainty about mental states (reflecting hypomentalization, Badoud et al., 2015) in pregnant women were predictive of their child's development one to three years later. Interestingly, our results suggest that higher certainty about mental states is associated with lower levels of post-traumatic, depressive and dissociative symptoms as well as better child global development. Although higher levels of certainty were hypothesized to reflect hyper-mentalizing (Fonagy, Luyten et al., 2016), results are in line with Badoud et al. (2015), who reported that a certain level of certainty about mental states at the RFQ would be associated with adaptive functioning. Although this is the first study, to our knowledge, to document such an association between maternal certainty and uncertainty about mental states and child global development, results expand previous findings showing that mothers' RF contributes to offspring's self-regulation (Heron-Delaney et al., 2016), secure attachment (Berthelot et al., 2015; Bérubé-Beaulieu, Ensink, & Normandin, 2016; Fonagy, Steele, Steele, Higgitt, & Target, 1994; Stacks et al., 2014; Zeegers, Colonnesi, Stams, & Meins, 2017), and temperament (Smaling et al., 2016).

One possible route through which mothers' hypomentalization impacts offspring development may be through its effect on maternal behaviors (Berthelot et al., 2015; Stacks et al., 2014; Zeegers et al., 2017). Mothers who have experienced severe adversity during their childhood may be more likely to misinterpret their children's mental states or to display a lack of curiosity regarding their children's internal world, a reality that may hold a child back from opportunities to learn about him/herself and the social world and from further developing the types of cognitive, interpersonal or motor abilities that were assessed in this study. We may hypothesize that when a child is facing a developmentally challenging task, the feelings of frustration or incompetence may evoke or reactivate a mothers' trauma. Mothers who hypomentalize may thus be particularly likely to withdraw from the interaction. In this situation, the child is left alone with a difficult task and may not benefit from the mother's support to learn to communicate adequately, solve problems, interact, or explore the environment. This remains hypothetical but finds some support in previous research on maternal attachment insecurity showing that dismissing adults, who typically hypomentalize (Ensink, Berthelot, Bernazzani, Normandin, & Fonagy, 2014), tend to fear intimacy and emotions (Bartholomew & Horowitz, 1991; Feeney, 2016) and to display less sensitive behaviors in interactions with their child than secure mothers (Mills-Koonce et al., 2011). In order to assess this hypothesis, future research should evaluate the association between maternal impairments in RF and parenting behaviors in mothers having been exposed to CA&N.

There is also a possibility that the association between impairments in RF in pregnant women exposed to CA&N and poor developmental outcomes in their child may be accounted for by biological and epigenetic mechanisms. Indeed, pregnant women with CA&N histories were shown to be at increased risk of displaying abnormalities in placental-fetal stress physiology (Buss et al., 2017; Moog et al., 2016; Toepfer et al., 2017) and elevated levels of inflammation (Coelho, Viola, Walss-Bass, Brietzke, & Grassi-Oliveira, 2014; Finy & Christian, 2018), which have been associated with poorer fetal and offspring development (Ghassabian et al., 2018). The capacity to maintain high levels of mentalization in the face of adversity may have an important regulatory impact on stress and immune systems. This hypothesis is supported by recent meta-analytic evidence showing that psychosocial interventions targeting sociocognitive processes, such as RF, were associated with improvements in immune system function over time (Shields, Spahr, &

Slavich, 2020).

In a complementary approach, we evaluated the association between maternal CA&N and the clustering of developmental delays in offspring though impairments in maternal RF. We first observed that, whereas child sex was not associated with general development using a continuous score of developmental outcomes, sex moderated the association between maternal CA&N and the clustering of developmental problems in offspring. Indeed, boys of mothers with CA&N histories were 2.6-times more likely to display a clustering of developmental delays between 11 and 36 months than boys of mothers without CA&N whereas girls of mothers with CA&N were 1.5-times more likely than their comparison group to experience problems across multiple spheres of development. Similar interaction effects between sex and trauma on the accumulation of risk indicators across development were reported in offspring of parents with major psychiatric disorders (Berthelot et al., n.d.). This finding also provides additional support to recent evidence showing that boys would be more vulnerable to the effects of maternal adverse childhood experiences than girls (Letourneau et al., 2019). We finally observed that the determinants of the clustering of developmental delays were different in boys and girls. Maternal history of CA&N, but not RF, was predictive of risk clustering in boys whereas maternal impairments in RF, but not maternal CA&N, were predictive of risk clustering in girls. These different determinants may contribute to the different developmental patterns observed across boys and girls in multiple domains of development (Chaplin & Aldao, 2013; Etchell et al., 2018; Peyre et al., 2019) and also contribute to the sex differences in vulnerability to psychopathology (Hartung & Lefler, 2019). Further research is thus required to enrich our understanding of the intergenerational repercussions of maternal exposure to CA&N on offspring general development, and on the different transmission processes in boys and girls.

This study has several strengths such as the use of a longitudinal design, the parallel analysis with a continuous score of child development and a categorical score that may be more informative in clinical practice, and the inclusion of child sex in the developmental models. The study's contributions should however be contextualized in light of some limitations. First, to interpret our findings, we relied on theoretical and historical grounds, namely the results of other investigations, as our study was correlational in nature. Despite the longitudinal design, the suggested direction between variables cannot be assured and therefore limits the ability to draw causal conclusions. Next, RF was assessed using a self-reported questionnaire which is not validated against the gold-standard interview assessing RF and which measures impairments in RF rather than abilities. Nonetheless, the RFQ was validated in several samples (Badoud et al., 2015; Fonagy, Luyten et al., 2016) and one particular strength of our study was our using the original version of the questionnaire instead of the brief 8-item version. We also observed low levels of endorsement for the Uncertainty scale, which is coherent with other studies using the RFQ with trauma-exposed adults (Li et al., 2020; Macfie et al., 2020). CA&N was similarly assessed using self-reported retrospective measures that may be sensitive to biases or distortions in recall. Likewise, child global development was measured from a screening instrument rather than using observational measures such as the Bayley (2006) and we cannot rule out the possibility of measurement errors. The longitudinal follow-up was also completed in a large timeframe that resulted in children being at different developmental stages at T2. However, this effect was mitigated by the use of different versions of the ASQ-3 adapted to the developmental level of the child and our findings showed no association between child age and global development. Finally, participants who did not complete the longitudinal follow-up were less exposed to CA&N than mothers who completed the prenatal questionnaires only, reducing the generalizability of the findings. Future research should thus consider studying larger and more socioeconomically diverse samples of parents.

In light of our research showing the mediating role of maternal impairments in RF assessed during pregnancy in the association between maternal CA&N and offspring development, there is an important need for the development and implementation of mentalization-based interventions during the perinatal period for mothers having experienced CA&N. Such prenatal programs for mothers having experienced CA&N (Berthelot, Lemieux, & Lacharité, 2018; Narayan, Bucio, Rivera, & Lieberman, 2016) and postnatal interventions for high-risk mothers (Fonagy, Sleed et al., 2016; Pajulo, Suchman, Kalland, & Mayes, 2006; Sadler, Slade, & Mayes, 2006; Suchman, Decoste, Mcmahon, Rounsaville, & Mayes, 2011) were recently developed. Future research should evaluate whether intervention-driven improvements in maternal RF also exert a positive effect on offspring development.

Declaration of Competing Interest

The authors report no conflict of interest.

Acknowledgments

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.chiabu.2021. 105030.

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