Pregnant Women's History of Childhood Maltreatment and Current Opioid Use: The Mediating

Role of Reflective Functioning

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Abstract

There is an association between the experience of childhood maltreatment and opioid misuse in adults, especially for women. However, we know little about this association in pregnancy, and less about processes that could be the target of interventions to help women parent their infants. We examined reflective functioning as a putative process. Reflective functioning is the ability to interpret one's own and others' behavior in terms of underlying mental states, e.g., emotions, motivations, and beliefs. We sampled 55 pregnant women who misused opioids and 38 women at high-risk due to medical factors, e.g., heart disease. We assessed maltreatment with the Maltreatment and Abuse Chronology of Exposure (MACE; Teicher & Parigger, 2015), and reflective functioning with the Reflective Functioning Questionnaire (RFQ; Fonagy et al., 2016). Maltreatment variables included the sum of severity across all subtypes, number of subtypes experienced, and severity of sexual, physical, and emotional abuse, and of neglect. We created a categorical opioid user group variable: women who used opioids in pregnancy vs. high-risk medical comparisons. We found that women who used opioids in pregnancy had poorer reflective functioning than did high-risk medical comparisons. We also created an opioid use severity scale (ranging from 0-3) from urine assays and history of prescribed opioids from medical records. Using Hayes's (2012) bootstrapping PROCESS macro, we found that reflective functioning mediated the association between all maltreatment variables and opioid use severity. We discuss the results in terms of how best to intervene to improve women's reflective functioning, which may help their ability to parent.

Key Words: opioid misuse; pregnancy; childhood maltreatment; reflective functioning;

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1. Introduction

There is an urgent need for research to address the opioid epidemic in the US to inform

prevention efforts, including for women who are pregnant (Stuart et al., 2018). The number of

pregnant women who misuse opioids more than quadrupled between 1999 and 2014 (Haight, Ko,

Tong, Bohm, & Callaghan, 2018). One pathway to opioid misuse found more often in women

than in men is the experience of childhood maltreatment (Conroy, Degenhardt, Mattick, &

Nelson, 2009; Stein et al., 2017). Indeed, of pregnant women who misused opioids, 61%

reported that their drug use began following childhood maltreatment (primarily sexual abuse, but

also physical and emotional abuse), compared with 20% following depression/anxiety

symptoms, 13% following family/peer pressure, and only 6% following chronic pain (Towers et

al., 2018). There is a gap, however, in identifying processes that link the experience of childhood

maltreatment to opioid misuse that could be targeted in interventions to prevent opioid misuse

(Austin, Shanahan, & Zvara, 2018).

In the current study, we assessed reflective functioning (also termed mentalization) as a

putative process. Reflective functioning refers to the capacity to understand one's own and

others' behavior as an expression of mental states such as feelings, thoughts, or motivations (also

referred to as the ability to mentalize), which develops in early caregiving relationships, and has

implications for emotional self-regulation, (Fonagy, Gergely, Jurist, & Target, 2002; Fonagy,

Steele, Steele, Moran, & Higgitt, 1991). Being able to perceive both oneself and others in terms

of mental states makes emotions, thoughts, and behaviors meaningful, understandable, and

predictable, which is key to navigating the social world (Slade, 2005). However, good reflective

functioning necessarily includes an element of uncertainty. We cannot be completely certain about our own or others' mental states: too much or too little certainty is associated with psychopathology (Fonagy et al., 1995). Instead of assessing reflective functioning with the time-consuming and expensive method of coding interviews (Fonagy et al., 1991; Slade, Grienenberger, Bernbach, Levy, & Locker, 2005), we used a questionnaire that yields two subscales: the degree of *certainty* about one's own and others' mental states and the degree of *uncertainty* (Fonagy et al., 2016). The certainty subscale reflects excessive thinking about mental states with a tendency to feel overly certain without having supporting evidence (hypermentalizing). In contrast, the uncertainty subscale reflects an inability to consider the complexity underlying mental states in self and other, with a tendency to feel overly uncertain (hypomentalizing; Fonagy et al., 2016).

1.1. Theoretical background

We theorized that childhood maltreatment and opioid misuse in pregnancy would be related through reflective functioning, based on the self-medication hypothesis. The self-medication hypothesis conceptualizes substance misuse not as a form of pleasure-seeking, but rather as a way to regulate negative emotions, for example, pursuant to childhood trauma (Khantzian, 1997). Childhood maltreatment may make the development of reflective functioning in early caregiving relationships challenging (Allen, 2013), and with poor reflective functioning the ability to regulate emotions is hampered. To cope with memories of past maltreatment and current negative emotions, an individual is thought to be more likely to embark on substance misuse (Khantzian, 1997). For a pregnant woman, this pathway may have implications not only for her, but also for her infant.

1.2. Reflective functioning, childhood maltreatment, and substance misuse

We were interested in potential differences in reflective functioning between pregnant women who misused opioids and pregnant women at high-risk due to factors other than opioid misuse, namely medical conditions. We were also interested in reflective functioning as a potential mediator in the association between a pregnant woman's experience of childhood maltreatment and the severity of her opioid use. Because reflective functioning develops in early caregiving relationships, maltreatment is theorized to be more germane than other types of trauma (Allen, 2013).

There is mixed evidence for an association between childhood maltreatment and reflective functioning. In a study of pregnant women who experienced childhood maltreatment, reflective functioning was low, and was related to difficulty investing in the pregnancy and a lack of positive expectations about becoming a mother (Ensink, Berthelot, Bernazzani, Normandin, & Fonagy, 2014). However, Stacks et al. (2014) reported that maternal history of maltreatment was not directly related to reflective functioning, although reflective functioning was related to infant attachment through sensitive parenting. Because Stacks et al. (2014) administered a maltreatment questionnaire over the phone, this may have inhibited women's openness in their responses. In a third study, there was no association between reflective functioning and childhood maltreatment in a sample of pregnant opioid users and normative comparisons (Perry, Newman, Hunter, & Dunlop, 2015). However, sample sizes were small ($n =$ 11 in the opioid group, $n = 15$ comparisons), which likely limited the power to detect effects.

In addition to limited data suggesting that maternal reflective functioning is related to childhood maltreatment, there is also some evidence that maternal reflective functioning is associated with substance misuse. In the Perry et al. (2015) study, there were no differences in reflective functioning between pregnant opioid users and normative comparisons. However, in

women who were pregnant for the first time, reflective functioning was negatively associated with substance misuse (Smaling et al., 2015), and substance-using mothers in treatment post-partum evidenced low reflective functioning, assessed with a structured interview (Pajulo et al., 2012).

1.3. The current study

In the current study we recruited women who misused opioids in pregnancy and compared them to pregnant women with medical co-morbidities unrelated to substance use. We hypothesized that: (1) women who misused opioids would have poorer reflective functioning (lower scores on the certainty subscale, higher scores on the uncertainty subscale) than would high-risk medical comparisons who did not misuse opioids, and (2) reflective functioning would mediate the association between maltreatment history (sum of severity across all subtypes of maltreatment, the number of subtypes of maltreatment experienced, severity of sexual abuse, parental physical abuse, neglect, and emotional abuse) and opioid use severity. See Figure 1.

2. Method

2.1. Participants

We enrolled 93 pregnant women from a High-Risk Pregnancy Clinic at a University Medical Center in the Southeastern US, serving 200-250 new patients per year in both rural and urban areas. All women in the high-risk clinic were eligible if they were over 18 years old and were in their second trimester or beyond. We recruited women between June and November 2017. Fifty-five women were at high-risk due to opioid use disorder and 38 were at high-risk due to medical factors and not drug misuse, e.g., morbid obesity (body mass index > 50), multiples in pregnancy, and cardiovascular, cardiopulmonary, hypercoagulable (an abnormal increased tendency to develop blood clots), or rheumatologic diseases. Women in the medical

risk comparison group were chosen so we could isolate high-risk due to opioid misuse from high-risk more generally. Women were referred to the clinic, e.g., by primary care physicians. Addiction medicine providers outside the clinic prescribed women's opioid maintenance medications (buprenorphine, buprenorphine plus naloxone, or methadone). Approximately 16-20% of the women who misused opioids may also have been at high-risk due to medical factors (C. V. Towers, personal communication, May 21, 2019). The Institutional Review Board at the hospital that housed the clinic approved the study. Women in both groups were seen monthly to 28 weeks gestation, biweekly to 36 weeks, and weekly to delivery. Behavioral support was available on the hospital premises for all women in the opioid use group. Women in the high-risk medical comparison group deemed to need behavioral support were referred outside the hospital.

2.2. Procedures and Measures

2.2.1. Overall

When a woman arrived for her appointment, a receptionist asked if she might be interested in taking part in a 30-minute study on high-risk pregnancies. If interested, a nurse brought the patient to a private examination room, where a research assistant explained the study purpose and procedures, addressed any questions she might have, and reviewed the study consent form. Following informed consent, the research assistant administered questionnaires. The mother received a $25 gift certificate as compensation for the time required to complete the questionnaires. Participants gave permission for us to review medical records.

2.2.2. Demographics

Patient demographic information was collected from medical records (age, gestation, ethnic background, employment, and partner status). See Table 1. We used receipt of Medicaid

as a proxy for socioeconomic status. Medicaid is a joint federal and state program to help with

medical costs for those with limited income. Pregnant women qualify in the state in which the

study took place if their income is below 160% of the federal poverty level (US Department of

Health and Human Services, 2016). All participants received Medicaid.

Table 1
Demographic and Gestation Differences between the Opioid and High-Risk Medical Comparison Groups

	Whole sample (*N* = 93)	Opioid (*n* = 55)	Comparison (*n* = 38)	Opioid vs. Comparisons
Participant variable	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*t*
Age (years)	27.2 (4.3)	28.2 (4.4)	25.7 (3.6)	2.94*
Gestation	26.8 (7.9)	27.6 (7.9)	25.7 (7.9)	1.08
	%	%	%	χ2
1Minority Ethnic Background	16	7	29	7.81**
Employed	17	15	21	0.69
Has partner	38	36	39	0.09

1 Other than "white". *p < .05; **p < .01.

2.2.3   *Opioid use severity*

We assigned women a score between 0 and 3 on an opioid use severity scale. Opioid use

severity was based on medical records of urine-based assays conducted by medical providers at

clinic appointments and prescribed medications for opioid misuse within 30 days prior to

participation in the study. In the context of support from medical staff and access to behavioral

treatment, women conferred with their physicians to choose a treatment goal at intake: either to

gradually detoxify from opioids or to maintain on prescribed doses. Severity ranged from no use

(the high-risk medical comparison group) to past but no current use, to prescribed use only, to

current use of illicit drugs. We assigned a "0" for "non-users" who did not produce a positive

sample for opioids or another illicit drug who were at high-risk due to medical complications

only (*n* = 38). We assigned a "1" for "opioid detoxification" if women produced urine samples

negative for opioids and other drugs within 30 days prior to participation and physicians

previously prescribed buprenorphine, buprenorphine plus naloxone, or methadone ($n = 4$). We assigned a "2" for "prescribed opioid use" if women who produced a positive urine sample within 30 days prior to participation for prescribed buprenorphine, buprenorphine plus naloxone, or methadone, and who were not positive for other illicit drugs ($n = 21$). We assigned a "3" for "non-prescribed opioid misuse" if women produced a positive urine sample for opioids which had not been prescribed for them within 30 days prior to participation (buprenorphine, buprenorphine plus naloxone, or methadone), or if women produced a urine sample with traces of opioids other than those that they were prescribed, and who may have tested positive for other illicit drugs. There were $n = 30$ women who scored a "3". Data for six women were not included because only drugs other than opioids were reported in urine tests in their medical records within the 30-day window.

2.2.4. *Opioid user group*

In addition to the opioid use severity rating, we created a dichotomous opioid user group variable (yes/no). A "0" for opioid severity (the comparison group) became a "0" on the opioid user group variable. We collapsed scores of 1 through 3 for opioid use severity which became a "1" on the opioid user group variable.

2.2.5. *Reflective functioning*

We used the 8-item reflective functioning questionnaire (Fonagy et al., 2016). The scale provides two subscales derived from factor analysis: *certainty* and *uncertainty* about one's own and others' mental states For example, high agreement with the item: "I don't always know why I do what I do," indicates good reflective functioning in terms of certainty, in acknowledgement that it is not possible always to be certain and that mental states may lack transparency. Similarly, low agreement with the item: "Sometimes I do things without really knowing why,"

indicates good reflective functioning in terms of uncertainty. The certainty subscale is indicative of excessive thinking about mental states and feeling overly certain without sufficient evidence (hypermentalizing). The uncertainty subscale is indicative of an inability to consider the complexity of mental states and feeling overly uncertain (hypomentalizing). Lower scores on the certainty subscale reflect more hypermentalizing, and higher scores on the uncertainty subscale reflect more hypomentalizing. There is overlap for 6 out of 8 items between the certainty and uncertainty subscales but each differs in how each item is scored. The authors assessed validity of the measure in clinical and community samples. The subscales were associated in predicted ways with empathy, mindfulness, perspective-taking, borderline personality disorder features, and parental reflective functioning measured with a coded interview (Fonagy et al., 2016). In the current sample, certainty and uncertainty were correlated $r = -.71, p < .001$. Cronbach's alphas for certainty was $\alpha = .81$, and for uncertainty, $\alpha = .72$, which reflect good and acceptable internal consistency respectively (D. George & Mallery, 2016).

2.2.6. Maltreatment

We administered the Maltreatment and Abuse Chronology of Exposure (MACE; Teicher & Parigger, 2015), which is a 52-item questionnaire that assesses the severity of the experience of maltreatment in childhood prior to age 18 along continuous scales. Teicher & Parigger (2015) developed the scale in a sample of over 1,000 participants from the community for a study advertised as "Memories of Childhood". Scale development used item response theory, which calculates the probability that an answer to an item is related to an underlying construct. Scoring serves to model responses to an item as differing due to both the characteristics of the person and characteristics of the item. For the MACE, the characteristic of the person is level of exposure to maltreatment and the characteristic of the item is maltreatment severity. Subscales were made

up of yes/no questions. Depending on the number of items contained in the subscale, subtype

severity was calculated either by the number of items endorsed, which was recalibrated to a total

exposure severity level between 0-10 (if there were at least five) or were rescored based on a

linear interpolation of items endorsed (if there were less than five). Average correlations

between MACE maltreatment subtypes were $r = 0.32$ +/- 0.11. The MACE was validated using

other measures of trauma in childhood (Child Trauma Questionnaire, CTQ; Bernstein et al.,

1994; Adverse Childhood Experiences, ACE; Dube et al., 2003) and accounted for more

variance in psychiatric symptoms than did the ACE or CTQ. Internal consistency is not an

appropriate measure for a questionnaire developed from item response theory. However, the

MACE demonstrated excellent test-retest reliability, and the subscales fit the model well, e.g., by

passing Andersen's Likelihood ratio test. In the current study we used the sum of maltreatment

severity across all subtypes, the number of subtypes of maltreatment experienced, and severity of

four subtypes: sexual abuse (7 items), parental physical abuse (6 items), neglect (average of

physical neglect, 5 items, and emotional neglect, 5 items), and emotional abuse (average of

parental verbal abuse, 4 items, and non-verbal emotional abuse, 6 items).

2.2.7. Data analysis

We used SPSS v. 24 to conduct analyses (IBM Corp., 2016) We first determined if there

were opioid user group differences in demographics that we needed to control. For continuous

demographic variables we conducted a *t-* test and for categorical variables a chi square. We then

conducted a MANCOVA to test Hypothesis 1 concerning opioid group differences in reflective

functioning. To test Hypothesis 2 for potential mediation of childhood maltreatment by

reflective functioning on opioid use severity (see Figure 1), we used the bootstrapping technique

and macro PROCESS v. 3 for SPSS (Hayes, 2012). Bootstrapping is a resampling procedure for

testing mediation that involves repeatedly sampling from the data set and estimating the indirect effect in each resampled data set. The bootstrapping method (Shrout & Bolger, 2002) has more power than traditional methods such as the causal steps regression approach (Baron & Kenny, 1986) and is thus useful with small samples as low as 20-80 cases (Koopman, Howe, Hollenbeck, & Sin, 2015). Unlike for Baron & Kenny mediation (1996), there is no requirement that there be a direct effect between the independent and dependent variables for mediation to occur (Hayes, 2009; Shrout & Bolger, 2002). Moreover, because it is a nonparametric test it does not assume normal distributions. Specifically, we calculated a 95% bias-corrected confidence interval (CI) with 5,000 bootstrap resamples to determine if reflective functioning helped explain the association between childhood maltreatment and opioid use severity. Comparable to testing a null hypothesis, if a zero does not fall within a 95% confidence interval, there is a 95% likelihood that the indirect effect is significant.
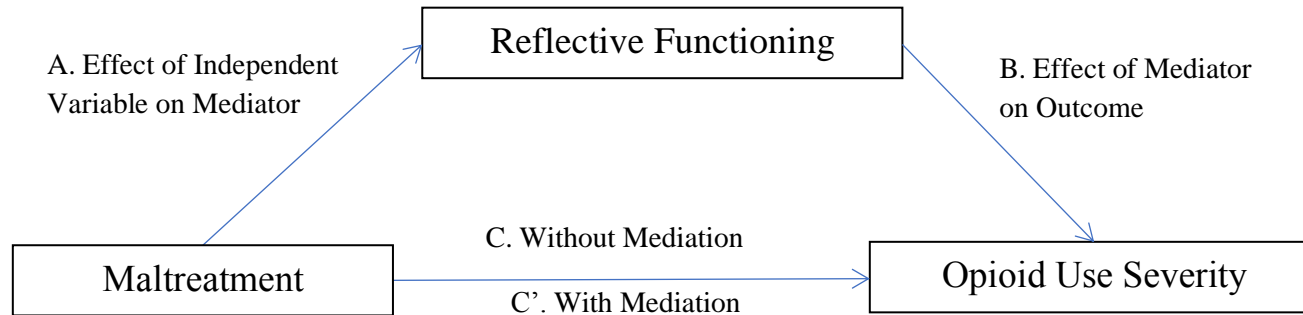
Reflective Functioning

A. Effect of Independent
Variable on Mediator

B. Effect of Mediator
on Outcome

Maltreatment

C. Without Mediation

C'. With Mediation

Opioid Use Severity

Figure 1.
Mediation Model

3. Results

3.1. Preliminary analyses

Women who used opioids were significantly older and less likely to be from a minority ethnic background than were those who were at high-risk due to medical problems, so we controlled for both in analyses. See Table 1. See Table 2 for descriptive of information regarding maltreatment and reflective functioning and Table 3 for correlations among study variables.

In both the opioid use and medical high-risk groups, all maltreatment variables were significantly correlated with each other. In the opioid use group, reflective functioning certainty was negatively correlated with the number of maltreatment subtypes experienced. In the high-risk medical comparison group, reflective functioning certainty was negatively correlated with the sum of maltreatment severity across all subtypes, the number of maltreatment subtypes experienced, parental physical abuse, and emotional abuse. See Table 3.

Table 2

Descriptive Information for Maltreatment Severity and Reflective Functioning and Percent of Women who Experienced Maltreatment

	Whole sample (N = 93)		Opioid (n = 55)		Comparisons (n = 38)	
Childhood maltreatment	*M (SD)*	%	*M (SD)*	%	*M (SD)*	%
Sum of maltreatment severity across all subtypes	16.57 (13.92)	96	18.93 (14.24)	98	13.21 (12.89)	92
Number of subtypes experienced	3.43 (1.96)	n/a	3.76 (1.90)	n/a	2.95 (1.96)	n/a
Sexual abuse	1.87 (2.82)	38	2.56 (3.14)	51	0.87 (1.91)	19
Parental physical abuse	4.02 (3.27)	76	4.35 (3.28)	78	3.55 (3.24)	74
Neglect	2.02 (2.11)	69	2.28 (2.17)	74	1.66 (2.00)	64
Emotional abuse	3.36 (3.08)	73	3.81 (3.17)	76	2.74 (2.88)	68
Reflective functioning						
Certainty	1.14 (0.90)	n/a	0.90 (0.80)	n/a	1.49 (0.92)	n/a
Uncertainty	0.78 (0.71)	n/a	0.93 (0.77)	n/a	0.58 (0.57)	n/a

Table 3

Correlations Among Study Variables by Opioid User Group, $N = 93$

	1	2	3	4	5	6	7
Opioid Users							
1.Sum of maltreatment severity across all subtypes							
2 Number of subtypes	.89***						
3 Sexual abuse	.78***	.61***					
4 Parental physical abuse	.79***	.83***	.60***				
5 Neglect	.78***	.75***	.52***	.41**			
6 Emotional abuse	.92***	.74***	.62***	.70***	.60***		
7 Reflective Functioning Certainty	-.22	-.40*	-.19	-.19	-.20	-.18	
8 Reflective Functioning Uncertainty	.22	.23	.14	.15	.22	.24	-.69***
High-Risk Medical Comparisons							
1.Sum of maltreatment severity across all subtypes							
2 Number of subtypes	.86***						
3 Sexual abuse	.71***	.61***					
4 Parental physical abuse	.91***	.83***	.59***				
5 Neglect	.84***	.75***	.58***	.66***			
6 Emotional abuse	.92***	.74***	.52**	.81***	.61***		
7 Reflective Functioning Certainty	-.45**	-.40*	-.14	-.41*	-.32	-.50**	
8 Reflective Functioning Uncertainty	.22	.23	.06	.14	.18	.27	-.72***

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

3.2. Differences in reflective functioning between pregnant women who misuse opioids and high-risk medical comparisons

We conducted a MANCOVA to test Hypothesis 1, that women who used opioids in pregnancy would have poorer reflective functioning than would high-risk medical comparisons. We entered opioid user group (opioid use vs. high-risk medical comparisons) as the independent variable, and reflective functioning certainty and uncertainty as dependent variables. We entered maternal age and minority ethnic background as covariates. There were no significant main effects for the covariates. However, as hypothesized, there was a significant main effect for opioid use, Wilks's approximate F (2, 88) = 5.50, p < .01, η_2 = .11. Univariate tests revealed that women who misused opioids demonstrated significantly lower certainty, $F(1,89) = 10.86$, $p < .01$ (opioid user group $M = 0.90$, $SD = 0.80$; comparison group $M = 1.49$, $SD = 0.92$) and significantly higher uncertainty, $F(1,89) = 6.64$, $p < .05$ (opioid user group $M = 0.93$, $SD = 0.77$; comparison group $M = 0.58$, $SD = 0.57$), than did high-risk medical comparison women.

3.3. Reflective functioning mediates the association between maltreatment and opioid use

We used Hayes' PROCESS macro (Hayes, 2012) to test Hypothesis 2, that reflective functioning would mediate the association between women's history of childhood maltreatment and their opioid use severity (0-3) in pregnancy. We bootstrapped 5,000 re-samples from the current data set. In support of our hypothesis, we found significant indirect effects between maltreatment and opioid use severity for certainty for overall maltreatment severity, the experience of multiple subtypes of maltreatment, and the severity of sexual abuse, parental physical abuse, neglect, and emotional abuse. However, contrary to our hypothesis, we found no significant indirect effects for uncertainty on any of the maltreatment variables. See Table 4. Although indirect effects were significant for certainty, there were no significant direct effects

between maltreatment and opioid use severity except for a trend towards significance for sexual

abuse severity.

Table 4

Standardized Indirect Effects of Reflective Functioning between Maltreatment and Opioid Use Severity, $N = 93$

Independent variable	RF Subscale	Effect of Maltreatment on RF (Path A)	Effect of RF on Opioid Use Severity (Path B)	Effect of Maltreatment on Opioid Use Severity without Mediation (Path C)	Bootstrap Indirect Effect (Path C')	Bootstrap 95% Confidence Interval
		β	β	β	β (SE)	β
Sum of maltreatment severity across all subtypes	Certainty	-.34**	-.35***	.08	.12† (.05)	.04 to .23
	Uncertainty	.27*	.24*		.00 (.04)	-.08 to .09
Number of subtypes experienced	Certainty	-.31**	-.35***	.04	.12† (.06)	.02 to .23
	Uncertainty	.23*	.24*		-.00 (.04)	-.07 to .10
Sexual abuse	Certainty	-.23*	-.35***	.17^	.07† (.05)	.00 to .18
	Uncertainty	.19	.24*		.00 (.03)	-.06 to .07
Parental physical abuse	Certainty	-.30**	-.35***	.02	.11† (.05)	.02 to .23
	Uncertainty	.17	.24*		.00 (.03)	-.06 to .07
Neglect	Certainty	-.25*	-.35***	.02	.09 † (.05)	.01 to .20
	Uncertainty	.23*	.24*		.00 (.03)	-.08 to .07
Emotional abuse	Certainty	-.34**	-.35***	.05	.12 † (.06)	.03 to .25
	Uncertainty	.28**	.24*		.00 (.05)	-.08 to .11

Note. RF = reflective functioning; regression coefficients for all paths adjusted for maternal age and minority status covariates; a value of .00 indicates above zero if taken to additional decimal places; a value of -.00 indicates below zero.
† significant for 95% confidence interval (when lower and upper confidence intervals do not contain zero).
^$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

4. Discussion

The current study increases our understanding of the association between childhood maltreatment and opioid misuse in pregnancy by examining an important mediator: reflective functioning, which is the ability to understand mental states in self and other. This was the first study to examine associations between maltreatment and reflective functioning in pregnancy, and the first to test a mediational model. In addition to opioid users we recruited a high-risk medical comparison group to provide a stronger test of our hypotheses than would be possible with normative comparisons. Findings support the self-medication hypothesis (Khantzian, 1997) such that a theorized difficulty in regulating negative emotions following the experience of childhood maltreatment due to poor reflective functioning would in turn be associated with opioid use severity in pregnancy.

We found that pregnant women in the opioid user group had lower certainty, and higher uncertainty, reflective functioning scores than did high-risk medical comparisons. Prior research demonstrated an association between reflective functioning and substance misuse in general in pregnancy (Smaling et al., 2015), but no differences in reflective functioning between pregnant opioid misusers and normative comparisons using small samples (Perry et al., 2015). With a larger sample and even with high-risk medical comparisons rather than normative ones, we were able to confirm differences specifically for opioid misuse for both subscales.

We also tested a mediational model of reflective functioning between the experience of childhood maltreatment and the severity of women's opioid use in pregnancy. Indirect effects were significant for the certainty, but not for the uncertainty, subscale of reflective functioning, such that greater severity of maltreatment was associated with poorer reflective functioning, which in turn was associated with greater opioid use severity. This finding is consistent with,

and extends, prior research that showed an association between childhood maltreatment and reflective functioning in pregnancy (Ensink et al., 2014).

4.1. Unexpected findings

First, the mediation model was only significant for the certainty subscale of reflective functioning, not the uncertainty subscale. The experience of childhood maltreatment may engender excessive thinking about mental states (hypermentalizing), e.g., to try to predict and avoid future maltreatment. However, despite the feeling of certainty, accuracy may be limited. This may in part be due to children being unwilling to reflect on their caregivers' mental states while they maltreat them given the likelihood of the emotional pain it would cause (Fonagy et al., 1996). With a tendency to be overly certain yet mistaken about mental states, the ability to regulate emotional arousal is thought likely to be impaired by impulsive behavior (Fonagy et al., 2002), e.g., drug misuse. Feeling overly uncertain, on the other hand, and being confused by the complexity of mental states (hypomentalizing) may not be associated with maltreatment and drug misuse in the same way. However, more empirical research is needed to discover reasons for these subscale differences.

Second, the significant mediation of reflective functioning certainty in the association between childhood maltreatment and opioid use severity in pregnancy was not accompanied by significant direct effects between maltreatment and opioid use severity. This may be due to the high percentages of women reporting maltreatment in both the opioid user (98%) and the high-risk medical comparison (92%) groups. Both groups came from low socioeconomic status backgrounds, which are linked to an increased likelihood of child maltreatment (Coulton, Richter, Korbin, Crampton, & Spilsbury, 2018; McLeigh, McDonell, & Lavenda, 2018)

4.2. Implications for infant development

Poor reflective functioning in pregnant women who misuse opioids may lead to future problems for the infants' development. A mother needs to be conscious of her own mental states to protect her infant from direct expression of them (e.g., of anger or fear) to prevent the infant from becoming disorganized under stress (Main & Hesse, 1990). Furthermore, there is empirical support for the importance of maternal reflective functioning, not only for the development of a secure attachment between mothers and infants at 12-18 months (Arnott & Meins, 2007; Ensink, Normandin, Plamondon, Berthelot, & Fonagy, 2016; Fonagy et al., 1991), but also for the development of the child's own reflective functioning (Ensink et al., 2015; Rosso, Viterbori, & Scopesi, 2015; Scopesi, Rosso, Viterbori, & Panchieri, 2015).

Poor reflective functioning on the certainty subscale (hypermentalizing) specifically may lead to problems. In both clinical and non-clinical samples of adults, the certainty subscale was associated with difficulties with empathy, whereas the uncertainty subscale was not (Fonagy et al., 2016). Moreover, in a community sample of mothers and their offspring, the certainty subscale for mothers of infants aged 10 months was associated with infant attachment insecurity, mediated by maladaptive attributions about the infant, and an inability to recognize the infant's subjective perspective, but the uncertainty subscale was not (Fonagy et al., 2016).

4.3. Implications for interventions.

It is potentially of significance for interventions that reflective functioning mediated the association between the experience of childhood maltreatment and the severity of opioid misuse during pregnancy, although more research is needed. Indeed, for pregnant women at high risk for difficulty with parenting due to poverty, an intervention focused on improving reflective functioning successfully increased the likelihood of a secure attachment with their infants at 12 months (Sadler et al., 2013). Furthermore, for mothers of children aged 11-60 months in

treatment for substance misuse who were randomly assigned to a reflective functioning intervention versus an equally intensive parenting education intervention, those in the reflective functioning condition improved in their reflective functioning, showed greater sensitivity towards their children and more secure attachment (Suchman et al., 2017). Moreover, reflective functioning that was specifically related to understanding the self rather than understanding others was associated with the ability to be responsive to their infants and toddlers in mothers with substance use disorders (Suchman, DeCoste, Leigh, & Borelli, 2010), making this a possible target of interventions. However, ideally, preventive interventions for women who misuse opioids, targeting reflective functioning would occur during pregnancy rather than after the child is born. Better still, it may be beneficial to employ interventions in late adolescence or early adulthood, e.g., following childhood maltreatment, to improve relationships and decrease the likelihood of substance misuse. Of course, these are empirical questions that need to be examined in future research.

4.4. Strengths and Limitations

Strengths of the study include high-risk medical comparisons, use of medical records (urine assays and prescriptions for medications) to assess opioid use severity, a measure of maltreatment severity for two overall variables and four subtypes, and a bootstrapping method to assess indirect effects. Weaknesses include the fact that this was a cross-sectional rather than a prospective longitudinal study, limiting the strength of conclusions, e.g., concerning the mediations. Moreover, the development of the reflective functioning scale is recent, and although the authors conducted several studies as part of its validation (Fonagy et al., 2016), there is limited information relating to different correlates for the two subscales and on the clinical meaningfulness of scores on each one. Additionally, effect sizes for the indirect effects

are small and so replication is needed. Furthermore, it would have been ideal to include a self-report measure of opioid use in addition to urine assays to compensate for the short half-life of opioids. Moreover, because the participation of women from minority ethnic backgrounds existed disproportionally in the high-risk comparison group, we had to control for minority status and results do not generalize to minority populations. Finally, it would have been better to identify the percentage of women with each medical risk condition in the comparison group and report whether women in the opioid user group suffered from any of the same conditions.

Considering the methodological limitations of the present study including the small sample size, future research with a larger and more diverse sample would provide a more nuanced understanding of the mediational effects of reflective functioning. Given research suggesting that mothers with maltreatment histories have difficulties in parenting their infants (Savage, Tarabulsy, Pearson, Collin-Vézine, & Gagné, 2019), it would be valuable to test this model controlling for the security of women's adult attachment (their current stance towards their childhood attachment to caregivers; C. George, Kaplan, & Main, 1984; Main, Goldwyn, & Hesse, 2002). Such an analysis would provide needed information to better understand how attachment history may be related to the mentalizing capacities of maltreated women who misuse opioids in pregnancy.

4.5. Conclusion

Opioid users in pregnancy had more difficulty understanding mental states (reflective functioning) when compared with high-risk medical comparisons. Moreover, reflective functioning mediated the association between the experience of childhood maltreatment and opioid use severity. We suspect that improving reflective functioning in pregnancy may benefit infant development. Pregnancy gives time not only for the fetus to develop, but also for a woman

to develop as a mother (Alhusen, 2008; DiPietro, 2010). The ability to see herself as a mother, her child as a separate being, and to develop an attachment to the fetus, is theorized to depend on reflective functioning (Slade, Cohen, Sadler, & Miller, 2009). The experience of childhood maltreatment may impede this development (Fonagy et al., 1996), leading to inaccurate representations of the infant (Fraiberg, Adelson, & Shapiro, 1975; Schechter et al., 2005) and insecure mother-infant attachment (Ensink et al., 2016). We look forward to future research targeting reflective functioning in women who misuse opioids in pregnancy to determine whether such interventions help women becoming mothers, and facilitate healthy infant development (Rutherford, Potenza, & Mayes, 2013).

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