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Mothers with Mild Intellectual Disability: Emotion-Interpretation, Traumatization, and Child Attachment Representations

--Manuscript Draft--

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Abstract

Prior research indicates links between parents' experiences of interpersonal trauma and emotion-interpretation difficulties, and between such difficulties and child attachment insecurity and disorganization. Although mothers with mild intellectual disability (ID) are at heightened risk for trauma and emotion-interpretation difficulties, and their children for attachment insecurity, corresponding links in this population have not been examined. We therefore investigated emotional interpretations among mothers with mild ID (*n*=23) and matched comparison mothers without ID (*n*=25), in relation to mothers' experiences of trauma and their children's attachment representations. Mothers with mild ID were not less accurate than comparison mothers with regard to general positive and negative emotion-interpretation accuracy, but they were significantly more likely to misinterpret shame and anger. Among mothers with mild ID, misinterpretations of shame were positively related to maternal experiences of trauma, and to child attachment insecurity and disorganization.

Key words: intellectual disability; attachment; emotion interpretation; interpersonal trauma; risk factor.

Extant research indicates links between parental experiences of interpersonal trauma and emotion-interpretation difficulties, as well as between such difficulties and child attachment insecurity and disorganization (e.g., Dayton et al., 2016; Bernstein et al., 2014). Research also suggests that both emotion-interpretation difficulties and experiences of interpersonal trauma are common among parents with mild intellectual disability (e.g., McGaw et al., 2007; Scotland et al., 2016) and that children of these parents are more likely to have insecure attachment representations (Granqvist et al., 2014). Yet, there is no research regarding possible links among these parameters in mothers with mild intellectual disability and their children. In this study, we therefore examine whether interpretation accuracy and misinterpretations of key negative emotions to infant faces are associated with maternal history of abuse, trauma, and maltreatment, and with child attachment representations.

Parental Interpersonal Trauma, Emotion-Interpretation, and Child Attachment

A large body of research has documented a link between parents' experiences of interpersonal trauma, and insecure or disorganized attachment in their children (e.g., Bernier & Meins, 2008; Huth-Bocks et al., 2004; Madigan et al., 2006; Schuengel et al., 1999; Zeanah et al., 1999). Trauma-related difficulties in processing facial emotional cues have been proposed as one mechanism behind this link (e.g., Fonagy et al., 2002). Facial emotional cues play a critical role in infants' attempts to engage their social environment, and caregivers' ways of interpreting and responding to such cues have important effects on numerous aspects of child development, including attachment (e.g., Beebe et al., 2010; Emde, 1993). Research also suggests that parental processing of infant facial emotional cues, as compared to adult emotional cues, may be especially affected by parental experiences of interpersonal trauma (Olsavsky et al., 2019). Hence, it is possible that altered processing of infant facial emotional cues plays an important role in the association between parental trauma and child attachment insecurity and disorganization. Along these lines, DeOliveira

and colleagues (2004) have suggested that trauma-related difficulties in the processing of infant emotional cues, in combination with maternal difficulties in regulating own emotions and distinguishing them from the infant's, may impede a mother's ability to respond to her infant's emotions in a marked, contingent, and predictable manner. As a result, the infant would repeatedly experience breakdowns in the dyadic regulatory process, which would hamper the development of organized emotion regulation strategies. Moreover, excessive non-contingent or unmarked maternal mirroring of negative emotions may potentially be experienced as frightening by the infant, thus increasing the risk of attachment insecurity and disorganization (Lyons-Ruth et al., 1999).

These proposals are supported by empirical findings indicating both general and specific emotion-interpretation difficulties in relation to child emotional faces among parents with experiences of interpersonal trauma. For instance, maternal experiences of interpersonal trauma have been linked to less accurate general recognition of children's facial emotional expressions (Bérubé et al., 2020), and to a tendency to view ambiguous infant facial emotional expressions as negative (Dayton et al., 2016). Similarly, neglecting mothers have been found to report higher rates of maltreatment in their own childhood, and to make less accurate interpretations of infants' facially expressed emotions (Hildyard and Wolfe, 2007).

Regarding specific emotion-interpretation difficulties, abusive fathers have been found to report significantly more own experiences of childhood maltreatment, and to be more likely to perceive infant faces as angry or fearful (Francis & Wolfe, 2008). Corresponding findings among mothers have shown maternal experiences of childhood abuse or maltreatment to be related to more frequent perceptions of fear in infant faces (Teeters, 2012). Findings also suggest a proclivity among severely traumatized mothers to perceive shame in infant faces (Hildyard and Wolfe, 2007). Similarly, a unique proclivity to perceive shame has also been observed among mothers at risk for maltreating their children

(Butterfield, 1993), as well as among mothers with unresolved experiences of interpersonal loss or abuse (Moran et al., 2008). These findings among traumatized parents can be contrasted with common emotion interpretation patterns among psychosocially well-functioning parents or parents in low-risk samples, who generally make more accurate emotional interpretations and, when biased, tend to err on the side of interpreting more emotions as positive (e.g., Krippl et al., 2010; Siddiqui et al., 2000; Appelbaum et al., 1993).

Research also indicates a link between parental emotional interpretations and children's attachment status. For instance, in a study on expectant mothers at risk for suboptimal parenting, Bernstein and colleagues (2014) found a heightened maternal proclivity to perceive infant faces as angry, and a lowered proclivity to perceive sadness, to be predictive of child attachment disorganization at 18 months. In another study, Waters and colleagues (2010) found that a higher concordance between maternal interpretations of their children's emotional expressions and childrens' self-reported emotions was positively associated with child attachment security. These links are further corroborated by studies of families at risk for child maltreatment or neglect, families with extensive socio-economic disadvantages, and families with severe parental psychiatric disorders. A large body of research has found elevated levels of interpersonal trauma among parents in these families (e.g., Pears & Capaldi, 2001; van IJzendoorn et al., 2020), as well as parental difficulties in processing children's emotional faces (Wagner et al., 2015). Children in such families are also notably more likely to develop insecure or disorganized attachment (Cyr et al., 2010).

Mothers with Mild Intellectual Disability and their Children

Research findings further indicate that individuals with mild intellectual disability (ID; IQ 50-69 + deficits in adaptive functioning; Schalock et al., 2010) may be especially vulnerable with regard to diminished emotion-interpretation capacities. For instance, adults with mild ID have been found to display lower facial emotion-interpretation accuracy,

compared to both age-matched adults (Owen et al., 2001; Owen & Maratos, 2016) and mental-age matched children (Godinovich, 2017; Scotland et al., 2016). However, while most previous studies have focused on general emotion-interpretation accuracy, knowledge about specific emotion-interpretation biases in this population is scarce, and no study has hitherto examined such biases among mothers with mild ID, or in relation to infant faces. Similarly, the role of interpersonal trauma for parental emotional interpretations is unknown in this population, as is the relationship between parental emotional interpretations and child attachment status.

These gaps in existing research are surprising, for several reasons. First, current evidence suggests that emotion-interpretation difficulties among adults with mild ID cannot be fully accounted for by the cognitive impairments inherent in intellectual disability (Scotland et al., 2016). Second, a growing body of research indicates that experiences of interpersonal trauma are highly overrepresented among individuals with mild ID. For instance, experiences of childhood physical, sexual, and emotional abuse are more common in this population (e.g., Horner-Johnson & Drum, 2006; Jones et al., 2012; Sullivan, 2009), as is childhood neglect (Miller & Brown, 2014). Individuals with ID are also at heightened risk for prolonged separations from their primary caregivers due to foster care placements (Slayter & Springer, 2011), and for repeated caregiver separations due to placement instability (Slayter, 2016). The heightened risk for interpersonal trauma also extends to adulthood, with especially women with ID being notably more likely to experience violent or sexual victimization in adulthood (Fogden et al., 2016; Harrell, 2017). An overrepresentation of abuse and other forms of trauma has also been documented in research on parents with ID. For instance, McGaw and colleagues (McGaw et al., 2007) found that almost 80% of parents with ID reported exposure to some form of abuse or neglect in childhood. Similar proportions were reported in a previous paper from the current project, in which almost 90% of mothers

with mild ID (compared to 30% of comparison mothers) were judged to have experienced

some form of abuse, trauma, and maltreatment (ATM) in relationships, based on conservative

abuse and trauma criteria (Granqvist et al., 2014). Thus, while the aforementioned findings

from parents in other populations indicate that interpersonal trauma is a risk factor for

difficulties in interpreting children's facial expressions of emotion, parents with mild ID are

at substantially heightened risk for such trauma.

Third, concerns about children's attachment quality have become increasingly

common in the context of evaluating parents with ID, not least in family court settings, and

concerns are often based on the belief that ID per se makes the parent incapable of

responding adequately to children's signals (Alexius & Hollander, 2014; McConnell &

Llewellyn, 2002). While this points to a need for empirical data on attachment-related factors

among these families, such data has, however, been extremely scarce. Addressing this issue,

the aforementioned paper from the current project examined attachment representations

among children of mothers with mild ID. The children displayed lower rates of security than

what is typically found in normative samples, but the rates were in line with findings from

other samples at heightened risk for forms of suboptimal care (e.g., Bernard et al., 2012), and

only marginally lower than among the matched comparison children. Rates of disorganized

attachment did not differ significantly between the groups. Moreover, among the children of

mothers with ID, lower attachment security and higher attachment disorganization were

related to the frequency of ATM in the mothers' history (but not to maternal IQ; Granqvist et

al., 2014). However, the role of parental emotional interpretations and their potential for

casting light on these associations were not examined in that paper.

The Present Study

Based on the aforementioned gaps in extant research, the aim of the present study was

to examine emotional interpretations of infant facial expressions in mothers with mild ID, in

relation to their experiences of ATM and their children's attachment representations. To allow for relevant comparisons, a matched comparison group was included, comprising mothers without ID and their children.

Because previous research was either scant, or results inconclusive or contradictory, all research questions were treated as exploratory. In sum, the study set out to answer three specific research questions: (1) Do mothers with mild ID differ from matched comparison mothers with normal IQ with regard to specific emotion-interpretation proclivities? Furthermore, are individual differences in such proclivities related to (2) the mothers' experiences of ATM and (3) their children's attachment representations?

Method

Participants

Mothers with mild intellectual disability and their children (ID group) were recruited in the central regions of Sweden. Recruitment was aided by professionals working with mothers with ID (e.g., staff at habilitation centers), who gave presumptive participants verbal and written information about the study. Interested mothers were subsequently contacted by the research team, and were given additional information about the study. For inclusion, it was required that (1) the mothers had been formally diagnosed with mild ID, (2) the mothers had children aged 5–8 years currently living at home for at least 50% of the time, and (3) both the mothers and their children spoke Swedish. Diagnosis of autism in mother or child was used as an exclusion criterion. The decisicion to include children aged 5-8 years, rather than infants, was based on two specific considerations. First, assessment of the most serious insecure pattern (disorganized [D] attachment) in infancy is partly based on observations of stereotypical behaviors and motor anomalies in the infant. While this assessment procedure has been thoroughly validated in normative samples, it may also imply a risk of false identification of disorganized attachment in infants who display such behaviors for other

reasons, such as considerable developmental delays or neurodevelopmental disorders (Granqvist et al., 2017; see also Main & Solomon, 1990). Second, such delays or disorders are more common among children of mothers with ID (e.g., Emerson & Brigham, 2014; Plomin et al., 2012). Thus, inclusion of infants in the study could have implied a heightened risk of overidentifying disorganized attachment in our maternal ID sample. This risk was deemed to be lower for the representational attachment measures used with older children. In total, 26 mothers with mild ID and their children were recruited. Three dyads only participated in one out of two data collections, and were hence excluded due to missing data. This resulted in a final ID group of 23 mother-child dyads (58% boys). The living conditions of the ID-group mothers compared well with available demographics for adults diagnosed with ID in Sweden (cf. Starke, 2005).

The comparison group was also recruited in the central regions of Sweden, via a register of mothers with children born during the same years as the children in the ID group. Comparison-group families were matched against a given ID-group family with regard to residential area demographics, including area population size, average income, social allowances, health figures, unemployment rate, and proportion of immigrants. Furthermore, from the relevant residential areas, we selected only mothers of children of the same age ($\pm$ 6 months) and sex as the matching children in the ID group. Eligible comparison mothers were sent initial study information via postal mail, and mothers who did not decline participation by returning a pre-stamped envelope were contacted by phone about one week later for further information. Ultimately, 26 comparison mothers and their children were recruited. One dyad only participated in one of the data collections and was hence excluded due to missing data. This resulted in a final comparison group of 25 dyads (56% boys).

Examination of group differences revealed no differences regarding maternal or child age, number of children in the household, or maternal income (including subsidies).

However, and in line with previous research (e.g., Feldman et al., 1997), the portion of mothers living without a partner was markedly larger in the ID group (69%, versus 19% in the comparison group). The group characteristics and differences have been described in more detail in the aforementioned study by Granqvist and colleagues (2014).

Procedure

Data were collected at two different occasions. First, two members of the research team visited the mothers individually in their homes, or at another place of their preference, such as the mother's habilitation center. On this occasion, each mother completed a thorough interview covering background information and experiences of abuse, trauma, and maltreatment (ATM). The second occasion consisted of a joint laboratory visit for mother and child, including assessment of maternal emotion-interpretation and child attachment representations. During this second occasion, the mothers also completed the "block design" subtest from the Wechsler Adult Intelligence Scales (WAIS-III; Wechsler, 2003), to enable subsequent control for maternal fluid intelligence.

To ensure maximum comprehensibility for all participants, all instructions were given in a very simple language. Instructions were designed by members of the research team with extensive experience of habilitation care, in collaboration with a representative of the main Swedish organization for individuals with ID. Throughout the study, we also repeatedly ascertained that instructions were fully understood by the participants.

Ethical advice was obtained from the regional ethical research board at Uppsala University. Written consent was obtained separately for every task on both study occasions, both before and after task completion. Information about anonymity and the confidential nature of the study was explained to the mothers. We also explained that participation was voluntary, that it could be terminated at any time without consequences, and that data would be used solely for scientific purposes.

Measures

Emotional Interpretations

Mothers completed the "Infant Facial Expressions of Emotion from Looking at Pictures" (IFEEL; Emde et al., 1993). Translation of the IFEEL emotion lexicon from English to Swedish was performed by a native English-speaker fluent in Swedish, and unclear translations of emotion words were discussed with a second native English-speaker, also fluent in Swedish, to ensure accurate translation.

In the IFEEL, the participant is presented with 30 color photographs of infant facial expressions, one at a time, and is asked to state the strongest and clearest feeling that each infant expresses. Standardized probes are used, in the event that the participant cannot come to think of any emotion words. The responses can be scored both categorically (i.e., emotion categories) and dimensionally (i.e., intensity and hedonic tone). Since our research questions primarily regarded interpretation of emotions, and to avoid complicating the task for the mothers, we only employed categorical scoring. The IFEEL emotion lexicon was used to classify each response into one of 12 emotion categories: (1) surprise, (2) interest, (3) joy, (4) contentment, (5) passive, (6) sad, (7) cautious-shy, (8) shame-guilt, (9) disgust, (10) anger, (11) distress, and (12) fear. Categories 1-4 are considered positive in valence, while categories 5-12 are considered negative. An "other" category was used to classify responses that didn't fit into any of the emotion categories (e.g., non-emotion words). Three mothers only responded to 29 of the 30 pictures, and the blank responses were classified as "no response".

The basic categorical scoring was then elaborated in two ways. First, to examine differential interpretation patterns of negative and positive emotions among the mothers, we constructed "accuracy" variables for positive and negative interpretations, respectively. This was done in line with an established procedure from previous research employing IFEEL (cf.

Broth et al., 2004; Hildyard & Wolfe, 2007), in which participant responses are compared for

concordance with a frequency distribution of emotions by picture based on a normative

reference sample described in the IFEEL manual (Emde et al., 1993; $N = 145$). Thus, in our

study, a response was considered accurate if it was endorsed by at least 20% of the

individuals in that normative reference sample and inaccurate if it was not. For 15 of the

items, only one emotion fulfilled this criterion. For 12 items, two or three emotions of the

same valence fulfilled this criterion. For the remaining three items, both positive and negative

emotions fulfilled the criterion. These three items were discarded due to their positive-

negative impurity, resulting in a final set of 27 unambiguously positive (17) or negative (10)

pictures. Positive and negative accuracy scores for each participant were computed as the

percentage of possible accurate positive and negative responses.

Second, to be able to investigate the role of specific emotion-interpretation difficulties

in the mothers, we constructed variables for negative emotional misinterpretations, that is,

negative interpretations that were not concordant with the reference sample responses. To

keep the number of statistical analyses within reasonable limits, we focused on three specific

emotions, namely anger, shame and fear. This choice was based on research (reviewed

above) indicating that interpretation biases regarding these emotions in infant faces may be

linked to parental trauma and various forms of parenting risks (e.g., Francis & Wolfe, 2008;

Moran et al., 2008; see also Taylor, 2015), as well as on the common occurrence of these

emotions in posttraumatic stress disorder (PTSD; American Psychiatric Association, 2013).

For each of these emotions, participant scores were calculated by summing up the total

number of interpretations across the 27 pictures that were not endorsed by at least 20% of the

normative reference sample.

Several studies have demonstrated the applicability of IFEEL for studying individual

differences in parents' emotional interpretations of children's facial expressions (see e.g.,

Webb & Ayers, 2014). Adequate validity (Ridgeway, 1993) and test-retest reliability (Appelbaum et al., 1993; Siddiqui et al., 2000) have been reported. The IFEEL also deliberately includes both prototypical positive or negative emotional expressions, and emotional expressions that are "blended" (e.g., anger/sadness, surprise/interest), which can be said to increase its ecological validity with regard to infant emotional expressions (cf. Matias & Cohn, 1993).

Maternal Experiences of Abuse, Trauma, and Maltreatment (ATM)

The occurrence of ATM in the mothers' biographies was examined with a semi-structured interview, containing 30 questions about concrete events, including physical, emotional or sexual abuse, traumatic separations and loss, observing serious violence, and neglect (iATM; Granqvist et al., 2006). The development, design and coding of this interview have been described in the study by Granqvist and colleagues (2014). Briefly, all affirmative responses to the concrete events were followed up by standardized probes about when, where, with/by whom and how often the specific ATM event had occurred. Responses were recorded and coded by a blinded coder for prevalence and frequency of ATM by attachment figures and others, respectively. For reliability purposes, 20 interviews were double coded by a second blinded coder. Inter-rater agreement was high (*intraclass r* for absolute agreement = .86). To obtain an overall ATM variable while decreasing the number of statistical analyses, the total frequency sum of ATM performed by attachment figures and/or others was used to tap maternal experiences of ATM.

Child Attachment Representations

Child attachment security and disorganization were assessed using the Separation Anxiety Test (SAT; Kaplan, 1987). The procedure and coding of this semi-structured interview has been outlined in the study by Granqvist and colleagues (2014). In essence, the child is presented with six pictures in a fixed order, illustrating child-parent separations of

varying severity, and questions are posed about how the pictured child feels, why the child feels that way, and what the child will do. Additionally, on four pictures, 15 follow-up probes are used regarding possible mental states in the pictured child. The SAT yields three different types of scores: continuous scores for (1) solutions and (2) emotional security, and (3) categorical data regarding the four attachment categories. We used the continuous scale (1–9) of emotional security and a semi-continuous measure of disorganization (D; 0 = no D classification, 1 = secondary D classification, 2 = primary D classification). This was done to maximize statistical power, in lieu of the limited number of participants, as well as to retain all available variance, some of which is lost when using categorical classifications. Transcripts were coded by a coder blinded to maternal ID-status, and 20 interviews were double coded by a second blinded coder. Inter-rater agreement was high (*intraclass r*s = .83 for security and .84 for disorganization).

The SAT has been shown to possess adequate criterion validity, with SAT classifications related retrospectively to the same individual's attachment classifications in infancy, to concurrent observed reunion behavior in the 6th-year-reunion procedure, and prospectively to Adult Attachment Interview classifications in early adulthood (Grossmann et al., 2002; Main & Cassidy, 1988; Main et al., 1985, 2005).

Statistical Analyses

The relatively small sample size limits both statistical power and the range of possible statistical analyses. Therefore, the main analyses consisted of tests of mean differences between the groups, and of bivariate and partial correlations among the included variables. To counteract bias due to sample limitations, all analyses were bootstrapped (BCa). Mean differences were mainly investigated by means of *t*-tests. However, in the case of shame misinterpretations, no mother perceived shame more than once, thus making this variable dichotomous in practice. Moreover, only mothers in the ID group perceived shame.

Therefore, the likelihood ratio chi-square, which is suited to handle low distribution of expected frequencies (Agresti, 2002; McHugh, 2013), was used to test the statistical significance of the group difference on shame misinterpretations. Bivariate relations were investigated within the two study groups rather than in the total sample. This was done to facilitate an examination of possible emotion-interpretation characteristics specific to the mothers with mild ID, as well as to examine differential patterns across groups. Reports of significance levels, which are influenced by power, are complemented with effect sizes. Small-sample corrected Hedges' *g* was deemed more appropriate than the conventional Cohen's *d*, since *g* is held to be less inflated, especially in the case of small sample sizes (e.g., Lakens, 2013). Like *d*, Hedge's *g* can be interpreted using Cohen's (1988) well-known rules of thumb (0.2 = small effect; 0.5 = medium effect; 0.8 = large effect). Phi (φ) was used as an estimate of effect size for group differences regarding shame misinterpretations.

Results

Descriptive Statistics and Preliminary Analyses

As described in the introduction, mothers in the ID group had experienced more ATM than comparison mothers. Security of attachment scores were also marginally lower among the children in the ID group, but with substantial variation around the means. No difference was found on child attachment disorganization (Granqvist et al., 2014).

Descriptive statistics for the emotion-interpretation variables are displayed in Table 1. Our study groups scored somewhat lower on accuracy than what has been reported in previous research on mothers at risk for suboptimal parenting (e.g., Broth et al., 2004), except in the case of comparison mothers' accuracy for negative emotions. Shame misinterpretations were rare; in total, three mothers misinterpreted infant faces as expressions of shame, over three different pictures. While this is a low number, it should be noted that it is proportionally within the range of that found in other samples at heightened risk for suboptimal parenting

(cf. Bernstein et al., 2014; Butterfield, 1993; Dayton et al., 2016; Francis & Wolfe, 2008;

Hildyard & Wolfe, 2007).

To address the potentially confounding effects of maternal fluid intelligence, we also

tested whether maternal fluid intelligence was assiociated with the pertinent emotion-

interpretation variables. Results showed that maternal fluid intelligence was unrelated to all

emotion interpretation variables in both groups (all p-values > .25 in the ID group, and > .16

in the comparison group). This is in line with previously reported findings from the same

project, which showed maternal fluid intelligence to be unrelated to child attachment

(Granqvist et al., 2014). Thus, subsequent analyses on the emotion interpretation variables

were performed without control for maternal fluid intelligence.

Insert Table 1 about here.

Group Differences on Emotion-Interpretation Accuracy and Emotional

Misinterpretations

There was no significant difference between the groups regarding accuracy for

positive emotional interpretations, $t(46) = -.10$, obs. diff. = .-43, BCa CI 95% [-8.25, 8.33], p

= .92, Hedge's $g = -.03$, or for negative emotional interpretations, $t(46) = -1.75$, obs. diff. = -

8.45, BCa CI 95% [-17.88, -.06], $p = .09$, Hedges' $g = -.49$. The relatively low p value for

negative emotional interpretations, in conjunction with the bootstrapped confidence interval

not including zero, does, however, signal uncertainty around this result, and might suggest

that there are significant group differences on some specific, key negative emotions.

Regarding misinterpretations of specific negative emotions, results revealed a

significantly heightened proclivity for misinterpretations of anger among mothers with mild

ID, $t(46) = 3.12$, obs. diff. = .99, BCa CI 95% [.34, 1.71], $p < .01$, Hedges' $g = .61$. This

finding corresponds to a medium effect size. Mothers with mild ID also displayed a

heightened proclivity for misinterpretations of shame, $G = 4.63$, $p = .03$, $\varphi = .27$, BCa CI 95%

[.12, .44]. This finding borders to a medium effect size. No significant difference was found regarding misinterpretations of fear, $t(46) = -.24$, obs. diff. $= .13$, BCa CI 95% [-1.17, .96], $p = .82$, Hedges $g = -.07$.

Emotion Interpretation, Maternal Experiences of Abuse, Trauma, and Maltreatment (ATM), and Child Attachment

Within-group correlations are displayed in Table 2, for the specific emotion misinterpretation variables that differed across groups (i.e., shame and anger). Specifically among mothers with mild ID, misinterpretations of shame were positively associated with the frequency of maternal ATM experiences. However, there was no significant association between misinterpretations of anger and experiences of ATM in either group (p-values > .45).

Misinterpretations of shame were also significantly associated with lower levels of child attachment security and with higher levels of child disorganization, again specifically in the ID group. Misinterpretations of anger were unrelated to child attachment security and disorganization in both groups (all p-values > .38).

Insert Table 2 about here.

In the maternal ID group, moderate to strong associations have also been reported between experiences of ATM and child attachment security and disorganization ($r = -.45$ and $r = .62$, respectively; Granqvist et al., 2014). Consequently, we conducted a set of supplemental partial correlations to test whether these links would hold even after accounting for maternal shame misinterpretations. Following control for shame misinterpretations, the association between ATM and attachment security decreased and dropped to non-significance (*partial r = -.32, p = .15*). The association between ATM and child attachment disorganization also decreased, but remained significant (*partial r = .52, p = .01*). Thus, maternal shame misinterpretations accounted for parts of the reported associations between experiences of ATM and child attachment insecurity and disorganization.

Discussion

In this study, we examined the accuracy of emotional interpretations of infant facial expressions, and misinterpretations of key negative emotions, among mothers with mild ID and comparison mothers without ID. We also investigated whether specific emotion-interpretation proclivities were related to the mothers' history of abuse, trauma, and maltreatment (ATM) and to their children's attachment representations. There were no fully significant differences between the two groups with regard to general positive and negative emotion-interpretation accuracy. Mothers with mild ID were, however, significantly more likely to misinterpret infant facial expressions as expressions of shame and anger. Misinterpretations of specifically shame among mothers with mild ID were also positively related to their experiences of ATM and to attachment insecurity and disorganization in their children.

Maternal Intellectual Disability, Traumatization, and Emotion Interpretation

The mothers with mild ID were not generally less accurate than the comparison mothers in interpreting positive or negative emotions. Furthermore, while low study power warrants interpretive caution regarding the result for negative emotional interpretations, there is nothing to suggest that the null-finding regarding positive emotional interpretations was due to power issues (Hedge's $g = -.03$). These results are somewhat unexpected, given previous reports of lower emotion-interpretation accuracy among adults with ID (e.g., Owen & Maratos, 2016; Scotland et al., 2016), and the heightened rates of interpersonal trauma in our maternal ID group. A potential explanation is that emotion-interpretation difficulties among mothers with mild ID may be differentially distributed over emotions, and that positive emotions – especially clearly positive emotions like joy – are easier to interpret correctly than other emotions. If so, such differences have likely had little impact on the total accuracy scores in previous studies examining ID adults' emotion interpretation capacities,

because most of those studies have constructed such scores based on accuracy for a rather narrow set of predominantly negative emotions (e.g., Owen et al., 2001). The few previous studies reporting accuracy for specific emotions indicate that adults with mild ID are equally able as adults without ID to interpret joy correctly (Godinovich, 2017; Rojahn et al., 1995). Similarly, some negative emotions may also be easier to interpret correctly. For instance, adults with mild ID have been found to display less extensive difficulties in interpreting sadness than other negative emotions (Godinovich, 2017).

Our finding of a heightened proclivity to misinterpret shame in infant faces among severely traumatized mothers with ID should be interpreted with caution, due to the small sample size. Nevertheless, this preliminary finding resonates with previous findings among traumatized mothers with normal IQ, where the same proclivity has been repeatedly observed (e.g., Hildyard & Wolfe, 2007; Moran et al., 2008). As noted above, the proportion of mothers misinterpreting shame in our study was also in line with that found in previous studies. In addition, our finding that shame misinterpretations were linked to child attachment insecurity and disorganization is analogous to previous findings of shame misinterpretations as a characteristic of mothers at risk for caregiving difficulties (e.g., Butterfield, 1993; Hildyard & Wolfe, 2007). Thus, although these findings regard a rare phenomenon, and although they need to be corroborated by future research, they may still be of clinical relevance.

With regard to mechanisms behind the noted finding, our results do not permit any conclusions. Theoretically, however, one potential explanation revolves around the mothers' own representational models of the self. Notably, the mothers who misinterpreted shame in our study were among the mothers who reported the highest frequency of traumatic experiences. Multiple experiences of interpersonal trauma may – regardless of ID status – lead to representational models of the self as shameful or defective (e.g., Feiring et al., 2002),

and for parents, emotions related to such models may, in turn, be misattributed to one's children. Indeed, difficulties in differentiating one's own emotions from those of others have been described as a common consequence of severe interpersonal traumatization (Fonagy et al., 2002; Streeck-Fisher & van der Kolk, 2000). Thus, rather than reflecting socio-cognitive difficulties related to ID per se, the heightened proclivity to misinterpret shame among the mothers with mild ID may reflect the mothers' own struggling with feelings of shame and worthlessness, related to multiple experiences of interpersonal trauma. However, future research – including assessment of mothers' own self-related shame – is required to substantiate this theoretical speculation with empirical data. Such research should also strive to include a comparison group with a more equal frequency of ATM experiences, to be better able to establish the role of maternal ID in this context.

Mothers with mild ID were also more likely to misinterpret anger, but this proclivity was unrelated to the magnitude of maternal ATM experiences (as well as to child disorganization). The statistical analysis also indicated that this was likely not due to low study power. These results deviate from previous research, which has suggested links between fathers' experiences of interpersonal trauma and a heightened proclivity to intepret infant facial expressions as angry (Francis & Wolfe, 2008). One hypothetical explanation for these inconsistent findings could be that anger misinterpretations, compared to shame misinterpretations, are a less specific indicator of severe traumatization in mothers than in fathers, for instance due to differential emotion socialization. Supporting this line of thought, mothers with unresolved experiences of loss or abuse in the study by Moran and colleagues (2008) were more likely to perceive shame, but not anger, in infant faces. Among adults with experiences of child abuse, more severely abused women are also more likely to report feelings of shame, whereas men are more likely to report anger (Hoglund & Nicholas, 1995).

While theoretically conceivable, this possibility also needs to be directly addressed in future research.

Maternal Intellectual Disability, Emotion Interpretation, and Child Attachment

Shame misinterpretations among the mothers with mild ID were also linked to insecure and disorganized attachment representations in their children. It is possible that recurring shame misinterpretations in the actual mother-child relationship could contribute directly to child attachment insecurity and disorganization. Most developmental theorists agree that young infants are not yet capable of expressing the complex self-conscious emotion of shame (e.g., Mills, 2005; Rochat, 2018), and maternal responses to perceived infant shame are therefore necessarily non-contingent on the infant's expression, with the risk of disturbing the infant-mother regulatory process (e.g., Fonagy et al., 2002). A perhaps more nuanced possibility is, however, that shame misinterpretations are nested within a broader set of trauma-related risk factors. That is, rather than having notable effects on child attachment in and of themselves, shame misinterpretations might work as an additional risk factor in the context of maternal traumatization. Our results do not permit any firm conclusions in this regard, but compatible with this theoretical speculation, our partial correlation analyses found maternal shame misinterpretations to account for parts of the previously reported relations between maternal ATM and child attachment insecurity and disorganization.

Methodological Considerations and Additional Future Directions

Due to study limitations, our results should be interpreted cautiously, and might best be viewed as hypothesis generating. The most significant limitation regards the relatively small sample size, which restricts statistical power as well as the range of suitable methods for statistical analyses. Future studies seeking to replicate or extend our findings should use larger samples, as well as more sophisticated, multivariate analyses. This would, for instance, allow for examination of possible mediating effects of emotional interpretations on the

association between maternal ATM and child attachment status. To avoid limitations with regard to the disambiguation of process directions, future research should also consider prospective longitudinal designs. Furthermore, our study only included mothers with mild ID who lived together with their children, while in the population at large, 30-60% of mothers with mild ID lose custody during their children's first years (Booth et al., 2005; Tøssebro et al., 2017). Thus, it might be that our sample was more well-functioning than mothers with mild ID in general. Although the high rates of interpersonal trauma and the ID mothers' enrollment with clinical services suggest that this was not the case, future research should also address representativeness.

Similar to much previous research on emotion interpretation, we also relied on static photographs of facial emotional expressions in assessing maternal emotion-interpretation capacities. Emotional interpretations in everyday life are, however, also influenced by other sources of information, such as kinaesthetic cues (de Gelder & de Borst, 2015; Meeren et al., 2005), and the importance of parental evaluations of infants' emotional states in everyday interaction extends far beyond sheer interpretation. Other dimensions concern the parent's capacity to remain open to the uncertainty of one's interpretations, and to repair misattunements (cf. parental mentalizing; e.g., Slade et al., 2005). Future research should incorporate these aspects, to deepen the scientific understanding of emotional communication among mothers with mild ID and their children. Assessment of Parental Embodied Mentalizing (PEM; Shai & Belsky, 2017) could be useful in this regard, since it examines parents' capacity to extrapolate their infants' mental states from kinaesthetic cues, and to continuously adjust their own behaviour accordingly. This measure is also non-verbal, and thereby likely less affected by the lower verbal intelligence associated with mild ID, than are verbal measures of parental mentalizing (cf. Shai et al., 2017).

The links found in this study also indicate the importance of examining attachment representations among mothers with mild ID. Individual variations in such representations have been linked to adults' experiences of childhood trauma (Stovall-McClough & Cloitre, 2006), parental emotion-interpretation difficulties (Moran et al., 2008), and child attachment status (van IJzendoorn, 1995). Yet, there is currently no empirical knowledge regarding attachment representations among mothers with mild ID. Future studies should therefore consider using the Adult Attachment Interview (AAI; George et al., 1996).

Notwithstanding its limitations, this is, to the best of our knowledge, the first study in the worldwide literature to examine emotional interpretations in relation to child attachment and relevant contextual variables, in the context of parenting among mothers with mild ID. A notable strength of the current study is also the use of a matched comparison group, which minimizes the impact of potential confounds related to the ID mothers' socio-economic status. Indeed, insufficient comparison groups, or lack of comparison groups all together, have hampered previous research on parents with ID (e.g., Hindmarsh et al., 2015). Furthermore, assessments of maternal ATM and child attachment representations were based on careful procedures, involving in-depth instruments and independent, blinded coders. Maternal emotional interpretations were also assessed by means of a well-validated instrument, developed specifically to capture the complexity of infant emotional facial expressions.

Conclusion

The current study raises several important questions. First, mothers with mild ID were not found to be generally less accurate than comparison mothers, with regard to positive or negative emotion interpretation accuracy. This null-finding, based on a differentiated instrument for emotion-interpretation, indicates a need for scrutinization of the common conception of general emotion-interpretation difficulties related to the diagnosis of mild ID

per se. Second, our study raises questions regarding possible mechanisms behind the established link between parental experiences of interpersonal trauma, and child attachment insecurity and disorganization among mothers with mild ID. We found that mothers with mild ID are more likely to misinterpret key negative emotional states from infant facial expressions, and that misinterpretations of specifically shame are linked to severe maternal traumatization, and to a heightened risk for attachment insecurity and disorganization in their children. In line with previous findings from our project, these results point to the importance of attending to specific risk factors related to the mothers' experiences of interpersonal trauma, rather than to the ID diagnosis per se, when trying to understand parenting risks among mothers with mild ID, and to distinguish mothers at elevated risk for parenting difficulties from those at lower risk. Moreover, the results again highlight the importance of identifying parents with mild ID who have experienced multiple interpersonal traumas, so that suitable supportive interventions can be offered to the mothers and their children.

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EMOTION-INTERPRETATION AMONG MOTHERS WITH MILD ID

Table 1.

Performance on the Emotion-Interpretation Variables among Mothers with Mild Intellectual Disability (ID; $n = 23$) and Mothers in the Matched Comparison (Comp.; $n = 25$) Group.

	ID group			Comp. group	
	M	*SD*		*M*	*SD*
Accuracy					
Positive	50.61	13.70		51.04	14.74
Negative	44.35	17.27		52.80	16.21
Misinterpretations					
Anger	1.40	1.41		.40	.71
Shame	.13	.34		-	-
Fear	1.87	2.12		2.00	1.71

Note: Accuracy, Positive, and Accuracy, Negative, are presented as percentage (%) of the total number of possible accurate interpretations for positive and negative emotions, respectively. Anger, Shame, and Fear misinterpretations are presented as the sum of participants' interpretations within each category that were not endorsed by at least 20% of the IFEEL reference sample (Appelbaum, Butterfield, & Culp, 1993).

EMOTION-INTERPRETATION AMONG MOTHERS WITH MILD ID

Table 2.

Emotion-Interpretation Variables and Their Associations with Maternal History of Abuse, Trauma, and Maltreatment (ATM) and with Child Attachment Variables, among Mothers with Mild Intellectual Disability (ID; $n = 23$) and Mothers from the Matched Comparison (Comp.; $n = 25$) Group.

	Shame misinterpretations		Anger misinterpretations	
	ID group	Comp. group	ID group	Comp. group
ATM	.47*[a]	-	.17[b]	.03[b]
Attachment security	-.41*[a]	-	-.19[b]	-.08[b]
Attachment disorganization	.43*[a]	-	-.01[b]	-.07[b]

Note: * $P < .05$ (two-tailed); bootstrapped (BCa) bivariate correlations.

[a] Point-biserial correlation (r_{pb}).

[b] Pearson correlation (r).

ATM = frequency of ATM experiences; Attachment security = continuous score for emotional security on the SAT (1-9); Attachment disorganization = semi-continuous score for disorganization on the SAT (0-2).

Dear Editors (Dr. Symons and Dr. Smith DaWalt),

We are delighted to have our article accepted for publication in AJIDD, and thank you for the opportunity to make a few additional revisions in order to further sharpen the paper. Also, we would once again like to express our sincere gratitude to the reviewers, whose careful readings and constructive comments have helped to substantially improve the manuscript. Regarding the reviewers' comments on the revised version, we have followed all the suggestions made.

As before, we list our additional revisions below (in italics), point by point in relation to the reviewers' remarks/suggestions.

Reviewer #1
I was pleased to see a revised version of this paper. The authors were quite responsive to reviewers' suggestions and the paper is significantly improved. I thought the introduction was much more aligned and focused on the topics of the paper, and thus reads much more clearly now. I also thought they added needed details to the measures and results section well. The discussion is also much improved; I appreciate the additional discussions surrounding nonsignificant differences in positive attributions, as well as being more careful in speculative wording regarding mechanisms and processes. While I still have questions about the sample size and significance of only 3 people reporting shame once, I do think they address the issue well and now cite quite a bit of literature regarding frequency of shame in other populations that help contextualize their findings.

Thank you! The improvements were greatly helped by the reviewer's previous suggestions, and we are pleased that our efforts seem to have remedied the problems noted in the first draft.

I just have one remaining issue to address:
1. In the letter, the authors gave a detailed explanation of why child ages 5-8 were chosen in the study, and I agree with them that a long, detailed explanation is not necessary. However, given that they're measuring attachment at a non-traditional age to do so (although I have no problems with that decision, the measure they used or its validity), readers may have questions. I still think a sentence or two are warranted about the reasons for the age chosen. I think it can be as simple as a sentence stating that in the broader study, ages 5-8 were chosen based on X, and that measuring attachment at younger ages in mothers of children with ID may be less reliable. I'd probably put it directly after the inclusion criteria on page 7 in the manuscript, but you could instead put it in the present study section if you preferred.

This is a good suggestion. While attachment can be measured at basically any age, (from about one year and up to adulthood, although measures and conceptualizations vary), we do see that to the larger research community, attachment may indeed be a phenomenon that is associated mainly with early childhood, and that readers may thus have questions with regard to the age span chosen in our study. As researchers from the attachment field, we may have failed to appreciate this. Following the reviewer's thoughtful suggestion, we have now clarified our reasons for the chosen age span on pages 7-8, after the inclusion criteria.

Reviewer #2
The manuscript has been extensively revised to address all of the concerns raised in the previous round of reviews. The result is an impressively clear and well-constructed article that

presents the findings in a way that is fair and respectful of the participants. Notably, the introduction is focused, thoughtful, and interesting. It sets the stage for understanding the nature of vulnerability in this population, possible consequences for the experiences of these mothers, and the implications for their ability to interpret infant facial expressions. The discussion is also a much more focused analysis of the present findings in light of relevant theory and research. Many other changes make the manuscript easier to follow, including the use of the term "emotional interpretation/perception" instead of "emotional attribution." The authors seem to have embraced each of the reviewers' suggestions without losing track of their own goals for the investigation.

Many thanks! We are happy to note the positive reception of our revised manuscript, and would once again like to emphasize that the revisions were much aided by the reviewer's previous comments.

1. A remaining limitation is that the provocative findings about the misinterpretation of shame are accounted for by reports from only three mothers. I believe that this limitation is a less critical flaw for the entire manuscript now that greater emphasis is placed on interpreting the findings about group similarities and differences, noting the accuracy of the mothers with mild ID when decoding positive emotional expressions. The authors also present a compelling review of literature and discussion about the sample size issue in item 10 of their response to Reviewer 1. The major thrust of this argument is mentioned briefly in the second paragraph of the results section (page 14). I encourage the authors to include more of this review in the discussion section of the manuscript as well. It does a nice job of acknowledging the tentativeness of a finding based on so little data, but also makes a convincing argument about why this rare, unusual behavior might be, nonetheless, noteworthy.

This is also a good suggestion. We have now included the main points from our previous response to reviewer 1 in the discussion section (p. 18).

2. A smaller concern relates to the partial correlation analysis to examine overlap in ATM and perceptions of shame in predicting child attachment. I recognize that the authors are exercising caution about strongly claiming that there is evidence for mediation, as suggested by Reviewer 1. Nevertheless, the issue of mediation is implied throughout the manuscript as a rationale for focusing on perceptions of emotion. In this context, the final analysis in the results section seems to be inaccurately designed to address mediation. According to the framework throughout the manuscript, emotional interpretations would be the mediator of ATM. So the question is: "Does the association between mother ATM and child attachment hold after accounting for the effects of emotional interpretation, the mediator?" The covariate should be shame misinterpretations, not ATM. Also, in interpreting the current analysis on page 20 of the discussion, I am not sure if the reasoning about overlap refuting mediation is accurate. Shame misinterpretation could be a causal factor even if it is accounted for by (overlaps with) the ATM variable.

This is again a very good point. We used ATM as a covariate to see whether the association between shame misinterpretations and child attachment "stood on its own legs" (i.e., if the association between shame misinterpretations and child attachment would hold even after accounting for maternal ATM), or if it was primarily driven by the previously reported association between ATM and child attachment. In retrospect, however, we regret that we may not have managed to fully do the job of going back-and-forth between the details and the bigger picture in the article. In other words, we think that the reviewer is right here – the

implicit rationale for focusing on perceptions of emotions is, indeed, the possibility of emotion perception as one potential partial mediator of the relationship between ATM and child attachment. Thus, we agree with reviewer 2 that it would make more sense to instead present the partial correlation analysis with shame misinterpretations as a covariate. We have now changed this on page 16, while remaining cautious about claiming evidence for mediation in the discussion, as wisely suggested by reviewer 1. A corresponding change has also been made on page 20.

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That's it in terms of the revisions we have undertaken in this second round. We agree with the reviewers that the final version of the paper is now much more solid and well-constructed, and we look forward to see it in print!

Sincerely,
The authors.